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Focus on Feelings: Emotion Regulation and Neuropsychological Rehabilitation after Acquired Brain Injury

Rowlands, Leanne

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Nid yw cwblhau'r gwaith hwn yn 'lockdown' wedi bod yn hawdd, ond mae wedi caniatau imi adlewyrchu a gwerthfawrogi fy mhrofiadau trwy gydol y PhD hwn, ac amgylchedd cefnogol yr Ysgol Seicoleg, Prifysgol Bangor, sydd wedi caniatau imi ffynnu. Mae'r tair blynedd diwethaf wedi bod yn rhai o gyfoethocaf fy mywyd. Mae'r gydnabyddiaeth hon yn adlewyrchu hynny, a phawb sydd wedi fy helpu i gyrraedd yma.

Yn gyntaf, i'm goruchwylwyr, yr Athro Oliver Turnbull a Dr Rudi Coetzer. Nid oes unrhyw eiriau a all ddal pa mor ddiolchgar ydw i am eich cred ynof fi, a'r cyfleoedd rydych chi wedi'u rhoi i mi. Mae gweithio gyda chi'ch dau wedi bod yn fraint enfawr, ac yn llawer o hwyl! Rydych wedi darparu cymaint mwy nag arweiniad. Trwy eich cefnogaeth, rwyf o'r diwedd wedi gollwng gafael ar hunan-amheuaeth sydd wedi fy nal yn ôl ers blynyddoedd. Mae'r profiad hwn wedi newid fy mywyd - diolch.

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Contents

Thesis Summary

Emotional regulation (ER) difficulties are common consequences of brain injury, and can persist in the chronic phase. Nonetheless, it is only recently that ER mechanisms after ABI have been systematically studied using a well-established theoretical framework (the Process Model). In addition, there are very few emotion-based interventions that incorporate ER strategies based on this overarching framework, and that are implementable in long-term and under-resourced outpatient settings. *Group* interventions may be a promising vehicle to deliver ER training. However, group interventions that are run clinically are seldom evaluated empirically, and there are very few qualitative investigations which consider the subjective experience of participating in groups. Finally, little is known about the therapeutic *processes* at play during such interventions, and which factors might facilitate or hinder their development.

This thesis aimed to address these crucial gaps, and bridge between the theoretical ER literature and clinical neuropsychological rehabilitation. Chapter Two and Three explored one specific ER strategy, reappraisal, and its related neuropsychological mechanisms. Chapter Two investigated this strategy across several discrete emotions in people with acquired brain injury (ABI) and healthy controls (HCs). The main findings were that the ABI group were impaired in their ability to *generate* reappraisals across all discrete emotions, and reported less *effective* reappraisals for up-regulating positive emotions. Chapter Three investigated reappraisal for personal and impersonal stimuli. The findings suggest that personal context facilitates the reappraisal process, and especially for the ABI group. Working memory and inhibition appeared important for certain components of reappraisal.

The remaining chapters are based on a novel emotion-based group intervention, developed specifically for an under-resourced community outpatient setting (the Brain Injury Solutions and Emotions Programme; BISEP). In Chapter Four, this intervention was

evaluated using qualitative methodology, to investigate the subjective experience, acceptability, and therapeutic 'ingredients' of BISEP. Key themes especially highlighted the value of the social 'milieu', learning strategies, and BISEP's role in promoting adaptive ER and positivity. Chapter Five reported a quantitative evaluation of the initial efficacy of BISEP, feasibility for a future trial, and the therapeutic predictors of improvement (therapeutic alliance and 'group attraction'). The main findings were that BISEP appears efficacious at improving reappraisal skills, and may improve emotional distress. Future research is certainly warranted and deemed feasible for a larger trial, across multiple study sites. 'Group attraction' was the only positive predictor of improvement.

Finally, Chapter Six explored the cognitive, emotional, and demographic predictors of key therapeutic processes at play during BISEP, namely the therapeutic alliance, 'group attraction', and engagement. The findings suggest that depression may negatively influence the therapeutic alliance and 'group attraction'. Facilitators may also need to tailor their clinical skills to promote engagement in those from lower educational backgrounds, and with impairment in working and episodic memory.

Considered together, this thesis especially supports two core conclusions for the long-term care pathway for people with ABI. Firstly, the relevance of group interventions and shared experience for neuropsychological rehabilitation. Secondly, the need for a focus on adaptive ER and optimism.

1. Chapter One

"I think to go through a brain injury it affects you emotionally. It makes you a bit more numb, to sometimes big things. Sometimes it makes you react too quickly to less important things […] Some emotions are so deep that it's difficult [to manage]"

- *Iolo (Participant from BISEP)*

1. Introduction

The first section of the introduction (Part A) focuses on broad, overarching, theoretical issues in the literature. The aim is to provide the reader with an overview of the relevant literature, and justification for the present research. Part B, on the other hand, highlights the gaps in the literature more explicitly, and describes how this thesis aims to address five core areas that are in need of research development. In the final part of this introduction (Part C), a thesis overview is provided, briefly summarising the content of each chapter.

1.1 Part A – Theoretical Background

An acquired brain injury (ABI) can have a devastating impact on a person's life (Andelic, Hammergren, Bautz-Holter, Sveen, et al., 2009; Dikmen, Machamer, Powell, & Temkin, 2003; Levack, Kayes, & Fadyl, 2010). Survivors can experience a range of impairment in cognitive, physical, behavioural, and emotional functioning (Khan, Amatya, Judson, Chung, et al., 2016; Ponsford, Downing, Olver, Ponsford, et al., 2014). Such changes are often a significant source of disability, with survivors' needs lasting a life-time (Oddy & McMillan, 2001). This means that survivors and their families must sometimes cope with difficulties, and an unpredictable recovery process, for many decades. Of the numerous effects of injury, the psychological changes are often most difficult for patients and their care-givers (Ergh, Rapport, Coleman, & Hanks, 2002; Levack et al., 2010; Testa, Malec, Moessner, & Brown, 2006). These include profound feelings of loss, changes in identity (Carroll & Coetzer, 2011; Villa, Causer, & Riley, 2020), and social isolation (Salas, Casassus, Rowlands, Pimm, & Flanagan, 2018). Low mood and anxiety are especially prevalent (Mitchell, Sheth, Gill, Yadegarfar, et al., 2017; Scholten, Haagsma, Cnossen, Olff, et al., 2016). Emotional difficulties are not only distressing, but can further compromise long-term adjustment (Ownsworth & Fleming, 2005), and community integration (Kersey,

Terhorst, Wu, & Skidmore, 2019). Therefore, there is a need to address such difficulties within neuropsychological rehabilitation. As stated by Wilson (2013, p.275), if the lives of people with ABI are saved, neurorehabilitation services "owe it to them to make sure their saved life is worth living".

Neuropsychological Rehabilitation – A Holistic Approach

Neuropsychological rehabilitation has undergone exceptional developments since the World War One era which laid the foundations for the practice today (Wilson, 2017 for review). The term *rehabilitation* has been the source of much debate between professionals working in the field (e.g. Prigatano, 1997; Wilson, 1997). In literal terms it means 'to make able again', but if this expression is to mean restoring to their former selves, this is seldom possible. Perhaps a more eloquent description is that of an activity aimed at improving psychological adjustment, to enable patients to come to terms with, and manage impairments precipitated by brain injury (Wilson, 1989, p.117). Importantly, rehabilitation also involves the establishment of a *meaningful* and satisfactory life (Ben-Yishay & Daniels-Zide, 2000; Cicerone, Mott, Azulay, Sharlow-Galella, et al., 2008).

The literature regarding neuropsychological rehabilitation is, indeed, exceptionally complex (Turner-Stokes, Pick, Nair, Disler, & Wade, 2015; Rohling, Faust, Beverly, & Demakis, 2009; van Heugten, Gregório, & Wade, 2012). The discipline necessarily relies on a number of approaches to treat patients, from those based on models of learning, cognitive function, and holistic principles (Wilson, 2002; 2008; Wilson & Gracey, 2009). *Holistic* rehabilitation has seen enormous development in the field. There is now a considerable evidence-base that holistic approaches are efficacious for people with ABI (Cicerone, Mott, Azulay, Sharlow-Galella, et al., 2008; Cicerone, Langenbahn, Braden, Malec, et al., 2011; Geurtsen, van Heugten, Martina, & Geurts, 2010). The evolving evidence-base is reported to

be among the most important advancements in neuropsychological rehabilitation (Wilson, 2013), especially regarding the UK perspective of treatment. This approach also emphasises the socio-emotional difficulties that are at the heart of patient complaints (Ben-Yishay, 2000; Ben-Yishay & Daniels-Zide, 2000; Ben-Yishay & Diller, 2011; Wilson, Evans, Gracey, & Bateman, 2009; Trexler, 2000).

Clinically, there appear to be very few concerns with the holistic approach (Coetzer, Roberts, Vaughan, & Rafal, 2003). The common elements are that the multiple and complex consequences of injury must be addressed in the context of the *person as a whole,* and that it is mostly ineffective to address the cognitive, functional, social, and emotional aspects separately (Wilson et al., 2009). Modern holistic rehabilitation typically involves very intense provision of individual and group interventions (including psychotherapy), to promote acceptance, address emotional adjustment and self-awareness, and provide compensation strategies to help manage difficulties (Wilson et al., 2009; Wilson, Gracey, Malley, Bateman, & Evans, 2009). Such programmes have been shown to improve functional independence, productivity, life satisfaction, and community integration (Cicerone et al., 2011, for review).

Long-term Rehabilitation

The emphasis of the majority of rehabilitation, including holistic programmes, has been placed on post-acute services (Cicerone et al., 2011; Greenwood & McMillan, 1993; Turner-Stokes et al., 2015; van Heugten et al., 2012), where patients would typically access *time-limited* support soon after leaving medical care. However, this approach has a number of limitations. For example, it can be expensive, involves a high staff-to-patient ratio (Trexler, 2000), and is not available for everyone (Coetzer, 2008). Another critical element is that the reality for many patients is that their difficulties are *persistent* (Fleminger & Ponsford, 2005; Levack et al., 2010), far exceeding their stay in post-acute services. It has been widely

documented that patients experience difficulties with transition back to the community (Abrahamson, Jensen, Springett, & Sakel, 2017; Holloway, Orr, Clark-Wilson, 2019; Picenna, Lannin, Gruen, Pattuwage, & Bragge, 2016), and there is a need for services which address the emerging *long-term* difficulties (Abrahamson et al., 2017; Chen, Zhangm Deng, Fan, et al., 2019; Harrison, Hunter, Thomas, Bordy, et al., 2017; Select Committee on Health, 2001). After all, it is in the community that patients and their families become more aware of the impact the injury has on their daily life (Nalder, Fleming, Foster, Cornwell et al., 2012), and adjust to new difficulties and changes in identity (Levack et al., 2010; Muenchberger, Kendall, & Neal, 2008). Anecdotally, many clinicians are aware that a lack of long-term support is a major patient complaint. However, continued rehabilitation provision in the chronic phase is often an area of unmet need, and is under investigated, highlighting a gap in the literature (Pickelsimer, Selassie, Sample, Heinemann, et al., 2007; Rotondi, Sinkule, Balzer, Harris, & Moldovan, 2007; Turner-Stokes et al., 2015).

In line with this, the National Service for Long Term conditions has acknowledged the chronic nature of difficulties after injury (Department of Health, 2005), and the Division of Neuropsychology of the British Psychological Society emphasised the role of outpatient neurorehabilitation services in providing support in the community (2005). In this regard, it is rather surprising that the number of community rehabilitation services, addressing the chronic needs of patients, does not meet the high demand for long-term support (McMillan & Oddy, 2001). A conclusion reached in a Cochrane review made it clear that adequate community-based services should be accessible for patients with on-going needs, even after discharge from an intensive post-acute programme (Turner-Stokes et al., 2015).

There is increasing evidence that community-based rehabilitation is *effective* and beneficial for patients, especially if delivered comprehensively (Cicerone, Mott, Azulay, &

Friel, 2004; Powell, Heslin, & Greenwood, 2002). However, the sombre reality for many

patients is that such community-based long-term service provision is under-developed and

poorly resourced, across many locations (Balchin, Coetzer, Salas, & Webster, 2017;

Kamenov, Mills, Chatterji, & Cieza, 2019; Krug & Cieza, 2019). Challenges in providing

long-term support can be further exacerbated in areas of socio-economic deprivation and

rurality (Coetzer, et al., 2003; Coetzer, Roberts, Turnbull, & Vaughan, 2018). This is

especially relevant for service provision across Wales, highlighting the need for cost-

effective, easy-to-implement programmes to rehabilitate patients in the community. See

Figure 1, Welsh Index of Multiple Deprivation (WIMD) map below.
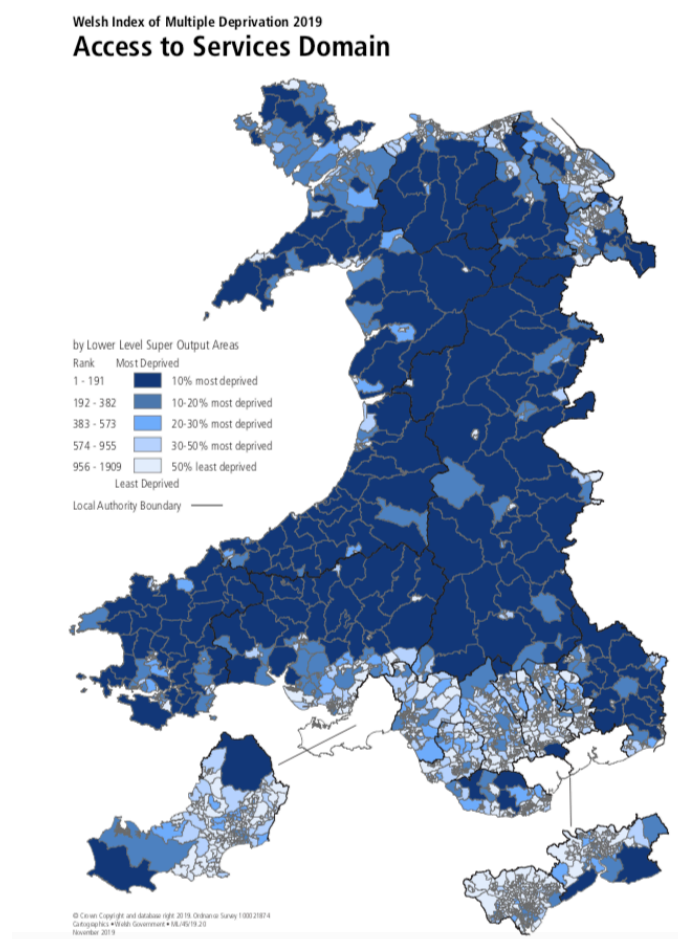
Figure 1. *WIMD 2019 Maps of Wales demonstrating that the majority of local authorities in the Country are in the 10% most deprived in terms of overall day-to-day access to services. Retrieved from https://statswales.gov.wales/*

What is especially pertinent, is that there are very few reports of *holistic* rehabilitation provided at the long-term community level (Cicerone et al., 2004; Turner-Stokes et al., 2015). This is likely because the intensity and high-frequency of sessions, and the consistent therapeutic milieu, are difficult to achieve in low-intensity community-based settings (Coetzer, 2008). However, the underlying *philosophy,* and principal aims, can certainly inform service provision at the community level (Coetzer, 2008; Trexler, 2000). There are some reports of how holistic approaches can be adapted to overcome barriers in lower resourced community settings (See Balchin, Coetzer, Salas, & Webster, 2017, for a handbook on this topic). This particularly emphasises a 'slow stream' approach, which focuses on delivering low-intensity support across years and decades, instead of intensive support in the post-acute stage alone (Coetzer et al., 2008).

One programme, in which there has been research, is the North Wales Brain Injury Service (NWBIS), UK. This is built upon the philosophical and theoretical foundations of the holistic model, in an outpatient community setting in rural North Wales, and provides individual and group rehabilitation (Coetzer et al., 2003; Coetzer, 2008). The main holistic principles that are central at NWBIS includes: neuropsychological orientation to address issues of self-awareness, provision of compensation strategies for difficulties, and facilitation of emotional adjustment (see Coetzer, 2000, and Texler, 2000, for further details). This 'slow stream' approach to rehabilitation means that patients can be followed-up for as long as is required, and clinicians are able to support survivors with emerging difficulties as they travel the unpredictable road of recovery.

There have been several attempts at measuring the effectiveness of *overall* multi-component programmes, such as comprehensive holistic settings and community services (Cicerone et al., 2011; Turner-Stokes et al., 2015). However, such an approach makes it

difficult to evaluate the *specific* interventions that are delivered *within* such programmes. Indeed, different individual interventions and models are required to meet the complex needs of patients (Wilson et al., 2009; Wilson & Betteridge, 2019). The effectiveness of such specific interventions within rehabilitation programmes, and factors that might influence patient benefit, have been identified as important areas for research development (Patterson, Fleming, & Doig, 2016; Turner-stokes et al., 2015), and are addressed in Chapters Four, Five, and Six.

Group Interventions

Of particular interest are *group* interventions. These typically involve psycho-education about the effects of brain injury, which aim to increase patient understanding, and improve aspects of impairment (Winson, Wilson, & Bateman, 2017). Providing treatment in a group modality is often seen as an expedient tool that allows a number of patients to receive therapeutic provision at the same time, and is thought to be cost-effective (Patterson et al., 2016, for a review). A number of additional benefits have been reported, including being valued by patients and their care-givers (Couchman, McMahon, Kelly, & Ponsford, 2014; Wilson, 2017), and providing an opportunity for peer support and co-operative learning (Lundqvist, Linnros, Orlenius, & Samuelsson, 2010; Patterson et al., 2016, for a review). The International Panel of Experts in Cognitive rehabilitation (INCOG) included group-based interventions for cognitive impairment in their guidelines for clinical practice (Bayley, Tate, Douglas, Turkstra, et al., 2014). Notably, their review focused on *cognitive* rehabilitation, and did not emphasise post-injury emotional and behavioural difficulties.

Clinically, a number of general and targeted group interventions are carried out routinely across different areas of rehabilitation. However, specific programmes are not often evaluated empirically. Education-based group interventions have been described as a

cornerstone of effective healthcare after ABI (Lukens & McFarlane, 2004; Smith & Testani-Dufour, 2002). A UK-based benchmarking report evaluated 17 similar services nationwide (Tyerman & Hucker, 2006). A variety of group interventions were reported across 14 of the services, including most commonly psycho-education, cognitive rehabilitation, and psychological therapy. It appears that group outcomes are not always part of a formalised system, or evaluated empirically. Consequently, the available literature may not be representative of routine clinical practice. A UK-based brain injury rehabilitation third sector organisation, with over 15 inpatient services reported that: *"psycho-education group approaches are used routinely across services as part of rehabilitation. Although formal outcome data related to these interventions is monitored on an individual basis, it is not currently reported centrally"* (Brain Injury Rehabilitation Trust, 2017, Personal communication to LR).

In line with this, the brain injury rehabilitation guidelines (Harley, Allen, Braciszeski, Cicerone, Dahlberg, & Evans, 1992), have been criticised for being based more upon expert opinion than empirical evidence (Cappa, Benke, Clarke, Rossi, Stemmer, & Van Heugten, 2003). Developing a robust evidence-base for neuropsychological interventions, including in the group format, is difficult due to the major challenges faced in this area of research (Kennedy & Turkstra, 2006). This includes rehabilitation taking longer than most funding resources allow, and difficulty conducting randomised controlled trial designs (Turner-Stokes et al., 2015). It is evident that, of the published evaluations, a number are disadvantaged by concerns over methodological rigour (Bayley et al., 2014; Patterson et al., 2016).

Focus on Feelings

The majority of evaluated interventions from the literature have focused on *cognitive* impairment (Bayley et al., 2014; Patterson et al., 2016 for review). For example, there are a

number of targeted group interventions which address memory (Barker-Collo, 2000; Evans & Wilson, 1992; Hildebrandt, Bussmann-Mork, & Schwendemann, 2006; O'Neil-Pirozzi, Strangman, Goldstein, Katz, et al., 2010), and executive function (Levine, Schweizer, O'Connor et al., 2011; Miotto, Evans, de Lucia, & Scaff, 2009; Rath, Simon, Langenbahn, Sherr, & Diller, 2003). Traditionally, it is the remediation of cognitive impairment that has taken precedence in rehabilitation services (Ben-Yishay & Prigatano, 1990; Rohling, Faust, Beverly, & Demakis, 2009; Wilson, 1997). More recently, however, there has been an 'emotional turn' in neuropsychological rehabilitation, where greater emphasis is placed on socio-emotional adjustment, and feelings are placed at the heart of case formulation (Bowen, Yeates, & Palmer, 2010; Coetzer et al., 2018; Wilson & Betteridge, 2019; Wilson & Gracey, 2009; McDonald, 2017).

This paradigm shift, towards emotional experiences, is due to several key factors. Firstly, there is a high prevalence of affective disturbances after ABI (Hesdorffer, Rauch, & Tamminga, 2009; Kreutzer, Seel, & Gourley, 2001; Scholten, Haagsma, Cnossen, Olff, et al., 2016; William, Evans, Wilson, & Needham, 2002). It is well-documented that survivors can experience a range of emotional disorders, most commonly anxiety and depression (Fleminger 2008; Kreutzer et al., 2001; Rao & Lyketsos, 2000; Scholten et al., 2016). Apathy, neurobehavioural disability, aggression, emotional lability, and a range of neuropsychiatric disorders (e.g. obsessive compulsive disorder and post-traumatic stress disorder) have also been reported (Beer & Lombardo, 2007; Schwarzbold, Diaz, A., Martins, Rufino, et al., 2008, for reviews; Williams et al., 2002). Secondly, emotional difficulties after ABI are *persistent* in the long-term (Fleminger, 2008), and represent a substantial area of unmet need for survivors in the chronic phase (Chen et al., 2019; McKevitt, Fudge, Redfern, Sheldenkar, et al., 2011; Walsh, Galvin, Loughnane, Macey, & Horgan, 2015). Finally,

emotional adjustment and mourning are key processes that signify identity changes after ABI (Coetzer, 2008; Levack, Kayes, & Fadyl, 2010; Smith, Jones, Gracey, Mullis, et al., 2019).

With the growing appreciation of the relevance of socio-emotional factors in recovery (e.g. Levack et al., 2010), there has been expanding research addressing various emotional processes after ABI. For example, in developing a three-part classification of the underlying *causes* of emotional and psycho-social difficulties (Gainotti, 1993). That is, those resulting from direct neurological damage, those that follow psychological and psychodynamic causes (e.g. appraisals of disability or self-esteem), and finally, socio-emotional difficulties which arise in response to psycho-social factors (e.g. loss of friends due to injury leading to isolation and low mood) (Gainotti, 1993). There is also a developing line of evidence that emphasises the role of *positive* experiences (e.g. support of family and friends; Fraas & Calvert, 2009; meaningful activities; Downing, Hicks, Braaf, Myles, et al., 2020; Lyon, Fisher, & Gracey, 2020) and psychological approaches (e.g. optimism, problem-focused coping; Glintborg & Hansen, 2016; Shotton, Simpson, & Smith, 2007), in promoting recovery and adjustment. Finally, there has been substantial interest in addressing various aspects of emotional impairment, such as emotion *perception* (Bornhofen & McDonald, 2008, for review), *recognition* (Croker & McDonald, 2005; Spikman, Boelen, Pijnenborg, Timmerman, et al., 2013) and *experience* (Calder et al., 2000; de Sousa, McDonald, & Rushby, 2012).

Emotion Regulation

One aspect of emotional difficulties after ABI that has received considerably less attention in the literature, but is especially important to consider, is *emotion regulation* (ER) (Bechara, 2004; Beer & Lombardo, 2007; Salas, 2012; Salas, Gross, Rafal, Viñas-Guasch, & Turnbull, 2013; Salas, Gross, & Turnbull, 2019). Broadly, this refers to processes that enable

people to flexibly modify their feelings, based on situational demands and individual goals (Gross, 2013). ER impairment is thought to be a common consequence of ABI, after damage to both focal and diffuse brain areas (Beer & Lombardo, 2007). For instance, the dysregulation of anger (Barrash, Tranel, & Anderson, 2000; Berlin, Rolls, & Kischka, 2004), and emotional lability (Beer & Lombardo, 2007).

Notably, ER is perhaps an underlying and transdiagnostic element of *global* distress and emotional symptomatology (Kersel, Marsh, Havill, & Sleigh, 2001; Shields, Ownsworth, O'Donavan, & Fleming, 2016), which often presents as a range of socio-emotional and neurobehavioural disturbances (Beer & Lombardo, 2007; Williams & Evans, 2003). Additionally, improving people's capacity to manage their difficult emotions is a central aim of a number of therapeutic approaches for people with ABI, such as Cognitive Behaviour Therapy (CBT) (e.g. Bradbury, Christensen, Lau, Ruttan, et al., 2008) or Acceptance Commitment Therapy (ACT) (e.g. Whiting, Deane, McLeod, Ciarrochi, & Simpson, 2019). This means that a focus on ER impairment in the context of neuropsychological rehabilitation may be a promising way to address difficulties in patients' emotional lives.

The study of ER in participants with brain injury has, thus far, been beneficial in developing an understanding of its underlying neurological and cognitive mechanisms (Beer & Lombardo, 2007; Rowlands, Coetzer, & Turnbull., 2019; Salas, Turnbull, & Gross, 2014), its influence on coping and adjustment (Abreau, Zgaljardic, Borod, Seale, et al., 2009), and its role in relationship difficulties (Wood & Liossi, 2005). A limitation of the literature, however, is that many studies have addressed ER from a neuropsychiatric perspective (Cattran, Oddy, & Wood, 2011), reducing emotion dysregulation to the presence of negative affect or psychiatric symptoms. Such a perspective neglects to take into account the psychological *processes* that allow feelings and experiences to be managed (Salas, Gross, &

Turnbull, 2019, for a review). As discussed in Chapter Two, previous perspectives also neglect the role of ER in *positive* feelings. Additional studies have addressed such difficulties from cognitive-behaviour, or personality, stand points, with a need for an overarching conceptual framework. It is only recently that ER problems after ABI have been systematically studied using a well-established theoretical model (Salas et al., 2019).

The Process Model of Emotion Regulation

Outside neuropsychological rehabilitation, there is a vast and well-developed literature on ER (Gross, 2013; 2015; McRae & Gross, 2020; Webb, Miles, & Sheeran, 2012; Werner & Gross, 2010). By far, the most established model of ER is that developed by Gross (Gross, 2013; 2015). The 'Process Model' defines ER as the *processes* by which emotions and their intensity are influenced, as well as how and when they are experienced and expressed (Gross, 2015). ER includes the up- and down- regulation of both negative and positive emotional states, in line with the regulatory goal (McRae & Gross, 2020). ER processes can be extrinsic (i.e. regulating someone else's emotions) (Nozaki & Mikolajczak, 2020). However, in line with the primary focus of the literature (McRae & Gross, 2020, for review), this thesis will focus on the *intrinsic* regulation of emotions (i.e. regulating one's own emotions). The pursuit of managing emotional responses can also occur along a spectrum, from conscious and controlled, to unconscious and automatic (Gross & Thompson, 2007). For the purpose of this thesis, the focus will be on the conscious and controlled use of ER strategies.

The Process Model distinguishes a set of five ER strategies that can be used to manage emotions (Gross & Thompson, 2007; Gross, 2013; 2015; McRae & Gross, 2020). Each can be implemented at a key time point in the emotion generation process (McRae & Gross, 2020). To first understand the five strategies of this model, it is necessary to

conceptualise the emotion generation cycle. At the first level of the Process Model (Figure 2a), a *situation* is first encountered, which can be external (e.g. in the physical environment), or internal (e.g. thoughts). Key aspects of the situation are then *attended* to, and are *appraised* in relation to goals. This then gives rise to physiological and behavioural *responses*, which in turn can change the situation (McRae & Gross, 2020).

At the second level of the model (Figure 2b), the five strategies can be implemented, according to the stage they intervene in the emotion generation process described above (See Figure 2a). These strategies are: 1) *situation selection*: choosing settings which give rise to desirable, or undesirable, emotions *before* the event; 2) *situation modification:* taking steps which change the external environment to alter the emotional impact of the situation; 3) *attentional deployment*: changing attentional focus (i.e. the internal environment), often by focusing on more desirable internal scenarios such as pleasant thoughts and memories, 4) *cognitive change (reappraisal):* changing the meaning of a situation to alter its emotional impact, through reframing an event as more positive or less negative, 5) *response modulation:* altering emotional response tendencies once they have been elicited, for example by inhibiting emotional expressive behaviours (e.g. suppression) (Gross, 2015; Gross & Thompson, 2007; Werner & Gross, 2010)[1]. Strategies one-to-four are considered *antecedent focused*, because they can be implemented prior to an emotional response (Gross, 2015). The final strategy, response modulation, is considered *response-focused* because it is typically implemented once an emotional response has been generated (Gross, 2015).

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[1] Description of strategies is from Chapter Three
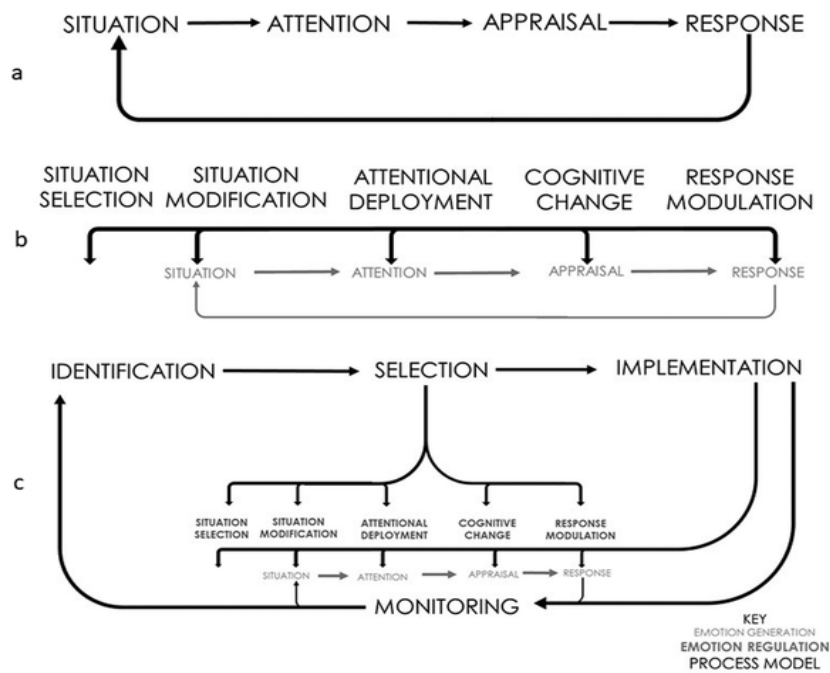
Figure 2. *The Process Model of emotion regulation, including the first level of emotion generation (a), the five strategies that can be implemented at key time points (b), and the stages that emotion regulation strategies can be carried out (c). Arrows represent constant cycles. [From McRae & Gross, 2020, adapted from Yih, Uusberg, Taxer, & Gross, 2019]*

The third level of the model (Figure 2c), describes the ER cycle. This begins with a discrepancy between someone's current state and the emotional state that they desire, which is *identified* as a need for regulatory input. A strategy is then *selected* to manage the emotion, before being *implemented*. Finally, the success of the strategy in achieving the desired emotional state is *monitored*. ER requires flexibility in order to identify the ER success, and the need to continue or switch to an alternative regulatory strategy (Aldao, Sheppes, & Gross, 2015; Bonanno & Burton, 2013; McRae & Gross, 2020; Pruessner, Barnow, Holt, Joormann, & Schulze, 2020). It is noteworthy, that there may be some overlap between strategy boundaries, especially situation selection and modification, and that the Process Model does not distinguish between adaptive and maladaptive approaches to ER strategy use (Gross, 2015).

In neurologically healthy participants, the study of various ER strategies has gained vast popularity (Webb et al., 2012, for a review). Importantly, using the Process Model as a framework has allowed researchers to develop a greater understanding of emotion dysregulation in the context of psychopathology and well-being (Gross & Jazaieri, 2014; Haines, Gleeson, Kuppens, Hollenstein, et al., 2016; Sheppes, Suri, & Gross, 2015; Quoidbach, Berry, Hansenne, & Mikolajczak, 2010; Werner & Gross, 2010). For instance, maladaptive use of strategies such as response modulation and rumination (an example of maladaptive attentional deployment) are characteristic of individuals with mood disorders (Aldao, Nolen-Hoeksema, & Schweizer, 2010, for meta-analysis; Cludius, Mennin, Ehring, 2020). Adaptive use of reappraisal, an example of a cognitive change strategy, has been frequently reported as being associated with positive outcomes, such as greater well-being (Gross & John, 2003), better physical health (Appleton, Loucks, Buka, & Kubzansky, 2014), and fewer mental health symptoms (Aldao, Nolen-Hoeksema, & Schweizer, 2010; Cludius et al., 2020). Indeed, it is the strategy of *reappraisal* that has received most attention in the literature, by a considerable amount (McRae & Gross, 2020; Webb et al., 2012). It is thought to be an especially effective and adaptive strategy (McRae, 2016; Troy, Wilhelm, Shallcross, & Mauss, 2010), and supported by cognitive control (Buhle, Silvers, Wager, Lopez, et al., 2014, for meta-analysis).

The number of studies which have investigated ER, from the Process Model perspective, in patients with *brain injury* remains modest (Salas et al., 2019). A recent review describes in detail how the use of specific ER strategies may be disrupted following discrete profiles of neuropsychological impairment, and proposes that the Process Model provides a robust framework to study ER difficulties after ABI (Salas et al., 2019). Nonetheless, the existing research has focused predominantly on the strategy of reappraisal (Falquez, Couto, Ibañez, Freitag, et al., 2014; Salas et al., 2019 for a review).

Reappraisal may be selectively impaired in those with brain injury (Salas et al., 2019), who often experience difficulties with thinking skills and cognitive control (Rabinowitz & Levin, 2014). The ability to generate positive reinterpretations of events likely relies on flexible use of thinking (Ochsner & Gross, 2004), and therefore may be a challenging strategy to modulate feelings. Indeed, evidence at the *case* level describes in detail how a marked profile of concreteness, following stroke, resulted in a complete inability to spontaneously reappraise (Salas, Rafal, Viñas-Guasch, & Turnbull, 2013). An additional case study describes how impairment in thinking processes compromised the ability to generate positive reinterpretations during negative emotional states (Salas, Radovic, Yuen, Yeates, et al., 2014b).

Evidence at the *group* level suggest that patients with brain injury may be especially vulnerable to the *generative* components of reappraisal (Salas et al., 2014). These components involve the timely production of positive re-interpretations of events (i.e. creating a reappraisal). This is distinguished from reappraisal effectiveness or success. It does not necessarily follow that a generated reappraisal effectively alters emotional responses (i.e. reappraisal effectiveness). Specifically, previous findings suggest that patients took longer to generate a reappraisal compared to neurologically healthy controls, but when time was not considered they were able to produce a similar *number* of reappraisals (Salas et al., 2014). Such findings are to be expected, due to difficulties with executive function that are commonly experienced by patients with brain injury (Beer & Lombardo, 2007; Rabinowitz & Levin, 2014). In Chapters Two and Three, additional evidence is provided, supporting the idea that a brain injury increases one's vulnerability to reappraisal difficulties. In contrast, Aboulafia-Brakha and colleagues (2016) concluded that patients with traumatic brain injury (TBI) *were* able to use reappraisal to manage the experience of anger, to a similar level to healthy controls.

In this context, the study of patients with brain injury, although modest, has contributed much to the understanding of the neuropsychological mechanisms that underlie reappraisal. For example, lesions to the right superior frontal gyrus, an area responsible for inhibitory control, is associated with poorer reappraisal effectiveness (Falquez et al., 2014). Additionally, inhibition, specifically a difficulty disengaging from negative material, and verbal ability, have been identified as key components of the reappraisal *generation* process (Salas et al., 2014; Salas et al., 2013). Chapters Two and Three further contribute to the understanding of the underlying cognitive control capacities of reappraisal.

Considered together, these studies provide evidence, complementary to extensive neuroimaging work in healthy controls, suggesting that reappraisal is associated with areas of cognitive control (Buhle et al., 2014, for meta-analysis), and lend further support to a model suggestive of a two-stage process of reappraisal (Kalisch, 2009; Salas et al., 2014). It may be that certain cognitive control capacities are important for the *early* phase of disengaging from the initial appraisal (inhibition) and generating new interpretations (verbal ability). In the second phase, the reappraisal needs to be maintained (using working memory), to shield it from the initial meaning (Kalisch, 2009)[2]. More research is certainly needed, to establish how a brain injury may compromise the ability to use reappraisal to manage emotions, and to develop a greater understanding of the mechanisms which underlie this ER strategy. As previously mentioned, these issues are addressed in Chapters Two and Three.

An additional element which requires exploration is the role of reappraisal for the up-regulation of *positive* emotions (Kim & Hamann, 2007; Nezlek & Kuppens, 2008). The majority of ER research in neurologically healthy participants have predominantly focused on the down-regulation of negative emotions, and have not taken into account the role that these

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[2] Description from Chapter Three

processes could play in emphasising positive emotion (Goldin, Webb et al., 2012; McRae & Gross, 2020). *Positive* ER may well be a promising mechanism to improve low mood after ABI (Silton, Kahrilas, Skymba, Smith, Bryant, & Heller, 2020; Quoidbach et al., 2010). The study of reappraisal across discrete emotions may be beneficial in developing a greater understanding of mechanisms which might underlie emotional difficulties after ABI (as addressed in Chapter Two), and shed light on potential intervention approaches (as addressed in Chapters Four and Five).

Positive Psychology

The use of ER to promote positivity, and not simply manage negative emotions, is a concept which overlaps with the philosophy of Positive Psychology (Seligman, 2011; Seligmen & Csikszentmihalyi, 2014; Seligman, Steen, Park, & Peterson, 2005). This field emphasises how positive health is much more than the absence of disability or illness (Ryff & Singer, 1998), and is concerned with optimising positive emotions, well-being, and resilience (Seligman & Csikszentmihalyi, 2014; Wong, 2013). Indeed, positive emotions are worth enhancing and fostering, due to their benefits in terms of mental health and well-being (Fredrickson & Cohn, 2008; Silton et al., 2020; Quoidbach, Berry, Hansenne, & Mikolajczak, 2010), physical health (Pressman, Jenkins, & Moskowitz, 2019), and broadening people's repertoires of cognition and actions (Fredrickson, 2001; 2004). Many previous psychological approaches, however, have been driven by pathology, and have focused largely on a disease model of human function (Seligman & Csikszentmihalyi, 2014). Much can be gained within neuropsychological rehabilitation from focusing on optimising positivity. This issue is addressed in Chapters Two, Four, and Five.

Positive emotions can be regulated by many approaches, including the same five strategies of the Process Model (Gross, 2015). Indeed, 75 identified methods that people

typically use to increase positive feelings (Livingstone & Srivastava, 2012) are broadly

consistent with the Process Model (Quoidbach et al., 2015). A core component of 'positive

interventions' is to promote positive emotions and well-being, through the underlying

mechanisms of ER strategies (Quoidbach et al., 2015; Schueller, Kashdan, & Parks, 2014).

For instance, focusing on present or past positive experiences to increase positive emotions

requires effective *attentional deployment* (e.g. reminiscence interventions and 'savouring'

exercises; Pinquart & Forstmeier, 2012; Smith & Bryant, 2017). *Cognitive change*, or

reappraisal, is an underlying strategy that can increase positive emotions through changing

the way a situation is *perceived* (Gross, 2013). In Positive Psychology, there is strong

evidence that increasing the perceived value of an event, and modifying an individual's

perceived role in a situation, can increase positive emotions (c.f. the locus of control, self-

efficacy, and attribution style literature; Quoidbach et al., 2015, for review, Sanjuán, Pérez,

Rueda, & Ruiz, 2008). It is notable that changing the *meaning* of a situation (i.e.

reappraising) may be a beneficial tool for promoting positivity, in the absence of a 'formal'

positive intervention.

By far, the Positive Psychology micro intervention that has been most influential

across many areas of Psychology is 'Three Good Things' (Mongrain, Anselmo-Matthews,

2012; Seligman et al., 2005). This involves making a note of three things that go well each

day, over the course of a week, and a short causal explanation (Seligman et al., 2005). This

activity has been consistently shown to have beneficial and sustained outcomes, such as

increased happiness (Carter, Hore, McGarrigle, Edwards, et al., 2016; Mongrain & Anselmo-

Matthews, 2012; Proyer, Gander, Wellenzohn, & Ruch, 2014; Seligman et al., 2005). This

simple activity may give rise to daily instances of positive emotional states, that are necessary

to promote durable resources for growth, resilience, life satisfaction (Keyes, Fredrickson, &

Park, 2012), and thriving relationships (Seligman et al., 2005). This task, although very

simple, likely relies on a number of Process Model ER strategies, most notably, attentional deployment, situation selection, and cognitive change. Due to the simplicity and effectiveness of this method, it could be easily incorporated into other aspects of neuropsychological interventions (Andrewes & O'Neill, 2014; Evans, 2011).

The applicability of Positive Psychology for emotion-related neurorehabilitation is evident (Evans, 2011). The 'Three Good Things' activity, and Positive Psychology, have been topics of growing interest in this context (Andrewes & O'Neill, 2014; Bertisch, Rath, Long, Ashman, & Rashid, 2014; Cullen, Pownall, Cummings, Baylan, et al., 2018; Karagiorgou, Evans, & Cullen, 2018). This field describes the 'meaningful life' as a form of happiness (Duckworth, Steen, & Seligman, 2005), characterised by engagement in purposeful activities, which contribute to longer-term goals, and a sense of connectedness to something greater than the self. It is well-known that survivors of ABI experience profound changes in identity and meaning (Villa et al., 2020, for a review). 'Light touch' Positive Psychology interventions may, therefore, provide an additional framework and insights for neuropsychological rehabilitation (Evans, 2011; Rabinowitz & Arnett, 2018), and especially for emotion-based interventions.

Emotion Regulation Interventions

The search for targeted interventions to address emotional difficulties after ABI has been arduous. Therapeutic approaches, such as CBT, are common (Stalder-Lüthy, Messerli-Bürgy, Hofer, Frischknecht, et al., 2013; Waldron, Casserly, & O'Sullivan, 2013), but can be challenging (Gallagher, McLeod, & McMillan, 2019) and require adequate resources and training. There are reports of promising interventions that address emotional distress, such as programmes based on Positive Psychology principles (Cullen et al., 2018; Karagiorgou et al., 2018). A number of approaches, however, address *specific* emotional disorders. For example,

there are reports of difficulties with the management of *anger* being treated with CBT (Aboulafia-Brakha, Buschbeck, Rochat, Annoni, *et al.,* 2013), group psychotherapy (Aboulafia-Brakha & Ptak, 2016), and various psycho-education based interventions (Hart, Brockway, Fann, Maiuro, & Vaccaro, 2015; Hart, Vaccaro, Hays, & Maiuro, 2012; Medd & Tate, 2000). Although these can be beneficial for the target emotional outcome, it has been suggested that such specific interventions may not generalise to *other* affective difficulties (Waldron et al., 2013). A more promising target, therefore, may be emotion *regulation*. However, only a small number of intervention studies have explicitly aimed to promote adaptive ER skills, based on the Process Model perspective (Salas et al., 2019, for a review).

The available studies of ER interventions appear to be growing, but with much variation in their modalities and theoretical approaches. For instance, a recent study by Kim, Zemon, Lehrer, McCraty, et al (2019) provides preliminary evidence of how heart rate variability biofeedback can improve adaptive cardiovascular responding, and in turn ER, in people with ABI. As regards *psychological* interventions provided individually, Neumann, Malec, and Hammond (2017) demonstrated how eight sessions of psycho-education and skill-building about emotional awareness, vocabulary, and regulation, had significant beneficial effects for some measures of ER and emotional distress. However, this intervention focused on alexithymia, not ER more generally.

Other ER intervention studies have provided treatment in the *group* modality. Cantor and colleagues (2014), for example, developed the Short-Term Executive Plus (STEP) intervention, which combines 108 individual sessions of CBT and skill building for executive function training, and just two 45 minute group sessions to address ER and problem solving. Though significant beneficial effects were found for executive function, no differences in ER were observed. Tornås and colleagues (2016) added a group ER module to Goal Management

Training (GMT). This module was consistent with GMT and mindfulness approaches, and involved the modulation of emotional experience by exploring the relationship between emotions, thoughts and situations. Significant improvement was found on self-report ER and emotional experience scales, with medium-to-large effect sizes. However, it is noteworthy that the GMT treatment package can be expensive for publicly-funded under-resourced services.

A final intervention of note is a 24 session, web-based, group intervention for ER, which included psycho-education, CBT principles, and skill-building, provided over video-conferencing (Tsaousides, Spielman, Kajankova, Guetta, et al., 2017). This intervention involved training in *strategies* to manage emotions. Significant improvement in ER was reported, with large effect sizes, and continued improvement following treatment completion. It is, however, possible that such an intervention may not fit into all service approaches, and with patients who are not comfortable with technology.

Considered together, it is difficult to draw an overall picture of the effectiveness of these interventions, because, as previously mentioned, they lack an over-arching framework (Salas et al., 2019). Without a unified definition, and a solid theoretically-driven approach, it is difficult to develop sound and easily-implementable neuropsychological interventions to improve regulatory skills. Similar to executive function interventions that are based upon models of frontal lobe function (Stuss & Alexander, 2007), ER interventions must also be based upon strong foundations. Indeed, as emphasised by Wilson and Gracey (2009), an understanding of theories and models is crucial to successfully rehabilitate emotional functioning. By using the Process Model as a theoretical framework, interventions can be mapped on to the psychological mechanisms that allow feelings to be regulated, and how

they relate to impairment. This may be a more useful way to understand and *treat* ER difficulties after ABI, and is addressed in Chapters Four and Five.

Patient Experience

An often neglected element of group intervention development and evaluation is the patient or 'consumer' experience (Patterson et al., 2016). This is especially interesting because rehabilitation is expected to be person-centred (Turner-Stokes, 2007; Wilson et al., 2009), and the 'patient experience' is especially emphasised in the NHS Wales Mandate, and Health and Social Care Act 2012 (Wales). Group-based interventions should, therefore, be informed by patient perspectives, as well as the quantitative research and theoretical literature (Patterson et al., 2016). There is also a growing appreciation of the limits of using standardised scales for evaluating patient improvement following interventions (Diener, Inglehart, & Tay, 2013; Wilson et al., 2008). Unfortunately, in neuropsychological rehabilitation there are still very few studies which explore patient experiences of group-based treatment in-depth (Patterson et al., 2016, for review).

A recent scoping review especially highlights a need for research to understand the key 'ingredients' of a group intervention, and their impact on real-world outcome, from the perspective of the patient (Patterson et al., 2016). Based on a modest number of qualitative studies, the authors recommend greater emphasis on group-interventions, and the use of patient perspectives to identify the elements which facilitate their success (Patterson et al., 2016). It appears clear that understanding the 'user experience', through qualitative research, is key to develop and improve neuropsychological programmes. This issue is addressed in Chapter Four, which focuses on the subjective experience of participating in a group programme.

Qualitative research has, thus far, been important in addressing key issues in the wider context of the rehabilitation experience (Graff, Christensen, Poulsen, & Egerod, 2018; Levack et al., 2010). For instance, the perceived benefit of good quality care, appropriate discharge planning, and continuity of multi-disciplinary input in the community, have all been identified as important for recovery (Downing, Hicks, Braaf, Myles, et al., 2020). Additionally, qualitative interviews identified *person-centeredness* as a core component of a positive experience of an inpatient rehabilitation programme (Wain, Kneebone, & Billings, 2008). One patient's account captured the discrepancy between a lack of improvement on empirical measurements and the subjective feelings of having improved (Wain et al., 2008). The clinical relevance of qualitative accounts, again, highlight the potential role of patient experiences in refining services, and in evaluating rehabilitation interventions. Investigating this issue through both qualitative and quantitative accounts is at the heart of this thesis.

Patient accounts have also helped to identify the key 'ingredients' of various rehabilitation programmes (Couchman et al., 2014; Graff et al., 2018; Salas, Casassus, Rowlands, & Pimm, 2020). For instance, the experience of 'safeness', and continued support, as underlying elements of a social rehabilitation day centre (Salas et al., 2020). Additionally, qualitative research points to the positive effects of adequate information and formal support on patients' motivation for rehabilitation (Maclean, Pound, & Rudd, 2000; Levack et al., 2010). In contrast, a lack of information, or transparency from professionals, are considered barriers to rehabilitation and recovery (Graff et al., 2018; Maclean et al., 2000).

In a meta-synthesis of qualitative research, external support (such as that provided by rehabilitation programmes) was, indeed, perceived as important for recovery (Levack et al., 2010). Elements of rehabilitation that were frequently reported as valuable include learning about their injury, and coming to terms with their disability (Paterson & Stewart, 2002;

Petrella, McColl, Krupa, & Johnston, 2005). Interacting with other survivors, for example in community groups, had a number of significant perceived benefits. These include, fighting social isolation, providing emotional support, and allowing them to experience a sense of 'normality' (Howes, Benton, & Edwards, 2005; Jumisko, Lexell, & Söderberg, 2005; O'callaghan, Powell, & Oyebode, 2006). The group experience is addressed qualitatively in Chapter Four, and quantitatively in Chapters Five and Six.

As regards *specific* group programmes, a number of interesting themes were identified, following the qualitative analysis of a multifamily group therapy (The Headstart programme) (Couchman et al., 2014). An overarching theme was the idea of a 'new normal': that the group was a place which allowed survivors and families to develop a sense of normality, within the context of similar others. The attendees expressed a sense of social connection, the enhancement of a sense of self-identity, and the value of the knowledge and understanding which came from interacting with group members. This is important because it highlights the value of the *group* environment, and how the informal learning which comes from it, was seen as more informative than the content of the intervention[3]. Similar findings were described in a recent scoping review of group interventions, where themes especially revolved around peer support, reduction of isolation, and adjustment (Patterson et al., 2016 for review).

Little is known, however, about the lived experience of specific *ER* interventions provided in a group format, and which key 'ingredients' are important from the patients' perspectives. There is one exception to this, Tsaousides et al (2017) included some *basic* qualitative feedback, that focused on patients' experience of the virtual nature of their web-based ER intervention. The majority reported that the programme was helpful, convenient,

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[3] Description from Chapter Four

relevant to them and their goals, and that they enjoyed connecting with other survivors. This is an important finding, because both the *experience* and the *engagement* in rehabilitation programmes may be crucial components for outcomes (Paolucci, Di, Massicci, Traballesi, et al., 2012; Williams, Rapport, Hanks, & Parker, 2019). Additionally, evaluating an intervention exclusively on statistical significance, without taking into account the 'consumer experience' or patient acceptability, may not be the best approach in achieving patient-centred clinical care. The importance of qualitative research for intervention evaluation, and identifying individual key 'ingredients', is addressed in Chapter Four.

Processes at play

A final aspect of group interventions that is under-investigated is the processes which may influence outcome and engagement (Patterson et al., 2016; Stagg, Douglas, & Iacono, 2019). In the wider context of patient *recovery*, research has been much more informative. For example, demographic factors, such as younger age (Forslund, Roe, Perrin, Sigurdardottir, et al., 2017; Senathi-Raja, Ponsford, & Schönberger, 2010) and higher pre-injury education level (Seagly, O'Neil, & Hanks, 2018), have been associated with more favourable outcomes. As regards personal characteristics, greater resilience (Wardlaw, Hicks, Sherer, & Ponsford, 2018), problem-focused coping (Shotton, Simpson, & Smith, 2007), and positive perspectives (Downing et al., 2020; Glintborg & Hansen, 2016), are among the factors that are thought to contribute to good recovery. Successful rehabilitation (as opposed to recovery) also inevitably depends on a number of dynamic underlying factors (Bright, Kayes, Worrall, & McPherson, 2015; Schönberger, Humle, & Teasdale, 2006c; Stagg et al., 2019). A better understanding of such processes, and which factors make people more likely to benefit from interventions, have been identified as key areas for research development (Patterson et al., 2016; Turner-Stokes et al., 2015)

Though the research remains relatively modest, patient perspectives have highlighted a number of important factors at play in the rehabilitation environment (Bishop, Kayes, & McPherson, 2019; Lawton, Haddock, Conroy, & Sage, 2016). These include negative variables, such as poor communication and lack of compassion from acute-care staff (Abrahamson et al., 2017), and insufficient information from health professionals (Couchman et al., 2014). In contrast, appropriate formal support by professionals is perceived to contribute to a positive adjustment trajectory (Smith, Jones, Gracey, Mullis, et al., 2019). Importantly, the relationship between the therapist and patient is considered 'pivotal' in encouraging engagement and participation in rehabilitation (Bright et al., 2015; Lawton et al., 2016, for reviews).

The therapeutic relationship, commonly described as the therapeutic 'working alliance', may be a key process at play during neuropsychological interventions (Stagg, Douglas, & Iacano, 2019). The therapeutic alliance (TA) is a term describing the *relational* processes which unfold during clinical interactions, and its roots are well-established in the psychotherapy literature (Horvath & Luborsky, 1993; Horvath & Symonds, 1991). The most influential theoretical framework of the TA consists of three underlying dimensions, which are all reliably shown to be important. These are: 1) the client and therapist agreement on the *tasks* to be completed as part of therapy; 2) agreement on the *goals* and expected outcomes; and 3) the interpersonal and emotional *bond* between client and therapist (Bordin, 1979). Within psychotherapy, the TA has been shown to be a moderate and robust predictor of outcome (Hovarth & Symonds, 1991; Martin, Garske, & Davis, 2000, for meta-analyses). However, the current literature provides only limited insight into the importance, and challenges, of the client-therapist relationship in neurorehabilitation.

The emerging idea, from the limited existing research, is that the TA is a process which can shape outcome, and is influenced by several factors present in the rehabilitation

environment (Stagg et al., 2019, for a review). Empirical investigations which have focused on *outcomes* have demonstrated positive associations between the strength of the alliance and vocational function (e.g. return to work) (Evans, Sherer, Nakase-Richardson, Mani, & Irby, 2008; Klonoff, Lamb, & Henderson, 2001; Lustig, Strauser, Weems, Donnell, & Smith, 2003; Schönberger, Humle, Zeeman, & Teasdale, 2006a; Stagg et al., 2019, for a review). As regards clinical outcomes, the TA may be associated with greater improvement in social interactions, independence, and communication skills (Schönberger, Humle, & Teasdale, 2006b).

According to Bordin (1979) the TA is relevant across *all* settings which involve a process of change, and that each new environment may bring to light factors which could shape its strength. However, most of the work investigating the TA in neurorehabilitation has focused on comprehensive and intense programmes (Stagg et al., 2019). The role of the TA across various rehabilitation settings, and within specific interventions, is much less clear. As previously mentioned, group interventions are commonly carried out across services and bring several benefits to patients (Couchman et al., 2014; Patterson et al., 2016). However, no previous study has investigated the TA in a low-intensity group psycho-education intervention (c.f. Schönberger et al., 2006ab, which investigated a comprehensive group programme). Given the role of the alliance in rehabilitation outcomes (Stagg et al., 2019), and the benefit of group psycho-education programmes within services, it is important to develop an understanding of the potential role of this therapeutic process in this context. This issue is addressed in Chapter Five.

The TA is also a potential mechanism to enhance patient *engagement* and compliance in neurorehabilitation, with the majority of evidence from qualitative research (Bishop et al., 2019; Bright, Kayes, Cummins, Worrall, & McPherson, 2017; Schönberger et al., 2006c).

For example, in a meta-ethnography of qualitative stroke rehabilitation studies, the establishment of a genuine bond was considered a crucial aspect of purposive rehabilitative activities (Lawton et al., 2016). Importantly, the TA was also described as having great benefits in terms of engagement and motivation (Lawton, et al., 2016). The direct role of the TA on patient engagement within specific rehabilitation interventions, however, remains unclear, and is addressed in detail in Chapter Six.

The nature of ABI impairment may place unique demands on the development of the therapeutic relationship (Judd & Wilson, 2005; Stagg et al., 2019). Careful attention, therefore, must be paid to factors which might impede, or facilitate, the strength of the TA. Insights from qualitative research have identified a range of *cognitive* consequences, *emotional* difficulties, and *behavioural* disinhibition, as frequently reported challenges in developing a strong therapeutic relationship (Judd & Wilson, 2005). Quantitative research provides modest insight into this issue (Stagg et al., 2019). However, younger patient age (Bishop et al., 2019; Schönberger et al., 2006c) and greater years in education (Sherer, Evans, Leverenz, Stouter, Irby, et al., 2007) may positively influence the strength of the alliance. As regards injury-specific factors, *cognitive* impairment has been reported to be weak in nature (Schönberger, Humle, & Teasdale, 2007). A more recent finding suggests that post-injury cognitive impairment, does *not* pose a barrier to developing a strong TA, at least in the context of CBT (Zelencich, Kazantzis, Wong, McKenzie, et al., 2019).

One aspect of brain injury that may pose a barrier to developing a good therapeutic relationship, but has not received much attention in the quantitative literature, are the emotional consequences. Qualitative research describes emotional difficulties as a barrier to developing a strong patient-therapist bond (Judd & Wilson, 2005). Limited quantitative evidence suggests that depression symptoms may also be a challenge to forming a TA

(Sherer, Nakase-Richardson, Mani, & Irby Jr, 2008). An investigation into such factors might enable clinicians to identify those patients that may be at risk of a poorer TA, and tailor their clinical skills accordingly. The predictive value of injury-specific, emotional, and demographic factors, in the context of the TA, is addressed in Chapter Six.

An additional underlying factor which may be particularly important to understand further is the *group* dynamic. Indeed, the qualitative literature highlights that the *social* element, of relating and sharing their experiences with other survivors, is often the most powerfully reported aspect of group and community programmes (Couchman et al., 2014; Salas et al., 2018; 2020; Smith, Jones, Gracey, Mullis, et al., 2019). In addition, patient perceptions have emphasised the important role and value of group processes, such as cohesion and interaction, for the experience of interventions (Couchman et al., 2014; Patterson et al., 2016). In the psychiatric literature, *group* processes, such a cohesion, have been identified as important contributors of psychotherapy outcome (Burlingame, McClendon, & Yang, 2018, for meta-analysis; Crowe & Grenyer, 2008). This effect has not been well-investigated in the context of neurorehabilitation group programmes. There is a need to explicitly explore underlying processes, and the effectiveness of groups as a vehicle of intervention (Patterson et al., 2016). This thesis addresses this gap in a number of ways, as seen in Chapters Four, Five, and Six.

1.2 Part B – Thesis Aims

The review has highlighted a number of crucial gaps in the literature, that are highly relevant for neuropsychological rehabilitation. The aims of this thesis are to address each one of these, using a number of methods and approaches. A useful way of conceptualising these gaps is through *five* core areas of neuropsychological rehabilitation science, that require

research development (as highlighted in Part A of this introduction). These gaps were approached in the following ways:

1.2.1   *Build Long-Term*

The provision of support for people with ABI in the chronic phase has been an area of little emphasis in the literature (Rotondi et al., 2006; Turner-Stokes et al., 2015). This is especially concerning for a number of reasons. Firstly, many patients' difficulties persist in the chronic phase (Ponsford et al., 2014), and can last a life-time. Secondly, long-term support is an aspect of unmet needs, with survivors describing inadequate provision of services for their emerging difficulties (Abrahamson et al., 2017; Chen et al., 2019). Finally, comprehensive post-acute rehabilitation is not available to *many* patients, and for those who do receive it, it should be followed up by long-term community support (Turner-Stokes et al., 2015). Due to their cost, comprehensive rehabilitation is often not possible across many services and locations, especially areas of socio-economic deprivation and rurality. Indeed, the research efforts and clinical care available in this area have been asymmetrical. Greater emphasis has been placed on services which are often inaccessible for many people, in particular in rural areas.

This thesis specifically aimed to address this asymmetry by developing collaborative clinical research with a community-based outpatient rehabilitation service, in rural North Wales (the NWBIS). Each chapter has focused exclusively on participants with ABI who are accessing *long-term* support (nine months to decades following injury), at NWBIS, or additional community settings. Importantly, community rehabilitation services, which are often under-resourced, seek out easily implementable and cost-effective interventions to treat their patients. To improve this provision, a core aim of the thesis was to develop, facilitate, and evaluate a theoretically-driven and holistically-influenced group intervention (The Brain

Injury Solutions and Emotions Programme; BISEP), to address a central aspect of patient difficulty (emotion regulation). This was designed to be appropriate and suitable to embed within a publicly-funded community service, and to be easily implementable by staff who are part-way through training. The intervention was evaluated in two ways. Chapter Four focuses on a *qualitative* evaluation, taking into account the perspectives of 20 people who completed the programme. Chapter Five presents a *quantitative* evaluation of a 'phase one' study, examining the initial efficacy of BISEP.

1.2.2 *Groups are Seldom Evaluated*

A number of general and targeted group interventions are carried out clinically across different areas of rehabilitation (Patterson et al., 2016), and are considered a crucial aspect of care after ABI (Lukens & McFarlane, 2004; Smith & Testani-Dufour, 2002). There are a modest number of published 'guides' on running group interventions. Unfortunately, these do not always have associated empirical data, and vary largely in their content and length (Backhaus & Ibarra, 2012; Powell, 2013; Powell & Malia, 2003; van den Broek & Dayus, 2002; Winson, Wilson, & Bateman, 2013; Ziyal, 2017). There are also a number of published intervention studies, again with much variation in their content, approach, settings, and methodological rigour (Patterson et al., 2016, for a review). Such empirically evaluated interventions studies are not always feasible in community settings. Many services also appear to have a 'homegrown' approach to running group programmes, which are developed in line with expert experiences and opinions, and are seldom evaluated empirically. Although group interventions that are run within clinical services are surely valuable, these existing approaches mean that there are a number of potential issues. For instance, facilitating an intervention which is not efficacious, or not acceptable to patients, is not the best use of already limited resources. Finally, such an approach limits the possibility of developing

research communities, and impact studies, which may facilitate the advancement of the wider field.

A core aim of this thesis was to address this issue, by developing a theoretically-driven group intervention, that could be easily embedded within routine clinical practice in a 'slow stream' community setting, and to evaluate it empirically. It is important to understand the 'patient experience' of such interventions, to ensure they are acceptable, and to identify key 'ingredients' and processes. In line with this, the intervention was evaluated through patient interviews in Chapter Four. Like any new intervention, it is also important to investigate initial efficacy, feasibility, and methodological issues, to lay the foundations for future randomised control clinical trials. These issues are addressed in a 'phase one' study in Chapter Five, where performance on a number of measures are compared before, after, and at a three-month follow-up, following completion of BISEP, in relation to a non-active control group. In addition, to build real-world capacity, the intervention resources will be made *freely* available, through the following link: https://drive.google.com/open?id=1SPu-ZKKR8zfXF8IzCRPQxbDSkicYF2l3[4]. In line with the local health board policy (Betsi Cadwaladr University Health Board; BCUHB), and the Welsh Language Act 1993, the intervention materials are available in both Welsh and English.

1.2.3 Focus on Feelings

Emotion *regulation* is a crucial element to address after ABI, as this is a common (Beer & Lombardo, 2007; Salas et al., 2019) and transdiagnostic consequence of injury (Shields et al., 2016). It is only recently that ER difficulties in neurological patients have been studied systematically, using the well-established Process Model as a theoretical framework (Salas et al., 2019, for a review). The Process Model is also particularly relevant

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[4] Outside the context of this thesis, LR must first be contacted for the link, for regulation purposes.

for rehabilitation, because it addresses a crucial problem in clinical neuropsychology: "the interface between cognition and affect" (Salas et al., 2019, p. 3). However, the literature remains modest. There are also very few interventions which explicitly address the *strategies* that allow people to manage their feelings, and may lack an over-arching theoretical framework. This is especially problematic because addressing ER from various perspectives limits the inferences that can be made from the overall literature. In addition, many approaches neglect to take into account *positive* ER.

For these reasons, addressing this substantial gap in the literature is no easy task. This thesis aimed, firstly, to contribute to the advancement of knowledge of ER after brain injury. Chapters Two and Three (experimental studies) focused on the Process Model strategy which has received most attention in the literature on neurotypical adults, that is *cognitive reappraisal*[5]. These chapters evaluate whether an ABI increases one's vulnerability to reappraisal impairment, and investigates the underlying cognitive control mechanisms. In addition, both chapters addressed various aspects of reappraisal, and aimed to increase the understanding of this particular strategy in a wider context (See more below in 'Thesis Overview).

Secondly, and perhaps most importantly, the present approach used the Process Model, Positive Psychology influence, and findings from Chapters Two and Three, to inform development of a group intervention. BISEP focuses especially on the strategies that can be used adaptively to manage emotions in real-life, and to promote positivity and optimism. In line with the holistic approach, BISEP also addresses other key issues (e.g. cognition, fatigue), though these aspects are only evaluated qualitatively. Chapter Four presents a

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[5] This strategy was chosen, as it now has a robust and strong knowledge base, and this allows for better comparison and understanding of reappraisal in the context of brain injury. Additionally, reappraisal is central to many therapeutic approaches.

qualitative evaluation of the intervention (using patient interviews), which included a question specifically addressing the effectiveness of BISEP in promoting emotion management. Chapter Five presents a 'phase one' quantitative evaluation of the group programme. This aimed to explore the initial efficacy of BISEP at improving reappraisal skills, and common emotion symptomatology (anxiety and depression).

1.2.4   Prioritising Patient Perspectives

The identification of key aspects of group programmes, through patient perspectives, has been identified as an important area for research development (Patterson et al., 2016). Understanding the patient experience through qualitative methods is crucial for intervention evaluation. Without taking into account subjective experience of group interventions, it is difficult to understand the salience and value of individual elements, factors related to engagement, and the acceptability of an intervention for patients.

To address this issue, this thesis has employed qualitative methods as an approach of equal importance for evaluating the developed intervention. Chapter Four describes in detail participants' subjective accounts and reflections of participating in BISEP. This chapter aimed to evaluate their thoughts on BISEP and the strategies offered, its effectiveness for improving ER, and to better understand the individual elements that are of particular value. This approach placed the *patient* at the heart of the evaluation. Additionally, in Chapter Five, the importance of participants' experiences of, and feelings towards, their *group* members (measured quantitatively) was investigated in relation to intervention improvement.

1.2.5   Predictors and Processes

The success and experience of group interventions likely depends on a number of underlying elements (Bishop et al., 2019; Schönberger et al., 2006c). A key area for the enhancement of research in this area is the investigation of factors which might make patients

more likely to benefit from interventions, such as group-based programmes (Patterson et al., 2016; Turner-Stokes et al., 2015). Though there is much clinical *advice* (e.g. Winson et al., 2017), there is only a modest amount of guidance based on empirical studies (Judd & Wilson, 2005; Schönberger et al., 2006c; Zelencich et al., 2019). This lack of research is not a minor issue, because clinicians and group facilitators have very few evidence-based reasons to make decisions. Processes which might be especially important to consider are the therapeutic working alliance (Stagg et al., 2019, for a review), and processes such as 'group attraction' (Burlingame et al., 2018). Better identification of potential barriers and facilitating factors during the intervention might enable clinicians to identify group members who may need additional support.

This thesis aimed to address this gap in two ways. Firstly, to investigate potential factors which might impede the development of important therapeutic processes. This is especially relevant in ABI, where injury-specific factors, such as cognitive impairment or emotional difficulty, might present a challenge (Stagg et al., 2019). In Chapter Six, several predictors were investigated, for their role in developing a therapeutic alliance, 'group attraction', and for patient engagement. Secondly, in Chapter Five, the predictive role of individual therapeutic alliance and 'group attraction' were explored in relation to patient improvement following the intervention. Research addressing these underlying processes might allow clinicians to tailor their skills and limited resources accordingly.

1.3 Part C - Thesis Overview

This thesis comprises five empirical chapters. Each is presented as 'stand-alone' but inter-linked articles: all are published, under review, or in preparation for submission. Together, this family of articles aimed to address the five core gaps in the literature,

discussed above. In addition, each chapter identifies a number of practical suggestions for clinical practice. A brief summary of each chapter is provided below.

Chapter Two (Experimental study) has been published as a research article, and focused on the most widely investigated ER strategy: Reappraisal. This study is the first to address the important question of reappraisal across *discrete* negative emotions, and for up-regulating positive emotion, in participants with ABI (Rowlands, Coetzer, & Turnbull, 2019). Another issue addressed in this chapter was whether patients with ABI were impaired across various components of the reappraisal process, compared to neurotypical healthy controls. Finally, this chapter aimed to provide complementary evidence to a body of neuroimaging work, and sought to identify the cognitive control mechanisms which underlie this ER strategy. This chapter, and the overall thesis, took a *functional* perspective, and did not seek to make inferences about specific brain areas or ABI pathology.

Chapter Three (Experimental study; under review) addressed a key issue for ER research, especially in the context of ABI. That is, the issue of *measuring* reappraisal in the lab, in an ecologically valid way. By using two different types of stimuli (personal and impersonal), this chapter sought to understand the relevance of personal context for reappraisal, and which approach might be most appropriate to measure ER for participants with brain injury. Again, this was the first to address these issues in people with ABI. An additional aim was to understand the relationship between reappraisal and an established self-report reappraisal questionnaire, and the chapter sought to replicate some of the findings from Chapter Two (i.e. reappraisal impairment, and cognitive control mechanisms).

Chapter Four (Qualitative study; manuscript in preparation) focused on the important issue of taking into account patient experience in intervention evaluation. This chapter used patient interviews to understand their perspectives on participating in the newly developed

group programme (BISEP). This approach was especially interesting because it allowed the identification of individual elements *within* the programme that were particularly valued and salient. An important feature of this chapter was that it placed patient experiences at the heart of the evaluation, and thus made person-centred recommendations for clinical practice.

Chapter Five ('Phase one' study; under review) provided an evaluation of the initial efficacy of the newly developed group programme (BISEP), and feasibility for a future randomised trial. This chapter sought to evaluate improvement in reappraisal skills and emotional distress post-intervention, relative to a treatment as usual control group. Importantly, the maintenance of improvement was also taken into account, by assessing both groups at a three-month follow-up interval. There are a number of processes at play in the rehabilitation environment, including therapeutic alliance and 'group attraction'. This chapter investigated their predictive value for intervention improvement. The findings of this chapter have several clinical implications, in terms of group interventions generally, and BISEP specifically. This chapter aimed to build important foundations for a future clinical trial, subject to financial support.

Chapter Six (Experimental study) has been published, and addressed potential barriers or facilitating factors in developing important therapeutic processes (Rowlands, Coetzer, & Turnbull, 2020). These included demographic, emotional, and cognitive factors that are commonly associated with ABI, and their influence on developing a strong therapeutic alliance, 'group attraction', and engagement with the group programme. This article described which patients may need extra attention, and how a group facilitator or clinician may tailor their clinical skills accordingly.

Chapter Seven (Discussion) brought together the contributions of each article, and synthesises the strands of evidence. This final section provides implications for clinical

practice, and for future research. Importantly, it offers a comprehensive overview of emotion regulation in neuropsychological rehabilitation, and some of the challenges of intervention development and research.

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                        │        Chapter 1: Introduction            │
                        └──────────────────────────────────────────┘
        ┌──────────────────────────────┐        ┌──────────────────────────────────┐
        │ Contribute to evidence-base  │        │ Use evidence-base to inform       │
        │ of emotion regulation after  │        │ intervention development, and     │
        │ ABI                          │        │ evaluate its effectiveness        │
        └──────────────────────────────┘        └──────────────────────────────────┘
   ┌──────────────┐  ┌──────────────┐      ┌──────────────┐  ┌──────────────┐
   │ Chapter Two: │  │ Chapter Three:│     │ Chapter Four:│  │ Chapter Five:│
   │ Reappraisal  │  │ Reappraisal  │      │ Patient      │  │ 'Phase one'  │
   │ and Discrete │  │ for Personal │      │ Experience   │  │ Evaluation   │
   │ Emotions     │  │ Stimuli      │      │ of BISEP     │  │ of BISEP     │
   └──────────────┘  └──────────────┘      └──────────────┘  └──────────────┘
              ┌──────────────────────────────────────────┐
              │ Investigate factors which might impede    │
              │ (or facilitate) the processes at play     │
              │ during intervention                       │
              └──────────────────────────────────────────┘
                   ┌──────────────────────────┐
                   │ Chapter Six:             │
                   │ Predictors of alliance,  │
                   │ group attraction, and    │
                   │ engagement               │
                   └──────────────────────────┘
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              │        Chapter Seven: Discussion          │
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Figure 3. *Schematic representing thesis components, structure, and aims.*

2. Chapter Two

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"But [reappraisal] is difficult, because I always go back to the same place in my head. I try to take myself out of it, but it's hard. Especially when I sit down at night. The mind always wants to go backwards, instead of looking forwards"

- *Emyr (Participant from BISEP)*

2.1 Good things better? Reappraisal and discrete emotions in acquired brain injury[1]

2.1.1 Abstract

There has been substantial interest in emotion after acquired brain injury (ABI), but less attention paid to emotion *regulation* (ER). Research has focused primarily on the ER strategy of reappraisal for regulating negative emotions, without distinguishing between classes of emotion, and there has been no attempt at exploring these differences in patients with ABI. The present study explored components of reappraisal, across classes of emotion, and their associated neuropsychological mechanisms. Thirty-five patients with ABI and twenty-two matched healthy control participants (HCs) completed two questionnaires, a battery of cognitive tasks, and an emotion regulation task (the Affective Story Recall Reappraisal task). Results suggest that those with ABI take *longer*, and generate *fewer* reappraisals than HCs across several discrete emotions. Notably, their ability to decrease emotional intensity did not differ significantly to HCs for *negative* emotions, but findings suggest that their reappraisals were less effective when up-regulating *neutral* emotions to *positive*. Working memory was the only significant predictor of the total number of reappraisals generated, and the time taken to produce a first reappraisal. Implications of these findings are discussed in the context of neuropsychological rehabilitation, including the role of the relatives in implementing and reinforcing micro-interventions.

2.1.2 Introduction

Emotional changes have long been recognised as common impairments following acquired brain injury (ABI) (Draper & Ponsford, 2009; Diaz, Schwarzbold, Thais, Hohl, et al., 2012; Gainotti, 1993), and there has been substantial interest in emotion after ABI (Alway, McKay, Ponsford, & Schönberger, 2012; Shields, Ownsworth, O'Donovan, & Fleming, 2016; Williams & Evans, 2003). A number of studies have investigated the effects of injury on, for example, emotion perception (Bornhofen & McDonald, 2008), recognition (Calder, Keane, Manes, Antoun & Young, 2000) and experience (Calder et al., 2000; de Sousa, McDonald, & Rushby, 2012). Indeed, this is in line with the emergence of a growing field of affective neuropsychology (McDonald, 2017).

One aspect that has received less attention, but is particularly important to consider, is emotion *regulation* (ER) (Bechara, 2004; Beer & Lombardo, 2007). The most extensively used approach to ER is the Process Model, which describes this ability as a range of strategies that influence emotions, their intensity and the way they are experienced and expressed (Gross, 2013, 2014, 2015; Gross & Muñoz, 1995). Impairment in ER is a common consequence of ABI, across various pathologies and brain regions (Bechara, 2004; Beer & Lombardo, 2007), and is a key transdiagnostic element of global distress and mood disorders in this population (Shields et al., 2016).

The Process Model of ER outlines five classes of strategy that are used to regulate emotions (Gross, 2014). One particular approach, *reappraisal,* is the most frequently investigated (Goldin, McRae, Ramel, & Gross, 2008; Troy, Shallcross, Brunner, Friedman, & Jones, 2018; Zilverstand, Parvaz, & Goldstein, 2017), and involves changing the meaning of a situation, to alter its emotional consequence (Gross, 2002; McRae, Ciesielki, & Gross, 2012b). Reappraisal is well-understood to be an effective method for managing feelings (Sheppes & Meiran, 2007; Troy, Wihelm, Shallcross, & Mauss, 2010). Its use is positively

correlated with well-being and greater psychological health in neurologically healthy individuals (Gross & John, 2003; McRae, Jacobs, Ray, John, & Gross, 2012).

Reappraisal and Cognitive Control

Reappraisal is also known to be dependent on several cognitive control processes (Ochsner & Gross, 2005). This idea is consistent with neuroimaging studies, which have identified activation in areas in the prefrontal cortex (PFC) supporting cognitive control (Buhle, Silvers, Wager, Lopez, et al., 2014; Kalisch, 2009; McRae, Hughes, Chopra, Gabrieli, et al., 2010). Researchers have also tried to identify which neuropsychological functions support this complex process (McRae et al., 2012); for example, in the neurologically healthy, working memory may be a key capacity to keep the first appraisal in mind (Hendricks & Buchanan, 2015; McRae et al., 2012; Schmeichel, Volokhov, & Demaree, 2008). However, research into the neuropsychological mechanisms of reappraisal has produced variable evidence (Hendricks & Buchanan, 2016; McRae et al., 2012; Salas et al., 2014). In part because participants' reappraisals cannot (because of movement artefacts) be verbally produced in an imaging setting (e.g. Buhle et al., 2014). Additionally, these studies are in neurologically normal participants who *retain* this ability.

To address these critical gaps, Salas and colleagues (2014) investigated reappraisal *generation* in patients with brain injury, comprising reappraisal *productivity* (number of reappraisals generated), and *difficulty* (time to generate first reappraisal). This has been a fruitful approach because patients with ABI are often impaired in the manipulation of thought (Gomez Beldarrain, Garcia-Monco, Astigarraga, Gonzalez, & Grafman, 2005; Luria, 1966), and therefore may struggle to *generate* positive re-interpretations (Salas et al., 2014). People with ABI may be especially vulnerable to reappraisal deficits in the presence of time limitations, related to inhibition and verbal ability performance, but not working memory

(Salas et al., 2014). Notably, this is a contrasting finding to the earlier literature in neurotypical participants, who are able to generate reappraisals (e.g. McRae et al., 2012).

Discrete Emotions

Research on ER, and its biological substrate, has focused primarily on reappraisal for *negative* emotions (e.g. Goldin et al., 2008), often not distinguishing *between* discrete negative emotions. Additionally, traditional reappraisal paradigms typically use visual stimuli (from the International Affective picture System, IAPS, Lang, Bradley, & Cuthbert, 1997) which may trigger diverse discrete emotions, but these emotional reactions are only assessed in terms of valence and intensity. This is noteworthy because different classes of emotion contain unique information about the interaction with the environment, and enable adaptive responding (Ekman, 1992; Lazarus & Smith, 1988; Mauss, Levenson, Wilhelm, McCarter, & Gross, 2005). Equally important, these discrete emotions are supported by different neural systems (Celeghin, Diano, Bagnis, Viola, & Tamietto; 2017; Panksepp, 2003; 2004; 2005; 2011, Vytal & Hamann, 2010), with a large neuroimaging literature supporting interacting brain regions associated with the experience, perception and recognition of various categories of emotion (Adolphs 2002; Lindquist, Wager, Kober, Bliss-Moreau, & Barrett, 2012, for a meta-analysis).

The identification of multiple classes of emotion has provided an opportunity to understand how such experiences might vary. Some discrete emotions have been more closely associated with differences in decision-making (Lerner & Keltner, 2001), perception of risk (Lench & Levine, 2005), and behaviour (See Lench, Flores, & Bench, 2011 for a meta-analysis). The majority of research on emotion *regulation* has yet to systematically compare strategies using a discrete emotion framework, instead viewing ER as a global ability across emotions (e.g. Gratz & Roemer, 2004; Gross & John, 2003). There is, however, a modest body of work describing how ER, and specifically reappraisal, varies across

positive and negative emotions (Kim & Hamann, 2007; Mak, Hu, Zhang, Xiao, & Lee, 2009; Nezlek & Kuppens, 2008). This work suggests that neurologically healthy individuals find it easier to up-regulate positive emotions through reappraisal, than down-regulating negative emotions (Kim & Hamann, 2007). Some of the most convincing evidence of the relevance of discrete emotions in ER comes from the finding that strategies employed to regulate anger and sadness differ in both their use and effectiveness (Rivers, Brackett, Katulak, & Salovey, 2007). Individuals are more likely to use reappraisal for sadness than anger, and more likely to use situation-based strategies for anger compared to sadness (Rivers et al., 2007). It is, however, less clear how people with brain injury use ER strategies across different emotions.

Discrete Emotions in ABI Research

In ABI, there is a large body of research exploring various aspects of emotional difficulties (e.g. Shields et al., 2016; Williams & Evans, 2003). This includes a prominent theory that the right hemisphere mediates and processes negative emotions, and the left hemisphere positive emotions (the valence hypothesis) (Davidson, 2001; Demaree, Everhart, Youngstrom, & Harrison, 2005). Though studies on the valence hypothesis have provided mixed support (Demaree et al., 2005, for a review), there is substantial evidence of right hemisphere dominance for emotional processing regardless of valence (the right hemisphere hypothesis) (Gainotti, 2005, 2012, for reviews).

Additionally, there are a number of investigations of difficulties with *discrete* negative emotions, in particular anger (Mcdonald, Hunt, Henry, Dimoska, & Bornhofen, 2010; Neumann, Malec, & Hammond, 2015), depression (Kreutzer, Seel, & Gourley, 2001), and a range of emotional disorders (Shields et al., 2016). There are also studies which systematically address emotional processes across various emotion categories, for example the study of emotion recognition across classes of emotions after TBI (Babbage, Zupan, Neumann, Tomita, & Willer, 2011; Croker & McDonald, 2005), the re-experience of discrete

emotions in Korsakoff patients (Stanciu, Rafal, & Turnbull, 2018), and emotional experience in patients with ABI (Salas, Radovic, Castro, & Turnbull, 2015).

The present study

There has been no attempt at exploring differences in emotion *regulation* (based upon the Process Model) across different classes of emotions, in patients with ABI and healthy controls (HC). This provides an opportunity to understand how a well-researched ER strategy, reappraisal, might differ across emotions following injury. Building on previous research, the present study employed an internal mood induction paradigm (Salas, Radovic, & Turnbull, 2012: Salas et al., 2015) adapted to measure reappraisal. Notably, personally-salient emotion elicitation tasks, such as the Affective Story Recall task (ASR) (Turnbull, Evans, & Owen, 2005), may be more effective at inducing specific discrete emotions, at greater intensities, compared to external emotion elicitation (Salas et al., 2012, 2015).

The present study is the first to investigate reappraisal in ABI patients using an autobiographical recall reappraisal task (c.f. Salas et al., 2015, which focused on emotion elicitation). In addition to reappraisal effectiveness, the present study also examined reappraisal *generation*, by measuring *productivity* (total number of reappraisals generated) and *difficulty* (time taken to reappraise), as based on previous reappraisal research in this patient sample (Salas et al., 2014).

Given that patients with ABI experience difficulties across a range of discrete emotions, the following hypotheses were explored. Firstly, a 'discrete emotion hypothesis': that patients with ABI will take longer to generate reappraisals (reappraisal *difficulty*), will produce fewer reappraisals (reappraisal *productivity*), and have less effective reappraisals (reappraisal *effectiveness*) compared to the HC group, differentially across classes of emotions. In addition, a 'cognitive control hypothesis': cognitive control abilities (working

memory, inhibition, and verbal ability) will be positively related to reappraisal *productivity* and *effectiveness*, and negatively related to reappraisal *difficulty*.

2.2 Methods

2.2.1 Participants

A total of 57 participants were included in the study, comprising an ABI group, and an age and education matched HC group.

Acquired Brain Injury Group

Thirty-five participants with acquired brain injury (ABI) were prospectively referred mainly by clinicians at the North Wales Brain Injury Service (NWBIS), Betsi Cadwaladr University Health Board (BCUHB), a community-based outpatient rehabilitation service ($n =$ 25). A small proportion were recruited from a social rehabilitation day service in Manchester (The Headforward Centre) ($n = 5$), and through North Wales branches of the brain injury charity, Headway ($n = 5$). Eligible participants were adults with a confirmed ABI, as per NWBIS referral criteria (Coetzer, Vaughan, Roberts, & Rafal, 2003), duration of 9 months or greater since injury, and sufficient cognitive and language ability to complete the tasks (as judged by clinicians and staff members). Exclusion criteria included the presence of a psychiatric or substance use disorder in need of acute care, a neurodegenerative condition, or learning disability. Participants were also excluded if they did not have the capacity to give informed consent.

The average age of participants was 51 (*SD* = 11.82, range 26 - 74), with an average of 13 years in education (*SD* = 2.24, range 10 - 18). There were 27 males and 7 females, with an average time since injury of 8.7 years (*SD* = 9.86, range 9 months - 32 years). Details of injury characteristics can be found in Table 1.

Healthy Control Group

Twenty-two, age and education matched, neurotypical healthy control participants were recruited from the North Wales community. The average age of participants was 54 (*SD* = 8.46, range 35 - 69), with an average of 12.5 years in education (*SD* = 1.79, range 10 - 16). There were 12 males and 10 females.

Table 1. *ABI participant information and injury characteristics.*

ID	Gender	Age	Education (Years)	Years since injury	Aetiology	Lesion location & information
1	M	57	17	1	CVA	Left MCA territory.
2	M	40	13	21	TBI	Bilateral frontal contusions
3	M	56	13	13	TBI	--
4	M	42	13	1	TBI	Diffuse
5	M	29	13	1	TBI	Bilateral frontal lobe contusion
6	M	55	16	7	Encephalitis	Bilateral asymmetric temporal lobe
7	F	56	18	1	TBI	Diffude
8	M	57	16	22	TBI	Right temporo-parietal lesion.
9	M	47	10	9 months	CVA	Multiple infarcts (bilateral).
10	F	47	16	1	TBI	Left frontal & parietal contusions
11	F	63	11	1	CVA	Right MCA occlusion
12	M	53	13	4	TBI	Left temporo-parietal
13	M	67	13	1	Hypoxic	--
14	M	55	10	10 months	CVA	Right PCA aneurysm
15	M	47	13	29	TBI	Left frontal and parietal lesions.
16	M	58	13	3	CVA	Multiple infarcts

17	M	58	13	5	TBI	Left frontal lesion and diffuse axonal injury
18	M	53	13	9 months	CVA	Left frontal infarct
19	M	54	11	1	TBI	Frontal
20	M	54	16	10	CVA	Right MCA territory infarct.
21	M	50	13	32	TBI	--
22	M	45	16	1	CVA	AcommA Aneurysm.
23	M	40	11	5	CVA	AcommA Aneurysm
24	F	26	13	8	TBI	Diffuse TBI --
25	M	45	10	1	TBI	Right frontal lesion, left temporal contusion
HF26	F	32	11	16	Tumour/CVA	Ruptured pituitary gland tumour
HF27	M	70	16	1	CVA	Bilateral multiple infarcts
HF28	M	46	13	20	TBI	Diffuse TBI, bilateral --
HF29	M	43	13	28	TBI	Diffuse TBI--
HF30	M	59	11	24	TBI	--
HW31	F	61	11	22	TBI	Diffuse TBI--
HW32	M	34	16	1	TBI	Right sided SAH. --
HW33	M	72	10	11	TBI	--
HW34	F	34	16	10	AVM/CVA	Right parieto-occipital lesion.
HW35	M	74	13	8	CVA	Left-sided PCA territory. --

TBI = traumatic brain injury; CVA = cerebrovascular accident; -- = No information available; AVM = arteriovenous malformation; SAH = subarachnoid haemorrhage; MCA = middle cerebral artery; PCA = posterior cerebral artery; ACommA = Anterior communicating artery. Participant IDs beginning with "HF" or "HW" were recruited through Headforward Centre and Headway, respectively.

2.2.2 Measures

Emotional assessment

In order to evaluate emotional symptomatology and functioning, two self-report

questionnaires were employed. Firstly, the Hospital Anxiety and Depression Scale (HADS)

(Zigmond & Snaith, 1983) was administered. This consists of anxiety and depression subscales, with 14 items such as 'I feel tense or wound up'. The participant indicates, on a 4 point scale, agreement with each statement. This is a reliable and valid measure of anxiety and depression (Zigmond & Snaith, 1983), and its use has been validated in individuals with brain injury (Schönberger & Ponsford, 2010). Secondly, the Emotion Regulation Questionnaire, adapted for children and adolescents (ERQ-CA) (Gullone & Taffe, 2012), to assess self-report reappraisal in daily life. The adapted version was used because feedback from previous work in our lab (Salas et al., 2014) using the original ERQ (Gross & John, 2003), suggested that several patients struggled to grasp the wording. The ERQ-CA reports sound internal consistency (Gullone & Taffe, 2012).

Cognitive control assessment

A short battery of cognitive control tasks was used to measure working memory, verbal ability, and inhibition.

a) *Working Memory* was measured using the Digit Span (forward, backwards, and sequence) sub-task from the Wechsler Adult Intelligence Scale (WAIS IV) (Wechsler, 2008). These tasks are informative measures of working memory in brain-injured participants, and have been used as a marker for cognitive deficits (e.g. Millis, Rosenthal, Novack, Sherer, et al., 2001).

b) *Verbal Ability* was assessed using the Letter Fluency sub-task from the Delis-Kaplan Executive Function system (D-KEFS) (Delis, Kaplan, & Kramer, 2001). Letter fluency has been shown to be more strongly associated to cognitive control than other measures (Henry & Crawford, 2004), and has been used previously to investigate cognitive control and reappraisal in patients with ABI (Salas et al., 2014).

c) *Inhibition* was evaluated using the Hayling sentence completion task from the Hayling and Brixton tests (Burgess & Shallice, 1997). This task was chosen due to its

sensitivity (Burgess & Shallice, 1997), and validity in a sample of brain-injured

patients (Odhuba, van den Broek, & Johns, 2005).

Affective Story Recall Reappraisal (ASRR) task

This task has been adapted from previous reappraisal generation tasks that have used

stimuli form the IAPS (Salas, Gross, Rafal, Viñas-Guasch, & turnbull, 2013; Salas et al.,

2014), and the ASR emotion elicitation task, described in detail elsewhere (Salas et al., 2012;

Turnbull et al., 2005). Recalled personal events, as opposed to traditional IAPS stimuli, may

elicit discrete target emotions at higher intensities (Chirico, Cipresso, & Gaggioli, 2018) and

follow an emerging trend in emotion research of focusing on naturalistic contexts (Siedlecka

& Denson, 2019).

The task (See Appendix A for details) was carried out on a 13" laptop screen,

providing step-by-step instructions, to avoid any memory bias. Following two practice trials,

the participant was shown an emotion word (either 'sad', 'scared', 'angry', or 'neutral'), and

described an event which caused them to feel that emotion. Following this they indicated how

intense they felt the emotion on a zero to 10 scale, before generating reappraisals, and

associated intensity measurement.

The three negative emotions (sadness, fear, and anger) were chosen because of

widespread agreement in the literature that these are *basic* emotions (Tracy & Randles, 2011,

for a review). The 'neutral' condition involved neutral recollections, to be reappraised *into*

positive emotions; chosen to map on to reappraisal in real life settings (e.g. Livingstone &

Srivastava, 2012).[2] Each emotion word appeared twice, resulting in eight total trials. The task

was recorded and transcribed *verbatim*, the total number of reappraisals were counted, and

the time to generate a first reappraisal noted.

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[2] The alternative, making positive emotions *more* positive, would effectively be promoting unrealistic optimism
(Fleming & Strong, 1995). It would also be difficult to measure any differences in emotional intensity because
of ceiling effects.

See Figure 1 for visual representation of one trial ("sad" condition).
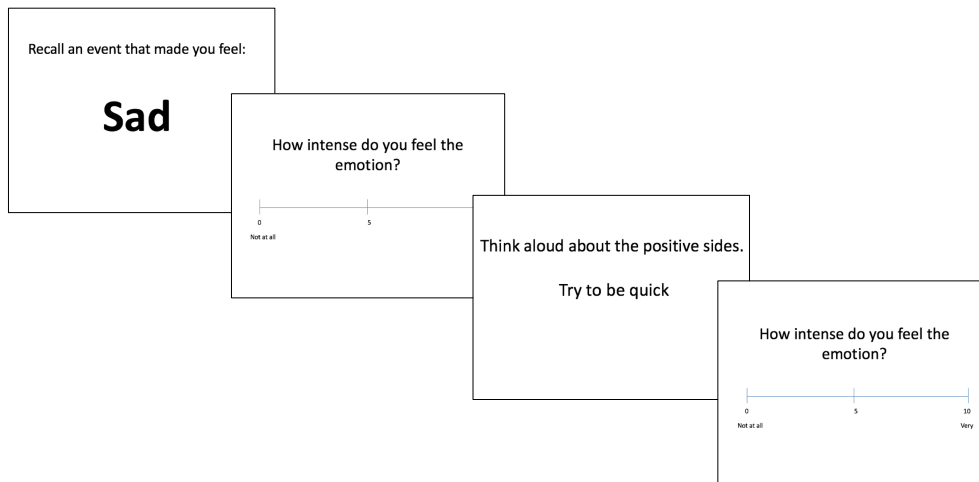
Figure 1. *Figure demonstrating one trial in the ASRR task (sad condition).*

2.2.3 Procedure

Ethical approval was granted by Bangor University (2017-16048) and BCUHB (224613). For the ABI group, potential participants were identified prospectively by members of the clinical team at NWBIS, rehabilitation staff at the Headforward Centre, and the Chairs of Headway branches. One referred participant was not included, due to later concerns of a neurodegenerative condition. HC participants were recruited from the community, and invited to take part. Following written informed consent, neuropsychological and emotional tasks were carried out within one session in a quiet room: at Bangor University, NWBIS, Headforward Centre, or participants' own homes. Questionnaires, neuropsychological tasks, and the ASRR task were administered in random order, with a short-break approximately half-way through the session. The ASRR task was transcribed and reappraisals were counted. If needed, a reappraisal coding guide was used in support (McRae et al., 2012b). All measures were administered by the first author, or trained research assistants.

2.2.4 Data Analysis

Three measures of reappraisal were produced by the ASRR task, resulting in three variables. Reappraisal *difficulty* was obtained by averaging the time taken to produce a first reappraisal. Reappraisal *productivity* was calculated by adding the total number of reappraisals produced, and reappraisal *effectiveness* was calculated by averaging the difference value between self-report emotional intensity before, and after, reappraising.

Data was analysed using 'R' Software, with additional packages ('Stats', 'Complmrob', and 'robustbase'). As the data was not normally distributed *the discrete emotion hypothesis* was analysed with several Mann-Whitney U tests, with Bonferroni adjustment for multiple comparisons (new alpha level .013), comparing 1) reappraisal *difficulty*, 2) reappraisal *productivity*, and 3) reappraisal *effectiveness* between patients with ABI and the HC group across the neutral, sadness, fear, and anger conditions.

The cognitive control hypothesis was explored by carrying out three separate robust multiple linear regression analyses (forced entry method) using the 'lmrob' function ('robustbase' package) with bootsrapped coefficients using fast and robust bootsrap via the 'bootscoef' function ('complmrob' package) with 'MM' method (Salibián-Barrera, Aelst, & Willems, 2008). Inhibition (Hayling sentences task scores), working memory (Digit Span WMS IV scores), and verbal ability (Letter fluency DKEFS scores) were entered as predictors, with the outcome variable consisting of reappraisal *difficulty, productivity,* and *effectiveness* across all emotion trials combined (ASRR Total). Bootstrapping techniques were employed for 999 bootstrap samples as a form of model validation (Babyak, 2004; Efron, 2003).

2.3 Results

2.3.1 Emotional and Cognitive functioning

Participants' average scores on measures of emotional and cognitive functioning can be seen in Table 2. In relation to depression symptoms, participants with ABI scored on average within the "borderline abnormal" range on the HADS, and were significantly more depressed than the HC group, with 11/35 scoring within the clinical range. On the anxiety subscale, participants with ABI also scored on average within the "borderline abnormal" range and were significantly more anxious than the HC group, with 20/35 in the clinical range. Participants with ABI also reported using reappraisal significantly less frequently to regulate their emotions than the HC group on the ERQ-CA.

On average both ABI and HC group scored within the "moderate average" range on the Hayling sentence task, as an indicator of inhibition. Working memory scores (Digit span, WAIS IV) and verbal ability scores (Letter fluency, DKEFS) for the ABI group were in the "low average" range, and were significantly less than the HC group.

Table 2. Emotional and cognitive functioning of ABI patients and HC participants

	Depression (HADS)	Anxiety (HADS)	ERQ-CA	Working memory (Digit Span, WAIS IV)	Verbal ability (Letter fluency, DKEFS)	Inhibition (Hayling sentences)
M, SD (ABI)	9.26, 4.11	9.89, 4.32	22.77, 6.91	22, 5.79	27.57, 11.24	15.03, 3.88
M, SD (HC)	3.32, 2.40	6.23, 3.32	31.32, 6.74	27.18, 3.40	32.32, 7.89	16.15, 2.90
M, SD Scaled Score (ABI)				7.51, 2.98	7.03, 3.43	4.66, 1.81
M, SD Scaled Score (HC)				10.14, 2.08	8.91, 2.49	5.14, 1.29
Score range for "borderline abnormal/impaired"	8 – 10	8 – 10		6 (scaled)	4 – 6 (scaled)	3 (scaled)
Score range for "clinical/impaired"	11 – 21	11 – 21		1 – 5 (scaled)	1 – 3 (scaled)	1 – 2 (scaled)
Number participants (/35) in the "borderline" range, "clinical/impaired range (ABI)	11, 11	2, 20		3, 10	12, 4	3, 4
Number participants (/22) in the "borderline" range, "clinical/impaired range" (HC)	1, 0	3, 2		0, 1	1, 0	3, 0
Significant difference (t-test *p* value)	< .001	.001	< .001	< .001	.041	.254

2.3.2 The Discrete Emotion Hypothesis

This sought to investigate reappraisal *difficulty, productivity,* and *effectiveness* across four classes of emotion.

Reappraisal Difficulty

The average time taken to produce a first reappraisal (reappraisal *difficulty*) was compared between the ABI and HC group, across the emotion classes (neutral, sadness, fear, and anger). See Table 3 for descriptive statistics.

Table 3. Time taken to generate a first reappraisal (reappraisal difficulty)

	Neutral	Sadness	Fear	Anger
ABI Group				
M, SD, Mdn	8.96, 4.38, 8.00	9.96, 3.48, 9.50	7.79, 3.18, 8.50	9.66, 3.90, 8.00
Mean Rank	35.71	34.47	35.84	32.13
HC Group				
M, SD, Mdn	4.68, 2.98, 3.50	6.59, 3.52, 5.25	5.52, 2.91, 5.50	7.32, 3.60, 8.00
Mean Rank	18.32	20.30	18.11	24.02

Table demonstrating descriptive statistics for reappraisal difficulty across all classes of emotion for ABI and HC groups.

Results of the Mann-Whitney U test demonstrated that the ABI group took significantly more time to produce a reappraisal compared to the HC group for the neutral ($U = 150.00, z = -3.86, p < .001, r = .51$), sadness ($U = 193.50, z = -3.14, p = .001, r = .42$), and fear conditions ($U = 145.50, z = -3.94, p < .001, r = .52$), all demonstrating medium-to-large effect sizes. There was no significant difference between groups for the anger condition, although there was a trend ($U = 275.50, z = -1.80, p = .072, r = .24$). See Figure 2.
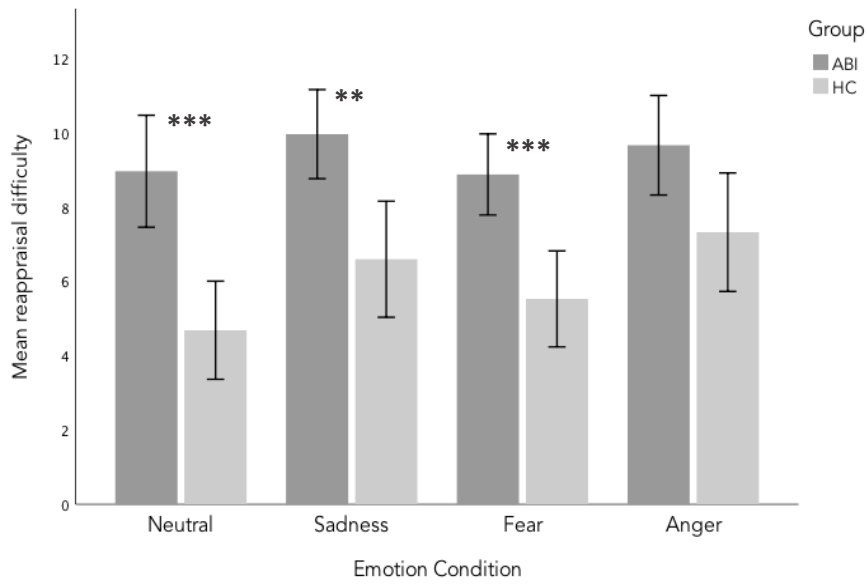
Figure 2. *Bar chart representing the average time taken (seconds) (reappraisal difficulty) to generate a first reappraisal across all emotion conditions for both the ABI and HC group. * <.05, **<.01, ***<.001*

Reappraisal Productivity

The total number of reappraisals produced (reappraisal *productivity*) was compared between the ABI and HC group, across the emotion classes. See Table 4 for descriptive statistics.

Table 4. Total number of reappraisals produced (Reappraisal *productivity*)

	Neutral	Sadness	Fear	Anger
ABI Group				
M, SD, Mdn	3.23, 1.35, 3.00	3.31, 2.06, 3.00	3.40, 1.96, 3.00	3.09, 1.82, 3.00
Mean Rank	24.36	24.63	24.00	24.96
HC Group				
M, SD, Mdn	4.59, 2.11, 4.00	4.73, 2.10, 4.00	4.86, 1.86, 5.00	3.23, 1.35, 3.00
Mean Rank	36.39	35.95	36.95	35.43

Table demonstrating descriptive statistics for reappraisal productivity across all classes of emotion for ABI and HC groups.

Results of the Mann-Whitney U test demonstrated that the ABI group produced significantly fewer reappraisals compared to the HC group for the neutral ($U = 222.50, z = -2.753, p = .005, r = .36$), sadness ($U = 232.00, z = -2.55, p = .010, r = .34$), and fear conditions ($U = 210.00, z = -2.92, p = .003, r = .39$), all demonstrating medium effect sizes. The difference between groups for the *anger* condition was marginally significant (with the adjusted alpha level), and demonstrated a medium effect size ($U = 243.50, z = -2.26, p = .018, r = .31$). See Figure 3.
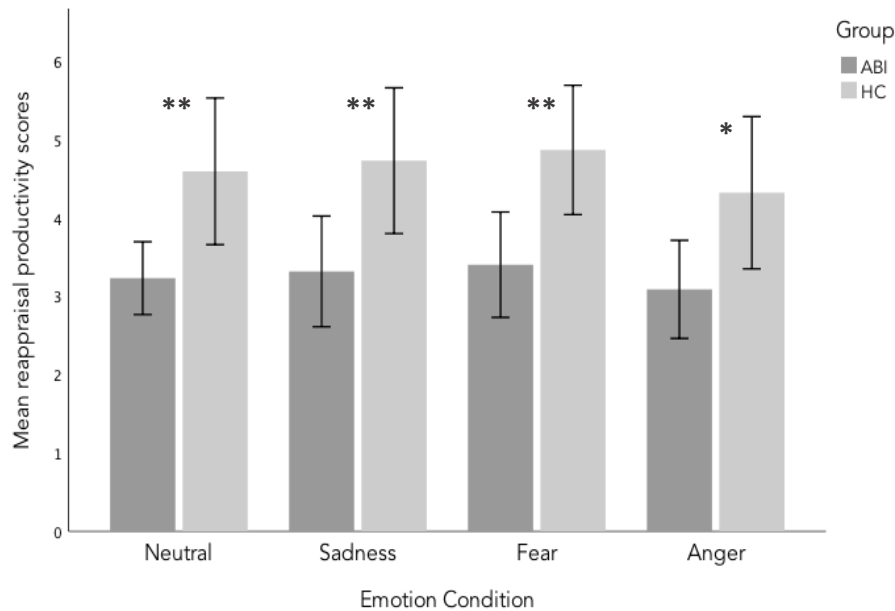
Figure 3. *Bar chart representing the average number of reappraisals produced (reappraisal productivity) across all emotion conditions for both the ABI and HC group. * <.05, **<.01, ***<.001*

Reappraisal Effectiveness

This analysis was conducted to investigate differences is reappraisal *effectiveness* between the ABI and HC group across classes of emotion. Participants' reappraisal *effectiveness* scores (difference between *initial* self-report arousal and arousal *after* reappraising) were compared across emotions: neutral, sadness, fear, and anger. For descriptive statistics see Table 5.

Table 5. The difference in emotional intensity before, and after, reappraising (Reappraisal *effectiveness* scores)

	Neutral	Sadness	Fear	Anger
ABI Group				
M, SD, Mdn	1.08, 1.18, 0.50	2.26, 2.01, 1.50	2.40, 1.98, 2.50	2.11, 2.21, 1.50
Mean Rank	23.37	26.13	26.90	25.64
HC Group				
M, SD, Mdn	3.21, 2.65, 2.75	3.32, 2.51, 2.75	3.59, 3.09, 2.50	3.46, 2.69, 2.50
Mean Rank	37.95	33.57	32.34	34.34

Table demonstrating descriptive statistics for reappraisal effectiveness across all classes of emotion for ABI and HC groups.

The ABI group had significantly lower reappraisal *effectiveness* scores, compared to the HC group, on the neutral condition with a medium effect size ($U = 188.00$, $z = -3.265$, $p = .001$, $r = .43$). There were no significant differences in reappraisal *effectiveness* across the sadness ($U = 284.50$, $z = -1.65$, $p = .099$, $r = .22$), fear ($U = 311.50$, $z = -1.21$, $p = .230$, $r = .16$), and anger conditions ($U = 266.500$, $z = -1.938$, $p = .053$, $r = .26$).[3] See Figure 4.

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[3] Given the distributed nature of lesion site and underlying pathology of the sample, Mann Whitney U tests were carried out to compare reappraisal *difficulty, productivity,* and *effectiveness* across all emotions; between those with TBI ($n = 20$) vs CVA ($n = 13$), and those with frontal brain injury ($n = 13$) vs non-frontal injury ($n = 6$). There were no significant differences or obvious trends. A Kruskal-Wallis test was used to compare the components of reappraisal across emotions between those with left lateralised ($n = 7$), right lateralised ($n = 7$), and bilateral lesions ($n = 9$). Again, there were no significant differences or obvious trends.
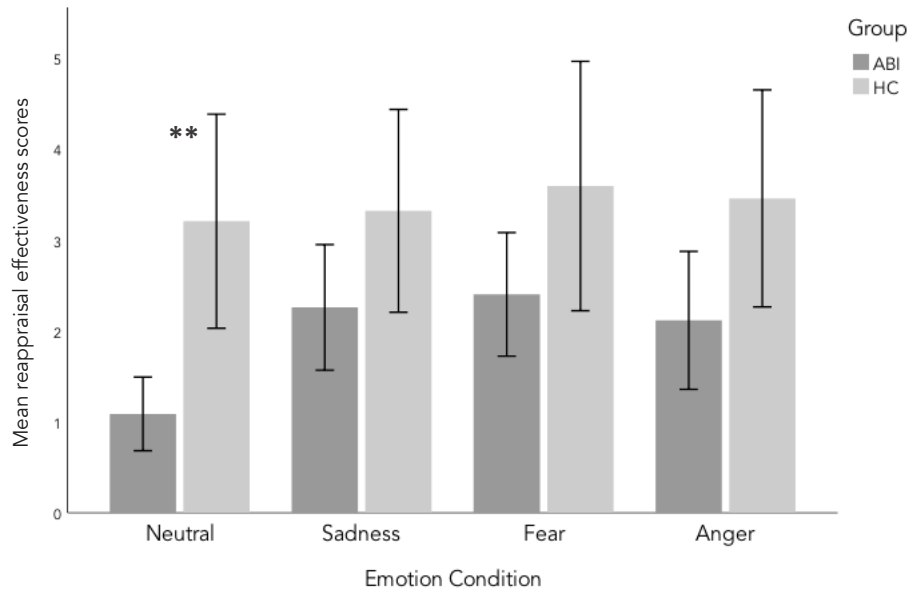
Figure 4. *Bar chart representing the average difference in emotional intensity after reappraising (reappraisal effectiveness) across all emotion conditions for both the ABI and HC group. * <.05, **<.01, ***<.001*

2.3.3 The Cognitive Control Hypothesis

This sought to investigate a range of cognitive elements related to the components of reappraisal. A series of robust multiple linear regression analyses were conducted to investigate the relationship between three measures of cognitive control (working memory, verbal ability, and inhibition) and reappraisal components (*difficulty, productivity,* and *effectiveness*) across all emotion trials combined (ASRR Total). For this the ABI group and HC group were combined to increase sample size.

Reappraisal difficulty. The model explained 25% of the variance, and significantly improved prediction of reappraisal *difficulty* ($R^2 = .25$, $F(3,53) = 17.40$, $p < .001$). According to bootstrap for coefficients, the only significant predictor was working memory (Digits WAIS scores) ($\beta = -.22$, $p = .006$), suggesting that a unit increase in working memory ability would result in a decrease of 0.22 seconds in the time taken to generate a first reappraisal.

Reappraisal productivity. The model containing all predictor variables (working memory, verbal fluency, and inhibition) explained 21% of the variance, and significantly

improved prediction of reappraisal *productivity* ($R^2 = .21$, $F(3,53) = 18.41$, $p < .001$). Bootstrap for coefficients, demonstrated that the only significant predictor in the model was working memory (Digits WAIS scores), $\beta = .54$, $p = .001$. The coefficients demonstrate that a unit increase in working memory would result in an 0.54 increase in the number of reappraisals produced.

Reappraisal effectiveness. The model explained only 2% of the variance in reappraisal *effectiveness*, and did not significantly improve predictions ($R^2 = .02$, $F(3,53) = 1.37$, $p = .712$). There were no significant predictors within the model.[4]

2.3.4 Summary of results

These findings suggest that, compared to HC participants, patients with ABI took *longer* to generate a reappraisal, and generated *fewer* reappraisals across most emotion classes. Participants with ABI were comparatively *less* effective at up-regulating neutral to positive emotion, compared to the down-regulation of sadness, fear, and anger. As regards the cognitive control hypothesis, the findings suggested that working memory had a role in two subprocesses of reappraisal only: predicting the time taken to produce a reappraisal (reappraisal *difficulty*), and the total number of reappraisals produced (reappraisal *productivity*). There were, however, no predictors of reappraisal *effectiveness,* suggesting that cognitive control may not play a role in regulating emotional experience through reappraisal.

2.4 Discussion

There has been no previous attempt to systematically compare components of reappraisal, using a discrete emotion framework, in an ABI sample. This is an important question, in particular in the context of people with brain injury, where it might inform

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[4] Due to the differences in reappraisal *effectiveness* between the negative emotions and the neutral emotion, reported in the *discrete emotion hypothesis*, a total score of negative emotions only (excluding neutral) was calculated and the regression run again. The results remained similar, with low explanation of variance (6%) and no significant predictors in the model.

rehabilitation clinicians. Additionally, the research into the underlying neuropsychological components has not been especially clear (Hendricks & Buchanan, 2016; McRae et al., 2012). The present study aimed to address these gaps, by investigating whether components of reappraisal (*difficulty, productivity,* and *effectiveness*) varied as a function of the emotion in patients with ABI relative to a HC group. A second aim was to investigate the cognitive control capacities related to these three components of reappraisal.

Reappraisal generation across discrete emotions

A key finding of the present study was that patients with brain injury took significantly *longer* to generate a reappraisal (compared to HC participants) for the sadness, fear, and the neutral to positive conditions. They also took longer for the anger condition, though this did not reach significance (perhaps an artefact of the small sample size). This provides further support for Salas and colleagues (2014), who found that patients with ABI may be vulnerable to reappraisal *generation* impairment in the presence of time limitations. Additionally, the present study extends this idea by suggesting that a brain injury compromises the capacity to positively re-interpret events quickly across several discrete emotion categories. In other words, it seems that this impairment is a global difficulty, and not related to any *specific* emotions.

The results also demonstrate that those with ABI generated significantly fewer reappraisals relative to the HC group, across the sadness, fear and the neutral-to-positive conditions, and approached significance for the anger condition. This is a contrasting finding to the only previous group study of reappraisal *generation* in an ABI sample, which demonstrated that participants with brain injury were able to generate a similar number of reappraisals to HCs (Salas et al., 2014). This variation may be a result of tasks used (traditional IAPS paradigm versus a task based on personally salient emotional memories).

This is consistent with the idea that reappraisal impairment may be exaggerated in situations that are closer to real life (Salas et al., 2014).

Considered together, it seems that those with an ABI are less able to *generate* reappraisals, across several emotions. If reappraisal is a two-stage process (initial meanings are inhibited, and new meanings generated) (Salas et al., 2014), the findings suggest that the presence of a brain injury particularly impacts upon this first stage. A possible explanation is that this particular ER strategy relies on the core ability to think flexibly, in order to generate new interpretations of events (Ochsner & Gross, 2004), something that is known to be affected in this patient group (Gomez Beldarrain, et al., 2005). Reappraisal is complex, and dependent upon cognitive control processes (McRae et al., 2012; Ochsner & Gross, 2005), therefore it is not surprising that patients with ABI who are executively impaired find it more difficult to *generate* reappraisals. This idea is consistent with a recent line of evidence in older adults, which suggests that reappraisal may not be the ER strategy of choice for those with age-related cognitive decline (Scheibe, Sheppes, & Staudinger, 2015).

Reappraisal effectiveness across negative emotions

The present study is the first to investigate reappraisal *effectiveness*, defined as the reappraisals' success at reducing (or amplifying) emotional intensity in line with the reappraisals' goals, in a group of patients with brain injury. There were no significant differences in reappraisal *effectiveness* between HCs and patients with ABI when regulating sadness, fear, or anger, although slightly lower for the ABI group and trending for anger. Overall, this suggests that once they were able to *generate* reappraisals, patients with brain injury were equally able to reduce the intensity of *negative* emotions through using this ER strategy. This has important implications for neurorehabilitation (See more below).

The present study suggests that all negative emotions were reappraised similarly for both the ABI and HC group, comparable to that reported elsewhere in the discrete emotion

literature in neurologically healthy adults (Mikolajczak, Nelis, Hansenne, & Quoidbach, 2008). The study also extends previous findings in work with children, which demonstrated that reappraisal is an effective strategy for regulating both fear and sadness (Davis, Quiñones-Camacho, & Buss, 2016). It is also similar to the results of a study using a similar autobiographical recall task, again in a neurologically healthy sample (Rivers, Brackett, Katulak, & Salovey, 2007). These findings suggest that reappraisal is an approach which has similar effectiveness across all negative emotions, for both HCs and individuals with brain injury, rather than suggesting that specific negative emotions have individual regulatory mechanisms.

The lack of significant difference between the ABI and HC group, however, is surprising, considering the numerous reports of specific emotional difficulties experienced by those with ABI (*e.g.* Fleminger, Oliver, Williams, & Evans, 2003; Gainotti 1993; Shields et al., 2016). For example, the commonly reported mood disorders such as depression (Bombardier, Fann, Temkin, Esselman, et al., 2010) and anxiety (Mallya, Sutherland, Pongracic, Mainland, & Ornstein, 2015), and difficulties with anger and aggression (Baguley, Cooper, & Felmingham, 2006). There are a number of possibilities for this finding. Firstly, it is likely that emotional distress is a result of emotion dysregulation, which includes *several* strategies (Shields et al., 2016), whereas the present study focused exclusively on reappraisal. Additionally, during the task participants were instructed to reappraise, it does not follow that patients would spontaneously reappraise in real life.

Reappraisal effectiveness for positive emotion

An unexpected finding was that of significantly lower reappraisal *effectiveness* scores when *up*-regulating to positive emotion, suggesting that patients with ABI find reappraisal comparatively less effective when attempting to increase neutral states. This is in line with the idea that the consequences and success of ER strategies are not always consistent across

negative and positive emotions (Gross & John, 2003; Gross & Levenson, 1997; Nezlek & Kuppens, 2008). This finding is especially interesting in the context of previous findings in neurologically healthy individuals, who find it easier to use reappraisal to regulate positive emotions, compared to negative emotions (Kim & Hamann, 2007; Nezlek & Kuppens, 2008; Ochsner, Ray, Cooper, Robertson, et al., 2004). It has been suggested that this may be because amplifying an emotional reaction is less difficult than decreasing it (Ochsner et al., 2004).

Notably, the opposite was found in the present study. There are a number of possibilities for this. Firstly, it may be related to how the conditions within the task differ. That is, for the down-regulation of negative emotions, participants first described a personal story which elicited a negative emotion. In contrast, the up-regulation of neutral to positive was framed as a neutral baseline, and therefore may require a different skill-set in which the ABI group were more impaired. This is in line with the idea that emotional intensity can affect ER strategy choice (Scheibe et al., 2015; Sheppes, Scheibe, Suri, & Gross, 2011; Sheppes & Gross, 2011).

A second possible explanation relates to reappraisal effectiveness in those with low mood, who show decreased ability to sustain positive emotions when using reappraisal (Heller, Johnstone, Shackman, Light, et al., 2009). If the experience of positive emotion increases reappraisal use (Nezlek & Kuppens, 2008; Fredrickson, 2001), then those who experience less positive affect may struggle to use reappraisal to up-regulate positive emotion. As there are high rates of depression among the ABI group, they may be subject to the same effects. However, re-investigation of our sample does not suggest that patients with lower mood are especially poor in up-regulation, as there was no correlation between their depression scores and reappraisal *effectiveness* for the neutral condition (*Spearman's rho* =

.06, $p = .736$). Future research would benefit from further investigating the effect of low mood in ABI on the up-regulation of positive emotion.

These findings suggest that reappraisal modulates all negative emotions to a similar level (likely due to shared neural mechanisms) regardless of the specific negative emotion. However, for individuals with brain injury, reappraisal seems comparatively less effective when up-regulating neutral to positive emotion.

Cognitive bases of reappraisal

In relation to the cognitive control hypothesis, the main finding was that working memory was the only significant predictor of both the average time taken to produce a reappraisal (reappraisal *difficulty*), and the total number of reappraisals produced (reappraisal *productivity*). This result provides additional support to previous findings in neurologically healthy participants that working memory is an important function for reappraisal (Hendricks & Buchanan, 2015; Jasielska, Kaczmarek, Bronska, Dominiak et al., 2017; McRae et al., 2012; Schmeichel et al., 2008). Additionally, these findings extend a well-established association between working memory and both reappraisal *effectiveness* (e.g. McRae et al., 2012), and *frequency* (e.g. Jasielska et al., 2017). Reappraisal is a complex cognitive process, that may well include several elements (McRae et al., 2012; Ochsner & Gross, 2008). The present study especially supports the role of working memory in maintaining the goal of reappraising, and shielding it from the initial meaning that may otherwise remain in the forefront of attention (Kanske, Heisser, Schönfelder, Bongers & Wessa, 2010; Gross, 2013).

A third finding of note was that none of the measures of cognitive control predicted the effectiveness of the reappraisal at modifying emotional intensity. This is surprising, because the majority of the literature has focused on this global ability, and the lack of significance might be argued to contradict the large body of neuroimaging studies demonstrating activation in brain areas associated with cognitive control (Buhle et al., 2014,

for a review). However, these neuroimaging studies were in neurologically healthy individuals, who are able to reappraise effectively. It is also possible that the lack of a significant predictor of effectiveness might be related to other components of cognitive control, not measured in the present study. For example, although somewhat unexplored, abstract reasoning may also be related to reappraisal (McRae et al., 2012; Salas et al., 2013). This is likely because reappraisal requires one to inhibit immediate emotional responses, in order to employ abstract ideas to change the meaning of a situation and its emotional impact (Salas et al., 2013).

Models of Reappraisal

How might these findings relate to existing models of reappraisal (e.g. Kalisch, 2009; Salas et al., 2014)? The present study appears to lend further support to a two-stage process, usually argued to consist of early and late components. The early stages are typically argued to involve choosing and implementing a reappraisal strategy, whereas the late components are concerned with maintaining the strategy in working memory (Kalisch, 2009). Developing this model further, Salas and colleagues (2014) suggested that inhibition and verbal ability might be important for the early stages (inhibiting the initial meaning and generating a new appraisal), but they found no evidence for the role of working memory in this early phase. In contrast, the present findings suggest that working memory appears to have a role in distancing from the negative initial appraisal, and producing a contesting mental representation of a positive nature. However, there may be an additional capacity required during the late phase, for example, to translate the reappraisal into a change in emotional intensity.

Implications for neuropsychological rehabilitation

The present study contributes to the understanding of how brain injury may impact upon reappraisal, across various emotion classes. In particular, by demonstrating that patients

with ABI were less able to generate reappraisals, and reported reappraisal as less effective for up-regulating positive emotions. This is consistent with the idea that a brain injury increases one's vulnerability to emotion dysregulation (Salas et al., 2013; 2014), and especially for *generating* reappraisals and the experience of sustaining positive emotions.

The finding that patients were impaired in their ability to generate reappraisals is particularly relevant for neuropsychological rehabilitation because this skill can be supported and facilitated externally, such as by family members. It has been shown that providing prompts can assist with the process of disengaging from the initial appraisal, and can improve the capacity to generate alternative interpretations of events (Salas et al., 2013). It may also provide suggestions for treatment, through the development of programmes which include an element of reappraisal generation training.

Another core difficulty may be regulating the experience of *positive* emotions. One way to help promote and acknowledge positive affect is by looking to the field of Positive Psychology (PP) (Seligman, 2000; Seligman, Steen, Park, & Peterson, 2005; See Donaldson, Dollwet, & Rao, 2015 for a review). Broadly, this field involves the study of positive emotion and traits, well-being, and optimal functioning, and has developed a number of small, simple PP interventions (Seligman et al., 2005). Recently, there has been growing interest and appreciation of such interventions in rehabilitation (Bertisch, Rath, Long, Ashman, & Rashid, 2014; Cullen, Pownall, Cummings, Baylan, et al., 2018; Evans, 2011; Karagiorgou, Evans, & Cullen, 2017; Rabinowitz & Arnett, 2018). PP has many light touch interventions, for example using signature strengths in a new way, savouring, letters of gratitude, and writing down 'Three Good Things' in a day (Boiler, Haverman, Westerhof, Riper, et al., 2013; Evans, 2011; Seligman et al., 2005).

An important point to address, however, is that many patients with ABI have executive impairment, and may find it difficult to implement such activities (Burgess,

Alderman, Evans, Emslie, & Wilson, 1998; Stuss, 2011; Stuss & Alexander, 2007). This highlights the role of *external* regulation of emotion, which can be very effective (Salas 2012b; Salas et al., 2013). For instance, the use of scaffolding or external dialogue from a relative has been shown to compensate for cognitive impairment (Salas et al., 2013). One promising approach would be to reach relatives and care-givers to embed these ideas, so they can be consistently reinforced, and optimise generalisation of therapeutic gains. It might be that micro-interventions by families, such as scaffolding, and supporting patients to reflect on 'Three Good Things', could help patients acknowledge and promote positive emotions.

Future directions

Calculating reappraisal *effectiveness* in the ASRR task relied on self-report scores of emotional intensity. Though previous work has demonstrated that self-report measures during reappraisal correlate with changes in neural activation and physiology (Ochsner, Bunge, Gross, & Gabrieli, 2002; Troy, Wilhelm, Shallcross, & Mauss, 2010), some have reported dissociations between these measures (Mauss & Robinson, 2009). Nonetheless, the subjective emotional experience is, in itself, an important component of ER processes. Future work may benefit from complementing the ASRR task with a measure of peripheral physiology. A further promising approach is the nature of the ASRR task itself, which has strong ecological validity. This follows an emerging trend in the study of emotion, where processes are observed or elicited with more naturalistic methods (Lench et al., 2011; Rovenpor, Skogsberg, & Isaacowitz, 2013; Salas et al., 2012; 2015). As previously noted, personal events may be particularly effective at inducing higher levels of emotional arousal (Salas et al., 2012; 2015), and are closer to real-life situations, where reappraisal is an important part of daily life (Brockman, Ciarrochi, Parker, & Kashdan, 2017; McRae et al., 2012). The ASRR allows for the investigation of reappraisal for various target emotions in a more naturalistic setting.

Much of the ER literature has investigated reappraisal, but there is growing interest in other regulatory processes: for example, situation selection (Markovitch, Netzer, & Tamir, 2017; Sands & Isaacowitz, 2017; Webb, Lindquist, Jones, Avishai, & Sheeran, 2018) and attentional deployment (Demeyer, Sanchez, & De Raedt, 2017; Ferri & Hajcak, 2015; Wirth & Kunzmann, 2018). Future work in people with neurological damage would benefit from better investigating these approaches, given that these strategies may be particularly important for those low in cognitive control, such as the elderly (Wirth & Kunzmann, 2018) and people with mood disorders (Webb et al., 2018).

Conclusion

Emotional changes after brain injury have been the focus of a growing literature (Fleminger et al., 2003; Shields et al., 2016; Williams & Evans, 2003). Indeed, with a greater understanding of the relevance of emotion in rehabilitation (Mateer, Sira, & O'connell, 2005), there has been a recent shift towards an approach which focuses upon socio-emotional adjustment (Bowen, Yeates, & Palmer, 2010). Nonetheless, research on the effects of ABI on emotion *regulation* (based upon the Process Model) has been relatively modest (Salas et al., 2013; 2014). The present study not only demonstrates that an ABI can compromise the capacity to generate reappraisals, and in particular to do this rapidly, but this is the first study to demonstrate that people with ABI find reappraisal especially difficult for up-regulating *positive* emotions. Consistent with previous research, the study also provides evidence in support of the role of working memory in reappraisal, and suggests a range of interventions which may be useful for clinicians and patients' families.

3. Chapter Three

"It's like the domino effect, pull the negative one out and put the positive one in"

  - *Liam (Participant from BISEP)*

3.1 This time it's personal: Reappraisal after acquired brain injury[1]

3.1.1 Abstract

Reappraisal is a widely investigated emotion regulation strategy, often impaired in those with acquired brain injury (ABI). Little is known, however, about the tools to measure this capacity in patients, who may find traditional reappraisal tasks difficult. Fifty five participants with ABI, and thirty five healthy controls (HCs), completed reappraisal tasks with personal, and impersonal, emotion elicitation components, questionnaires measuring reappraisal (the ERQ-CA) and neuropsychological assessment. The main findings demonstrated that both groups rated their reappraisal ideas as more *effective* for personal stimuli. The ABI group were significantly *faster* to generate reappraisals for personal, compared to impersonal, stimuli. Yet, participants with ABI performed worse than HCs on the majority of reappraisal components, across both the personal and impersonal reappraisal task. Results of regression analyses revealed significant relationships between certain measures of cognitive control and certain reappraisal components, which varied for the personal and impersonal reappraisal task. Notably, while inhibition predicted aspects of reappraisal in both the ABI and HC group, working memory was only related to reappraisal in participants with ABI. The study suggests that personal context plays a key role in facilitating reappraisal, especially for those with ABI, and proposes a model to better understand the role that cognitive control plays across the reappraisal process.

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[1] Rowlands, L., Coetzer, R., & Turnbull, O. H. (Under Review). This time it's personal: Reappraisal after ABI. Cognition and Emotion.

3.1.2 Introduction

Acquired brain injury (ABI) is a major public health concern (Corrigan, Selassie, & Oman, 2010; Tagliaferri, Compagnone, Korsic, Servadei, & Kraus, 2006), with survivors experiencing complex psychological impairment that can, in many cases, contribute to significant disability (Andelic, Hammergren, Bautz-Holter, Sveen, et al., 2009; Bramlett & Dietrich, 2015; Dijkers, 2004). Of these consequences, the emotional element is typically the greatest source of distress in patients and their relatives (Diaz, Schwarzbold, Thais, Hohl, et al., 2012; Ergh, Rapport, Coleman, & Hanks, 2002). Developing an understanding of ways to manage emotions after ABI, however, is further complicated by a methodological difficulty in measuring various emotional processes.

Emotion regulation after brain injury

Despite the large body of research into various emotional sequelae following brain injury (Williams & Evans, 2003; Hesdorffer, Rauch, & Tamminga, 2009, for a review), studies which have focused on emotion *regulation* (ER) strategies have been comparatively sparse (Beer & Lombardo, 2007; Salas, Gross, & Turnbull, 2019). There is widespread agreement in the literature that there are a range of strategies that can be employed to influence the intensity of emotions, and the way in which they are experienced and expressed (Gross & Thompson, 2007; Gross, 2013; 2015). The Process Model, which is the most influential model of ER in the literature of neurotypical participants, consists of several strategies: situation selection, situation modification, attentional deployment, cognitive change (reappraisal), and response modulation (Gross, 2013). This model has provided an effective framework for the investigation of regulatory processes in the psychiatric literature (Hu, Zhang, Wang, Mistry, et al., 2014, for a meta-analysis), and may be a promising framework to investigate ER difficulties after brain injury (Salas et al., 2019, for a review).

By far the most well-investigated method for modulating feelings is the cognitive change strategy of *reappraisal* (Goldin, McRae, Ramel, & Gross, 2008; Ochsner, Silvers, & Buhle, 2012). This involves re-interpreting an event, sometimes changing its *meaning,* to modify its emotional consequences (Gross & Thompson, 2007; Gross, 2015). Though the majority of research has focused on the down-regulation of negative emotions, reappraisal can also be used for the up-regulation of positive emotions (Gross, 2015; McRae & Gross, 2020; Silton, Kahrilas, Skymba, Smith, Bryant, & Heller, 2020). In neurologically healthy individuals, reappraisal has been a strategy of particular interest to understand various elements of emotional symptomatology, such as stress (Lewis, Yoon, & Joormann, 2018), depression (Joormann & Gotlib, (2010), and anxiety (Goldin, Manber-Ball, Werner, Heimberg, & Gross, 2009).

The number of studies which have investigated reappraisal in people with ABI remains modest (Salas et al., 2019, for a review). However, the study of participants with brain injury has contributed much to the understanding of the underlying cognitive mechanisms of reappraisal. For example, Falquez, Couto, Ibañez, and colleagues (2014) found that lesions to the right superior frontal gyrus, an area responsible for inhibitory control, were associated with poorer reappraisal effectiveness. Additionally, investigations of the *generative* components of reappraisal have identified inhibition, verbal ability (Salas, Gross, & Turnbull, 2014; Salas, Rafal, Viñas-Guasch, & Turnbull, 2013), and working memory (Rowlands, Coetzer, & Turnbull, 2019; Chapter Two) as key components of the process. These *generative* components of reappraisal involve the timely construction of positive re-interpretations, and thus the creation of a reappraisal itself (i.e. creating a reappraisal). This generative aspect needs to be distinguished from other components, such as reappraisal effectiveness, since generating a reappraisal does not automatically mean it will be effective in altering one's emotional response.

The capacity to *generate* reappraisals can be selectively impaired in those with ABI. In particular, patients with brain injury took longer to generate a reappraisal (referred to as reappraisal difficulty), but when time was not considered they were able to produce a similar number of reappraisals (referred to as reappraisal productivity) to neurologically healthy controls (Salas et al., 2014). Extending on these findings, Rowlands et al (2019) found that patients with ABI were impaired across *both* reappraisal productivity and difficulty on an autobiographical recall reappraisal task, and reported less effective use of reappraisal to up-regulate positive emotions.

Considered together, these studies provide evidence, complementary to extensive neuroimaging work in healthy controls, suggesting that reappraisal is associated with areas of cognitive control (Buhle, Silvers, Wager, Lopez, et al., 2014, for meta-analysis), in particular *working memory* (Hendricks & Buchanan, 2016), and lend further support to a model suggestive of a two-stage process of reappraisal (Kalisch, 2009; Salas et al., 2014). It may be that certain cognitive control capacities are important for the *early* phase of disengaging from the initial appraisal (inhibition) and generating new interpretations (verbal ability). In the second phase, the reappraisal needs to be maintained (using working memory), to shield it from the initial meaning (Kalisch, 2009). Recent evidence suggests that working memory may also play a role in the *early* phase, perhaps to keep the goal of reappraising in mind (Rowlands et al., 2019).

Some inconsistencies are, however, notable in previous studies. It is possible that these are due in part to the methods used to *measure* reappraisal (Ochsner & Gross, 2005). For example, using a reappraisal task based on personal stimuli, Rowlands and colleagues (2019) reported that *working memory* was the only significant predictor of reappraisal. In contrast, Salas and colleagues (2014), who used impersonal stimuli, reported that inhibition and verbal ability was predictive of reappraisal, but *not* working memory. To better

understand the neuropsychological capacities involved in reappraisal, it is important to investigate these mechanisms for both types of stimuli, within the same sample.

Emotion elicitation methods

Researchers looking at various affective processes have increasingly studied emotion and its elicitation with more naturalistic methods (Chirico, Cipresso, & Gaggioli, 2018; Salas, Radovic, & Turnbull, 2012; Salas, Radovic, Castro, & Turnbull, 2015; Siedlecka & Denson, 2019). For example, participants being required to carry out a frustrating task with punishment to induce anger (Lobbestael, Arntz, & Wiers, 2008), and mental imagery to induce a range of emotions (Zhang, Yu, & Barrett, 2014). Of particular relevance for emotion elicitation may be *personally* salient information, as in Affective Story Recall (Turnbull, Evans, & Owen, 2005). This involves generating personal affective memories, in order to reactivate and re-experience previous emotions (Prkachin, Williams-Avery, Zwaal, & Mills, 1999). Autobiographical recall tasks have been shown to elicit target emotions effectively, including the associated subjective experience and peripheral physiology (Siedlecka & Denson, 2019, for a review). Nonetheless, impersonal visual stimuli remain some of the most widely used emotional tools in experimental research (Lench, Flores, & Bench, 2011).

The relevance of personal salience for emotion elicitation has prompted some to investigate the feasibility of such procedures for reappraisal research (Holland & Kensinger, 2013; Speed, Levinson, Gross, Kiosses, & Hajcak, 2017). Reappraisal tasks using autobiographical recall elicitation have largely shown that they are effective tools to measure the modulation of emotions, and show similar activation patterns in neuroimaging studies to traditional impersonal tasks (Holland & Kensinger, 2013). These studies are, however, limited in that no comparisons have yet been made between such tasks, making it difficult to infer the difference between reappraisal for impersonal and personal affective stimuli.

The choice of elicitation procedures is a particularly important methodological question to consider in the context of participants with brain injury. This is because they often present with cognitive difficulties, which may impact upon their ability to effectively engage with visual stimuli (Levenson, 2007), or to follow the plot in film clips (Levenson, Ascher, Goodkind, McCarthy, et al., 2008, Salas et al., 2015). In addition, difficulties with empathy (deSousa, McDonals, Rushby, Dimoska, & James, 2010; Williams & Wood, 2010) and emotion perception have long been established as common impairments following ABI (Bornhofen & McDonald, 2008 for a review; Prigatano & Pribram, 1982).

Only one study has systematically compared personal (i.e. internal) and impersonal (i.e. external) emotion *elicitation* tools in patients with neurological damage, and concluded that target emotions were elicited at higher intensities when recalling personal affective memories (Salas et al., 2015). Interestingly, such methodological comparisons have not been carried out to the same extent in emotion *regulation* research. Personal and impersonal reappraisal tasks have important methodological distinctions in the emotion *elicitation* component, which is a necessary first step to investigate the subsequent emotion *regulation* attempts. Where impersonal tasks involve the generation of emotional responses from stimuli presented from the outside (i.e. externally), and personal tasks involve the generation of emotion from stimuli which the person generates themselves (i.e. internally).

Previous work has demonstrated that a personal emotion elicitation task (the affective story recall task) can be used to measure reappraisal in neurological patients (Rowlands et al., 2019). However, with the absence of a *direct* comparison with an impersonal elicitation task (such as visual stimuli) there is a lack of understanding regarding: 1) how personal context affects reappraisal; 2) which task might be more appropriate to measure this ER strategy in both neurological patients and healthy controls; and 3) whether the underlying cognitive mechanisms of reappraisal differ depending on the personal relevance of the stimuli.

The present study

The primary aim of the present study was to provide a *direct* comparison of performance on a reappraisal task with personally-salient stimuli (i.e. the ASRR task; Turnbull, Evans, & Owen, 2005; Salas et al., 2015; Rowlands et al., 2019), with performance on a reappraisal task with standardised, impersonal, stimuli (i.e. pictures from the International Affective Picture System, IAPS; Lang, Bradley, & Cuthbert, 2008) in both patients with ABI and healthy controls (*Personal versus impersonal reappraisal tasks*). This aimed to provide better understanding of the importance of personal context for reappraisal, and which task might be easier or most effective for measuring reappraisal in patients with ABI.

As part of a wider research study, there were a number of secondary aims. Firstly, to extend previous findings of reappraisal impairment (Rowlands et al., 2019; Salas et al., 2014), by investigating performance across *both* personal and impersonal reappraisal tasks, and with a larger sample (*How ABI affects reappraisal*). A further extension of previous work (Rowlands et al., 2019) was the investigation of the cognitive mechanisms underlying reappraisal, this time across two tasks (*Cognitive mechanisms of reappraisal*). Finally, the study aimed to investigate whether performance on both tasks correlated with an established reappraisal questionnaire (Gullone & Taffe, 2012), as a measure of validity (*Reappraisal tasks and self-report*).

3.2 Methods

3.2.1 Participants

Fifty five participants with ABI and 35 healthy control participants were included in the study ($N = 90$)[2]. Those with brain injury were prospectively recruited from a community

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[2] 51 of these participants (57%) were included in Rowlands et al (2019; Chapter Two), however this previous study investigated reappraisal in ABI across discrete emotions, and thus included different, non-overlapping research questions.

outpatient rehabilitation service, the North Wales Brain Injury Service (NWBIS), Betsi

Cadwaladr University Health Board ($n = 39$), and a small proportion recruited though

Headway branches in North Wales ($n = 12$), and a rehabilitation day service, the

Headforward Centre ($n = 4$). Inclusion criteria included the presence of a confirmed ABI (as

per NWBIS criteria, Coetzer, Vaughan, Roberts, & Rafal, 2003), a minimum of nine months

since time of injury, and language abilities persevered to a level sufficient enough to

complete the tasks (as judged by service staff). Exclusion criteria included being unable to

give informed consent, the presence of a psychiatric disorder in need of acute care, a

neurodegenerative or neurodevelopmental disorder. Healthy control participants were

recruited from the North Wales community. For sample characteristics see Table 1.

Table 1. Demographic and injury information for both the ABI and HC group

Group	Age	Education	Gender	Years since injury	ABI Aetiology
	M *(SD)* Range	M *(SD)* Range		M, *SD* Range	
ABI	46 *(11.44)*	13 *(3.21)*	M ($n = 38$)	7 *(8.52)*	CVA ($n = 20$) TBI ($n = 28$)
	22-67	10-20	F ($n = 17$)	9 months - 32	Encephalitis ($n = 2$) Tumour removal ($n = 1$) Hypoxia ($n = 2$) Radiation ($n = 1$) Hydrocephalus ($n = 1$)
HC	46 *(10.90)*	12 *(1.77)*	M ($n = 21$)		
	32-69	10-17	F ($n = 14$)		
Sig.	$t = -1.60$ $p = .114$	$t = 1.23$ $p = .221$			

Education = years; CVA = cerebrovascular accident, TBI = traumatic brain injury. There were no significant differences in age or education between groups

3.2.2 Measures

Impersonal reappraisal task

      This task was adapted from previous studies of reappraisal (Lench, et al., 2011, for a

review; Liberman, Inagaki, Tabibnia, & Crockett, 2011; McRae et al., 2012; Salas et al.,

2014). Tasks were carried out on a 13 inch laptop, providing step by step instructions, to avoid memory bias. The task began with instructions, and two practice trials. Participants were shown eight images from the IAPS, one at a time. Participants then indicated the intensity of their emotional response to each image, on a zero to 10 scale. Following a cue ('Think aloud about the positive sides. Try to be quick'), participants were required to generate as many reappraisals as possible, as quickly as possible, before indicating emotional intensity again. See Appendix B for task instruction.

Personal reappraisal task

The personal reappraisal task (Affective Story Recall Reappraisal, ASRR) is described in detail elsewhere (Rowlands et al., 2019), and instructions described in detail in Appendix A. Participants were presented with emotion words one at a time ('sad', 'scared', 'angry' and 'neutral'), and were required to describe a personal event from memory for each emotion category. Participants then indicated emotional intensity on a zero to 10 scale, before generating as many positive sides as they could, as quickly as they could. Following this, they rated emotional intensity again. The negative emotions ('sad', 'scared', and 'angry') involved the down-regulation of emotional intensity via reappraisal. The 'neutral' condition involved the up-regulation of low-intensity neutral events into higher-intensity positive ratings. All emotion words appeared twice, resulting in eight trials, and the participant was required to recall a different event for each emotion word.

Given the wide range of cognitive abilities within the ABI population, a standardised exposure time was inappropriate. Participants, therefore, described their stories (and looked at the IAPS pictures) for as long as they felt necessary, but not exceeding three minutes. To avoid bias, participants were not instructed on the content of recalled stories. Both sets of stimuli were, therefore, not fully matched. Notably, both tasks present a trade-off, where impersonal IAPS stimuli allow for high experimenter control at the cost of ecological

validity, and the personal task presents higher salience and ecological validity at the cost of loss of experimenter control.

Emotion regulation questionnaire

The Emotion Regulation Questionnaire (adapted for children and adolescents) (ERQ-CA) (Gullone & Taffe, 2012) measures self-reported use of reappraisal in daily life and is based upon the original and well-established Emotion Regulation Questionnaire (Gross & John, 2003). The adapted version was chosen because of the simplified language. The ERQ-CA includes 6 items measuring reappraisal, scored on a 7-point Likert scale. The ERQ-CA has sound internal consistency ($\alpha = .86$) and validity.

Cognitive control tasks

Working Memory was assessed using the Digit Span sub-task from the Wechsler Adult Intelligence Scale (WAIS IV) (Wechsler, 2008), an informative measure of this ability in individuals with ABI (Millis, Rosenthal, Novack, Sherer, et al., 2001). The full Digit Span sub-task was used, as this is required to compute scaled scores which take into account each participant's age. In addition, evidence suggests that the separate dimensions of Digit Span should be interpreted together (Bowden, Petrauskas, Bardenhagen, Meade, & Simpson, 2013; Twamley, Palmer, Jeste, Taylor, & Heaton, 2006).

Inhibition was measured with the Hayling sentence completion task from the Hayling and Brixton tests (Burgess & Shallice, 1997), which reports sensitivity (Burgess & Shallice, 1997), and validity in a sample of people with ABI (Odhuba, van den Broek, & Johns, 2005). The overall Hayling score was used as a proxy of inhibition, as it includes the 'error score' and 'time taken to respond'. It is reported to have higher ecological validity, and correlates more highly with the inhibition factor on the Dysexecutive questionnaire (Odhuba, Van Den Broek, & Johns, 2005).

Verbal Ability was measured using the Letter Fluency sub-task from the Delis-Kaplan Executive Function system (D-KEFS) (Delis, Kaplan, & Kramer, 2001). This capacity has been shown to be one of the strongest predictors of cognitive control (Henry & Crawford, 2004).

3.2.3 Procedure

Ethical approval was granted by the Health Board and Bangor University. Participants were invited to take part, and assessments carried out at Bangor University, NWBIS, Headforward Centre, or participants' homes. Following written informed consent, cognitive control tasks, reappraisal tasks, and the questionnaire were administered in random order, and completed in one session, with a short break half-way through. For the personal task, participants were randomly allocated to one set of eight images from the IAPS (Lang et al., 2008), out of a possible five sets that were matched for valence and arousal (See Appendix C). Participants were told that the aim of both reappraisal tasks was to produce as many positive sides (reappraisals) as possible, as quickly as possible. Both tasks were recorded and transcribed *verbatim*, and provided three measurements: *reappraisal productivity* (the total number of reappraisals produced), *reappraisal difficulty* (the average time taken to produce a first reappraisal), and *reappraisal effectiveness* (the average difference in emotional intensity ratings before, and after, reappraising). All measures were completed by the first author (LR) or trained research assistants.

3.2.4 Data Reduction

Three components of reappraisal were considered for each of the study aims: 1) *Reappraisal productivity* involved the total sum of reappraisals produced across each task; 2) *Reappraisal difficulty* was calculated by averaging the time taken to produce a first reappraisal across all the trials in each task, and 3) *Reappraisal effectiveness* consisted of the

difference in score between the emotional intensity rated for each story recall (personal task) or IAPS picture (impersonal task) before and after reappraising, averaged across all trials.

The initial emotional intensity rating to the stimuli was identified as a covariate, and included in all analyses. It was calculated by averaging the initial emotional intensity rating across all trials (with reverse scoring for the neutral condition). Finally, scaled scores were computed for the cognitive control tasks.

3.2.5 Data Analysis

All analyses were carried out using the statistical software 'R' (R Core Team, 2019) with additional packages 'Robustbase', 'Complmrob', and 'Stats'. The alpha level was not adjusted for multiple comparisons, because of the number of questions addressed and concern over loss of power (Cabin & Mitchell, 2000).

Personal versus impersonal reappraisal tasks

Reappraisal productivity, difficulty, and effectiveness were compared for the personal and impersonal reappraisal tasks using a series of analysis of covariance (ANCOVA), with average initial emotional intensity ratings to stimuli as a covariate, for both groups separately.

How ABI affects reappraisal

To compare reappraisal components between the HC and ABI group, a series of ANCOVA analyses were carried out. This was done for both the personal and impersonal tasks separately, again with initial emotional intensity ratings as a covariate.

Cognitive control mechanisms of reappraisal

A series of forced entry robust multiple linear regression models were carried out, with 'MM' method (Salibián-Barrera, Aelst, & Willems, 2008), and bootstrapped coefficients from 999 bootstrapped samples (as a form of model validation) (Babyak, 2004; Efron, 2003). Separate regression models were carried out for each outcome variable (reappraisal productivity, difficulty, and effectiveness) for the personal and impersonal reappraisal tasks.

The predictor variables for each model consisted of the scaled scores for working memory (Digits, WAIS), inhibition (Hayling task), and verbal ability (D-KEFS). The average initial emotional intensity ratings were, again, controlled for by including these in the models as a covariate. This was done for each group separately, to gain insight into the potential relationships between neuropsychological mechanisms and reappraisal independent of group affiliation.

Reappraisal tasks and self-report

As an indicator of their validity and reliability, performance on both tasks was correlated with an established reappraisal questionnaire (ERQ-CA; Gullone & Taffe, 2012), using partial Pearson correlation analyses, correcting for initial emotional intensity ratings on the tasks. Analyses were carried out for both groups separately.

3.3 Results

As could be expected, the ABI and HC group differed in their level of cognitive functioning and self-report use of reappraisal in daily life. The ABI group performed worse across most components of reappraisal on both tasks. See Table 2 below for descriptive statistics.

3.3.1 Personal versus impersonal reappraisal tasks

Performance on the personal and impersonal reappraisal tasks were compared using ANCOVA for both the ABI and healthy control group separately.

*Acquired brain injury group*

After correcting for emotional intensity at baseline, the ABI group took significantly less time to generate a first reappraisal (reappraisal difficulty) on the personal task, compared to the impersonal reappraisal task, ($F(1,107) = 9.24, p = .001, r = .29$), with a medium effect size (see Figure 2). This group also reported significantly more effective reappraisals

(reappraisal effectiveness) for the personal task ($F(1,107) = 31.94, p < .001, r = .50$), with a

large effect size (see Figure 3). Participants with ABI produced more reappraisals

(reappraisal productivity) on the personal task, and this was marginally significant, $F(1,107)$

$= 2.03, p = .047, r = .19$, with a small effect size (see Figure 1).

Table 2. Descriptive statistics of performance on all measures

	Group	*M*	*SD*	*Mdn*	Sig. difference (ABI vs HC)
Working Memory	ABI	7.55	2.67	8.00	<.001***
(Digits WAIS)	HC	10.11	1.86	10.00	
Verbal Ability	ABI	7.04	3.43	7.00	<.001
(Letter Fluency D-KEFS)	HC	9.57	3.18	9.00	
Inhibition	ABI	4.82	1.81	6.00	.001**
(Hayling)	HC	5.92	1.13	6.00	
Self-report reappraisal	ABI	23.78	7.14	24.00	<.001***
(ERQ-CA)	HC	30.23	7.00	31.00	
Impersonal Reappraisal Task					
Reappraisal productivity	ABI	12.50	5.80	11.00	.032*
	HC	15.94	5.84	15.00	
Reappraisal difficulty	ABI	10.92	3.18	10.89	<.001***
(seconds)	HC	6.59	2.73	6.00	
Reappraisal	ABI	0.97	1.13	0.75	<.001***
effectiveness	HC	2.13	1.49	2.00	
Personal Reappraisal Task					
Reappraisal productivity	ABI	15.33	7.32	13.00	.021*
	HC	19.46	5.78	21.00	
Reappraisal difficulty	ABI	9.05	2.71	9.00	<.001***
(seconds)	HC	5.91	1.93	6.00	
Reappraisal	ABI	2.51	1.61	2.25	.110
effectiveness	HC	3.44	2.12	2.75	

Significance *** < .001 , ** < .01, * < .05.
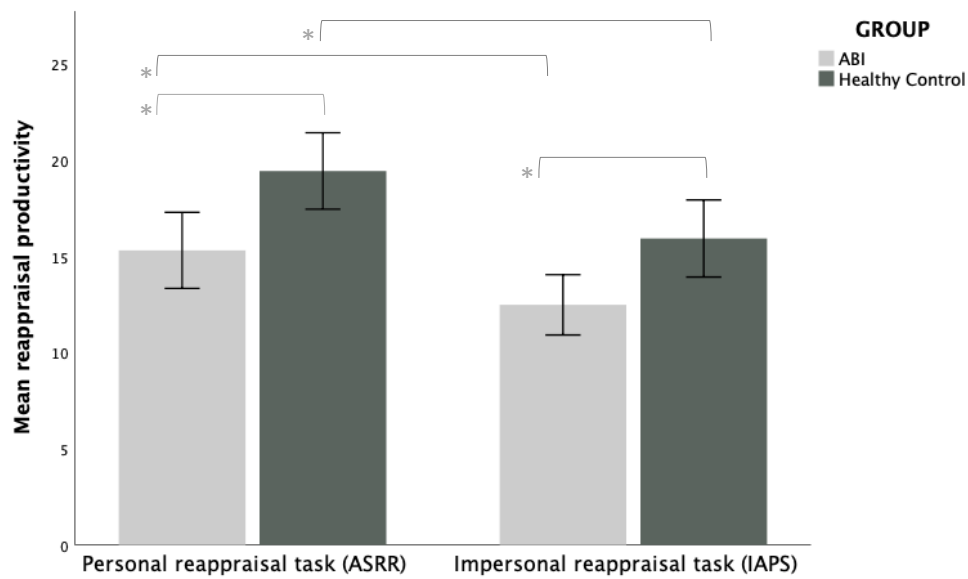
Figure 1. Graph demonstrating mean reappraisal productivity scores for both the ABI and healthy control group, on the personal and impersonal reappraisal tasks. Significance ******* <.001, ****** < .01, * < .05. Error bars represent 95% CI.
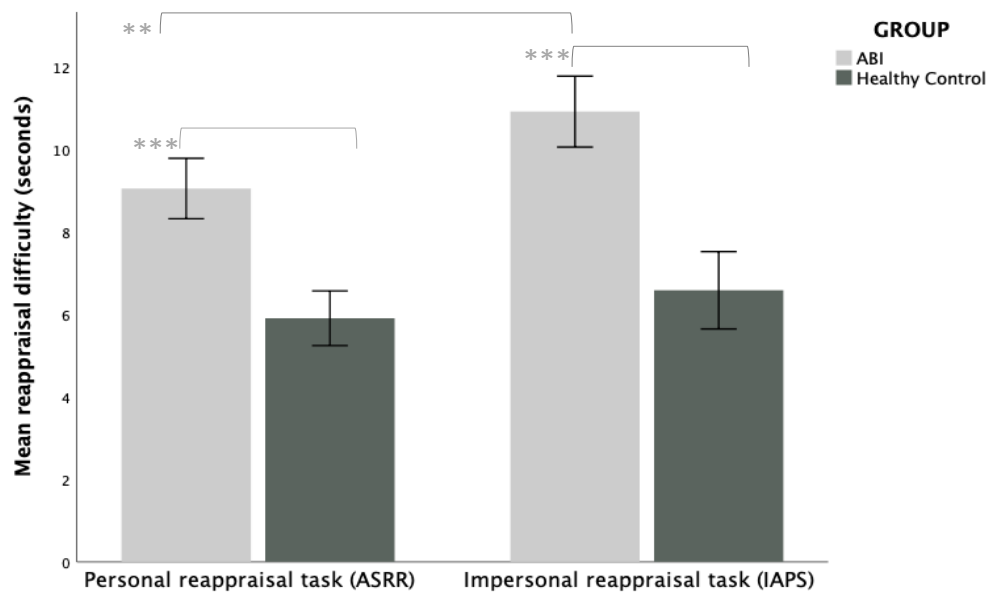
Figure 2. Graph demonstrating mean reappraisal difficulty (seconds) for both the ABI and healthy control group, on the personal and impersonal reappraisal tasks. Significance ******* <.001, ****** < .01, * < .05. Error bars represent 95% CI.

Figure 3. Graph demonstrating mean reappraisal effectiveness for both the ABI and healthy control group, on the personal and impersonal reappraisal tasks. Significance *** <.001, ** < .01, * < .05. Error bars represent 95% CI.

Healthy control group

The healthy control group produced significantly more reappraisals on the personal task, compared to the impersonal task, $(F(1,67) = 5.40, p = .025, r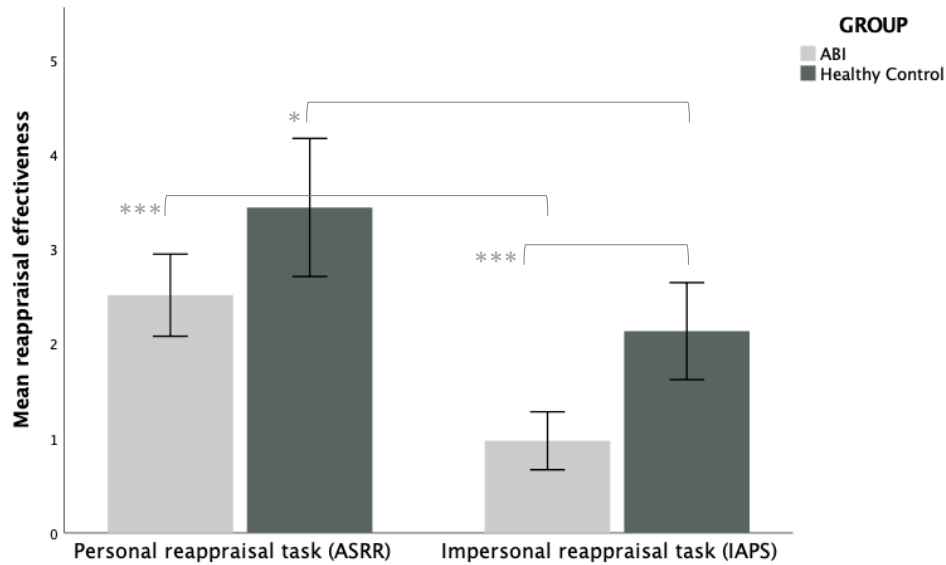 = .27)$, with a small-to-medium effect size (see Figure 1). The HC group also reported significantly more effective reappraisals for the personal task $(F(1,67) = 6.90, p = .011, r = .31)$, with a medium effect size (see Figure 3). The time taken to produce a first reappraisal was similar for both tasks $(F(1,67) = 1.64, p = .204, r = .15)$ (see Figure 2).

Both groups reported more *effective* reappraisals on the personal task, compared to the impersonal stimuli[3]. Participants from both groups produced a greater number of reappraisals on the personal task. Participants with ABI also took significantly less *time* to produce a reappraisal on the personal task, a feature unique to this group.

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[3] A series of partial Pearson correlations were carried (with initial emotional intensity as a covariate) to investigate the relationships between reappraisal effectiveness, and productivity and difficulty. The only correlations of note were between reappraisal effectiveness and productivity on the personal task for the ABI group ($r = .47, p <.001$), and the healthy control group ($r = .33, p = .055$), suggesting that a greater number of reappraisals is associated with greater change in emotional intensity for stimuli with personal relevance.

3.3.2 How ABI affects reappraisal

Impersonal reappraisal task

The results of the ANCOVA demonstrated that, on the impersonal reappraisal task, the ABI group took significantly *longer* to generate a first reappraisal compared to the healthy control group ($F(1,86) = 37.00, p < .001, r = .54$), with a large effect size (see Figure 2). Additionally, patients with ABI reported significantly *lower* reappraisal effectiveness on the impersonal reappraisal task compared to the healthy control group ($F(1,86) = 11.97, p < .001, r = .34$, with a medium effect size) (see Figure 3), and produced significantly *fewer* reappraisals ($F(1,86) = 4.76, p = .032, r = .23$, with a small effect size) (see Figure 1).

Personal Reappraisal task

On the personal reappraisal task, the ABI group took significantly longer to generate a first reappraisal ($F(1,86) = 29.72, p < .001, r = .51$, with a large effect size) (see Figure 2), and produced significantly *fewer* reappraisals, compared to the healthy control group ($F(1,86) = 5.49, p = .021, r = .24$, with a small effect size) (see Figure 1). Both groups reported similar reappraisal effectiveness ($F(1,86) = 2.64, p = .110, r = .17$, with a small effect size) (see Figure 3).

3.3.3 Cognitive mechanisms of reappraisal

For results of all the regression analyses, see Table 2 and 3 (ABI group), and 4 and 5 (HC group). Only regression models with significant cognitive control predictor variables are reported here.

ABI Group

Reappraisal Effectiveness. For performance on the *personal* task in the ABI group, the model containing all cognitive predictor variables, and baseline emotional intensity ratings as a covariate, explained 22% of the variance, and significantly improved prediction of reported reappraisal effectiveness ($R^2 = .22, F(4,54) = 14.35, p = .006$). Bootstrapped

coefficients demonstrated that inhibition scores were the only significant *cognitive* predictor variable within the model ($\beta = 2.44, p = .037$). On the *impersonal* task, inhibition was, again, the only significant cognitive predictor of reappraisal effectiveness ($\beta = 0.18, p = .041$). The overall model was, however, non-significant ($R^2 = .15, F(5,54) = 8.51, p = .074$), and explained 15% of the variance.

     Reappraisal Difficulty. The regression model for the *personal task*, did not significantly improve prediction of the time taken to generate a reappraisal ($R^2 = .13, F(4,54) = 6.47, p = .166$), however working memory was a single significant predictor within the model ($\beta = -0.25, p = .041$). The regression model on the *impersonal* task, did not significantly improve prediction of the time taken to generate a reappraisal ($R^2 = .16, F(4,54) = 7.74, p = .102$), however inhibition was a single significant cognitive predictor ($\beta = -0.56, p = .020$).

     Reappraisal Productivity. The regression model marginally improved prediction of that number of reappraisals generated ($R^2 = .18, F(4,54) = 9.21, p = .056$) for the *impersonal* reappraisal task alone, and explained 18% of the variance. Within this model working memory was the single significant cognitive predictor variable ($\beta = 0.52, p = .034$).

Table 2. Results of robust multiple linear regression models for the personal reappraisal task (ABI group).

Model	R^2	F	p (sig.)	β coefficients (bootstrapped)	p (sig.)	95% CIs
ABI Group						
Personal Reappraisal Task						
Reappraisal Productivity	.05	2.10	.718			
Working Memory				0.38	.177	-0.48 – 1.15
Verbal Ability				0.29	.241	-0.42 – 1.13
Inhibition				-0.42	.302	1.91 – 1.05
Baseline intensity (covariate)				0.21	.271	-0.63 – 0.94
Reappraisal Difficulty	.13	6.47	.166			
Working Memory				-0.25	.041*	-0.54 – 0.04
Verbal Ability				-0.07	.191	-0.26 – 0.11
Inhibition				-0.17	.399	-0.68 – 0.43
Baseline intensity (covariate)				-0.26	.137	-0.75 – 0.19
Reappraisal Effectiveness	.22	14.35	.006**			
Working Memory				-1.71	.420	-0.19 – 0.14
Verbal Ability				3.74	.242	-0.06 – 0.14
Inhibition				2.44	.037*	-0.01 – 0.51
Baseline intensity (covariate)				2.46	.007**	0.07 – 0.42

*** Significance <.001, ** Significance < .01, * < .05

Table 3. Results of robust multiple linear regression models for the impersonal reappraisal task (ABI group)

Model	R^2	F	p (sig.)	β coefficients (bootstrapped)	p (sig.)	95% CIs
ABI Group						
Impersonal Reappraisal Task						
Reappraisal Productivity	.18	9.21	.056			
Working Memory				0.52	.034*	-0.05 – 1.07
Verbal Ability				0.21	.204	-0.30 – 0.74
Inhibition				0.10	.412	-0.93 – 1.13
Baseline intensity (covariate)				0.71	.005**	0.18 – 1.16
Reappraisal Difficulty	.16	7.74	.102			
Working Memory				-0.13	.192	-0.43 – 0.16
Verbal Ability				0.02	.408	-0.19 – 0.23
Inhibition				-0.56	.020*	-1.11 – -0.02
Baseline intensity (covariate)				-0.08	.323	-0.48 – 0.27
Reappraisal Effectiveness	.15	8.51	.074			
Working Memory				0.01	.483	-0.15 – 0.15
Verbal Ability				-0.04	.211	-0.16 – 0.07
Inhibition				0.18	.041*	-0.02 – 0.40
Baseline intensity (covariate)				0.09	.035*	-0.01 – 0.17

*** Significance <.001, ****** Significance < .01, * < .05

Healthy Control Group

    Reappraisal Difficulty. For performance on the impersonal reappraisal task in the HC group, the model explained 28% of the variance, and significantly improved prediction of the time taken to generate a first reappraisal ($R^2 = .28$, $F(4,34) = 11.69$, $p = .019$). Inhibition scores were the only significant cognitive predictor variable within the model (β = -0.74, $p = .004$).

Table 4. Results of robust multiple linear regression models for the personal reappraisal task (HC group)

Model	R^2	*F*	*p* (sig.)	β coefficients (bootstrapped)	*p* (sig.)	95% CIs
Healthy Control Group						
Personal Reappraisal Task						
Reappraisal Productivity	.15	.12	.538			
Working Memory				0.27	.388	-1.52 – 2.18
Verbal Ability				-0.37	.164	-1.19 – 0.34
Inhibition				0.23	.367	-1.89 – 2.87
Baseline intensity (covariate)				1.29	.191	-1.52 – 3.86
Reappraisal Difficulty	.28	11.69	.019*			
Working Memory				-0.07	.399	-0.53 – 0.34
Verbal Ability				0.09	.208	-0.11 – 0.30
Inhibition				-0.74	.004**	-1.27 – -0.18
Baseline intensity (covariate)				0.12	.297	-0.40 – 0.54
Reappraisal Effectiveness	.46	15.96	.003**			
Working Memory				-0.04	.438	-0.37 – 0.34
Verbal Ability				-0.15	.087	-0.38 – 0.11
Inhibition				0.13	.397	-0.61 – 0.94
Baseline intensity (covariate)				0.90	.002**	0.30 – 1.96

*** Significance <.001, ****** Significance < .01, * < .05

Table 5. Results of robust multiple linear regression models for the impersonal reappraisal task (HC group)

Model	R^2	*F*	*p* (sig.)	β coefficients (bootstrapped)	*p* (sig.)	95% CIs
Healthy Control Group						
Impersonal Reappraisal Task						
Reappraisal Productivity	.04	1.24	.872			
Working Memory				-0.51	.165	-1.83 – 0.80
Verbal Ability				-0.03	.447	-0.65 – 0.63
Inhibition				0.47	.301	-1.56 – 2.05
Baseline intensity (covariate)				-0.12	.403	-1.50 – 1.07
Reappraisal Difficulty	.15	1.81	.771			
Working Memory				-0.05	.456	-0.77 – 0.57
Verbal Ability				0.01	.438	-0.32 – 0.35
Inhibition				-0.86	.093	-2.35 – 0.37
Baseline intensity (covariate)				0.22	.188	-0.31 – 0.80
Reappraisal Effectiveness	.21	8.22	.084			
Working Memory				-0.16	.153	-0.50 – 0.21
Verbal Ability				0.02	.363	-0.11 – 0.21
Inhibition				-0.14	.337	-0.71 – 0.41
Baseline intensity (covariate)				0.33	.030*	-0.02 – 0.63

*** Significance <.001, ** Significance < .01, * < .05

To summarise, for those with brain injury, better working memory appears to predict a greater number of reappraisals generated on the *impersonal* task, and less time to generate a reappraisal on the *personal* task. Better inhibition appears to be an important capacity for reappraisal effectiveness on both tasks, and less time to generate a reappraisal on the *impersonal* task alone. For the healthy control group, inhibition predicted less time to generate a reappraisal on the *personal* reappraisal task.

3.3.4 Reappraisal tasks and self-report

A series of partial Pearson correlations analyses were carried out, to investigate the relationships between performance on both tasks, with self-report use of reappraisal on the ERQ-CA. For full correlation results, see Table 6. Only significant relationships are reported here.

Table 6. Correlations between task performance

	ABI Group
Task	Correlation coefficients (*p* value)
Personal reappraisal task	**ERQ-CA**
Reappraisal Productivity	.41 (.002)**
Reappraisal Difficulty (seconds)	-.34 (.011)**
Reappraisal Effectiveness	.559 (< .001)***
Impersonal reappraisal Task	
Reappraisal Productivity	.30 (.026)*
Reappraisal Difficulty (seconds)	-.14 (.321)
Reappraisal Effectiveness	.09 (.507)
	HC Group
Task	Correlation coefficients (*p* value)
Personal Reappraisal Task	**ERQ-CA**
Reappraisal Productivity	.10 (.560)
Reappraisal Difficulty (seconds)	-.02 (.901)
Reappraisal Effectiveness	.16 (.371)
Impersonal reappraisal Task	
Reappraisal Productivity	.40 (.018)*
Reappraisal Difficulty (seconds)	-.19 (.288)
Reappraisal Effectiveness	-.10 (.588)

Significance ***<.001, ** < .01, * < .05

ABI Group

Self-report use of reappraisal on an established questionnaire (ERQ-CA) showed a significant moderate positive correlation with reported reappraisal effectiveness ($r = .56, p < .001$), a significant moderate positive correlation with the total number of reappraisals produced ($r = .41, p = .002$), and a significant moderate negative correlation with the time taken to generate a first reappraisal ($r = -.34, p = .011$), on the *personal* reappraisal task. On the *impersonal* reappraisal task, ERQ-CA scores demonstrated a significant moderate positive correlation with the total number of reappraisals produced ($r = .30, p = .026$).

Healthy Control Group

For the HC group, the general picture is much less informative. Participants' self-report use of reappraisal on the ERQ-CA showed a significant moderate positive correlation with the total number of reappraisals produced on the *impersonal* task alone ($r = .40, p = .018$). The ERQ-CA was not notably related to any other component of reappraisal across either task.

Considered together, these results suggest that performance on the personal reappraisal task is highly correlated with the established reappraisal questionnaire, suggesting the task has high validity for the ABI group.

3.4 Discussion

The present study aimed, particularly, to gain further insight into how reappraisal performance may vary depending on the personal relevance of task stimuli. Secondary aims were to extend previous findings regarding reappraisal impairment in people with ABI, the underlying cognitive mechanisms of this ER strategy, and finally, to investigate correlations between task performance and self-report use of reappraisal, as a measure of task validity.

Personal versus impersonal reappraisal tasks

An important conclusion of the present study is that *both* groups of participants generated *more* reappraisals, and more *effective* reappraisals, to their own recalled memories. That is, generating new meanings, and successfully changing emotional intensity, appeared to be less difficult when reappraising their own recalled events, in particular for the ABI group. These findings suggest that a reappraisal task with personally salient emotional memories as the elicitation component (as in previous studies in neurotypical individuals, Holland & Kensinger, 2012; Speed et al., 2017) can be a highly successful tool to measure ER. A limitation of the previous literature, however, was the absence of a *direct* comparison with a standardised, *impersonal*, external elicitation measure. The findings of the present study suggest that personal salience may *facilitate* the reappraisal process.

A key theme of the finding is the potential importance of context (Aldao, 2013). The high ecological validity of the personal reappraisal task likely reflects how reappraisal plays out in more real-life contexts. That is, reappraising emotions based on real, and sometimes powerful, events is a complex and dynamic process (Kalisch, 2009). Better generation and more effective reappraisal for such events might mirror how regulatory strategies unfold in response to higher and more complex situational demands (c.f. the regulatory flexibility literature; Bonanno & Burton, 2013; Burton & Bonanno, 2016).

In particular, reappraisal is thought to be more effective in situations that are uncontrollable, where the person can only regulate the *self* (Troy, Shallcross, & Mauss, 2013). These were the types of events frequently recalled on the personal task (common themes include illness, death, relationships). Such judgements require adequate situational information (context), which is minimal in impersonal stimuli, such as IAPS pictures. Ambiguity and a lack of information seems likely to decrease situational demands, and leaves individuals with little sense of agency to regulate the self.

Given the absence of adequate information on the impersonal task, participants might be required to think *hypothetically* about how abstract ideas can change the emotional outcome of the picture's content (Salas et al., 2013). Such a skill surely requires abstract reasoning, and verbal ability, both impairments which have been shown to compromise reappraisal *generation* (for a detailed description see Salas et al., 2013). If the impersonal reappraisal task relies more heavily on more abstract aspects of cognition, it is possible that differences in cognitive ability contribute to the lower effectiveness of reappraisals, and would explain why the ABI group alone took longer to generate a reappraisal on the impersonal task. This may be particularly marked in dysexecutive patients, who often struggle with disengagement from immediate experience and manipulating thoughts (Gomez Beldarrain, Garcia-Monco, Astigarraga, et al., 2005; Salas et al., 2012). Such inflexibility, and lack of a reflective stance, may be more pronounced when emotions have been generated *externally*. However, when emotions are self-generated through memory recall, dysexecutive patients may be less influenced by perceptual aspects of stimuli and therefore able to utilise the personal content and relevance to manipulate ideas. Appendix D demonstrates examples of reappraisals across both tasks, which reflect these possible explanations.

How ABI affects reappraisal

If reappraisal is a two-stage process (Kalisch, 2009), the present study suggests that having a brain injury especially compromises the *early,* generative, stage, regardless of the type of stimulus that is reappraised. This provides further support to previous findings, which demonstrated that a brain injury can compromise the capacity to generate reappraisals, and to do so *quickly* (Rowlands et al., 2019; Chapter Two).

For the ABI group, reappraisal *effectiveness* seemed to be influenced by the nature of the reappraisal task. That is, when reappraising impersonal stimuli, the ABI group reported significantly poorer reappraisal effectiveness compared to healthy controls, but this

difference was not present for the personal task. The observation that reappraisal effectiveness was similar to healthy controls on the personal task, is consistent with previous findings that patients with brain injury were able to down-regulate negative emotions at similar levels to a healthy control group (Rowlands et al., 2019). A likely explanation for the difference on the *impersonal* task is that those with impaired cognitive control may experience more difficulties for impersonal or abstract situations.

The neglected role of context

This study shows that there is an important distinction between reappraisal for *personal* and *impersonal* material, especially for the ABI group. It appears that when reappraising material that is relevant to the *self,* spontaneous generation of information (or idea generation) is easier. Participants are, therefore, able to use this contextual information to build more effective reinterpretations, and more quickly. Impersonal (i.e. external) stimuli may present an additional challenge, because there is insufficient contextual information to build reappraisals.

The notion that contextual information is important is consistent with a developing line of research, which suggests that context effects are central in ER (Aldao, 2013, for a review; Bonanno & Burton, 2013). For example, in contexts where stressful situations *can* be controlled, the use of reappraisal is considered maladaptive (Troy & Mauss, 2013). Additionally, the adaptiveness of a reappraisal might rely on the realism of the information used to build the new meanings (Aldao, 2013; Gross 1998; van't Wout, Chang, & Sanfey, 2010). It is, therefore, possible that contextual information is critical to building positive reinterpretations, that are then accepted as realistic.

This idea can be seen anecdotally in the example below, of a participant in the ABI group.

Impersonal task (Sad Girls picture): *"We don't know what's happened to them. In my mind, the three of them are crying like something big has happened. We don't know, maybe someone has been hurt. I look on the dark side, but when I try not to look on the dark side, maybe it's not a terrible thing but a friend has gone to work in another country and they are just missing the friend. We just don't know. Because I don't know I think it is like the dark side, so [how I feel] doesn't change".*

Personal task (Scared when joined a community brain injury group): *"Positive side is that now I enjoy going. And if I get invited to other places now, I will go. I enjoy taking part in all the activities, and meeting new people. It's comforting to meet people who have gone through the same as you, and they know what you've been through and can help. It's nice to be with people that listen to you there too, like the volunteers and that".*

In the impersonal task, the participant attempted to seek out contextual information to build reappraisals, but then rejects them because they were apparently not credible. In contrast, when faced with a personal story, where there is an abundance of information to build reappraisals, they were more easily able to accept the new meaning as credible. It seems, therefore, that being able to *generate* a reappraisal is not always enough, participants have to then *accept* the reappraisal in order for it to successfully alter emotional responses. Given the absence of contextual information in impersonal stimuli, reappraisals may be harder to accept, and thus do not change the intensity of emotions to the same extent.

Cognitive mechanisms of reappraisal

The present study found associations between several cognitive control capacities and components of reappraisal. While it appears that cognitive capacities are important for reappraisal, their link to specific reappraisal components seems to depend on both the nature of the stimuli and the participant group. The most notable finding was that, for those with ABI, *inhibition* appeared to be particularly important for a reappraisal's effectiveness at

changing emotional intensity, regardless of stimuli, comparable to previous studies in neurologically heathy participants (Buhle et al., 2014, for meta-analysis). Inhibition was also predictive of the time taken to generate a reappraisal on the impersonal task (for the ABI group) and the personal task (HC group). This is a similar finding to a previous study of reappraisal in ABI (Salas et al., 2014), and suggests that being able to effectively inhibit the initial appraisal is a necessary step to generate an alternative interpretation quickly.

Working memory appeared to be important for some elements of reappraisal for the ABI group alone. Specifically, better working memory appeared to support quicker generation of reappraisals for the personal task, and seemed important for generating a greater number of reappraisals on the impersonal task. This extends well-established findings of working memory and reappraisal (Hendricks & Buchanan, 2016; Jasielska, Kaczmarek, Brońska, Dominiak et al., 2017; McRae et al., 2012; Rowlands et al., 2019). It is, somewhat, surprising that working memory was not found to be predictive of the number of reappraisals produced on the personal task, given the previous findings using that same task (Rowlands et al., 2019).

These findings are, indeed, very complex, but what is especially noteworthy is that cognitive control appears to be more predictive of reappraisal performance for the ABI group, and for the impersonal stimuli. This could be because such capacities might be required to a much greater extent for ambiguous situations (e.g. IAPS pictures), where there is not enough contextual information to draw from. Additionally, the highly varied nature of cognitive ability in the ABI group may have allowed the detection of these effects, whereas the majority of participants in the healthy control group scored within a restricted 'average' range for cognitive control.

Reappraisal tasks and self-report

The strong associations between task performance on the *personal* task, and the self-report use of reappraisal on an established questionnaire (ERQ-CA), suggest that the personal task is especially reliable and appropriate for measuring this ER strategy in participants with brain injury, and has strong ecological validity. Such associations were not found for the healthy control group. This may be related to the narrower range of reappraisal performance in this group, or a discrepancy between habitual use of reappraisal in daily life, and what people are capable of doing when they are instructed in laboratory tasks (McRae et al., 2012; Troy; Wilhelm, Shallcross, & Mauss, 2010; Weber, Assunção, Martin, Westmeyer, & Geisler, 2014). Such tasks focus exclusively on the 'implementation stage' of ER, and in daily life people would have to first choose reappraisal as the ER strategy to be implemented (i.e. the 'selection stage') (McRae & Gross, 2020; Sheppes, Scheibe, Suri, Radu, et al., 2014). It is also possible that people may report frequent use of reappraisal in their lives, but do so rather unsuccessfully (Perchtold, Papousek, Fink, Weber, et al., 2019). The present study's findings provide support that the number of reappraisals generated on the impersonal task is somewhat associated with the validated questionnaire, regardless of group.

A model of reappraisal: context and cognition

These findings support the idea that reappraisal is a dynamic *two*-stage process, consisting of early and late phases (Kalisch, 2009; Paret, Brenninkmeyer, Yuen, Gartmann, et al., 2011). Expanding on the Implementation-Maintenance model (Kalisch, 2009), Salas and colleagues (2014) suggested that the early phase, reappraisal *generation*, requires inhibition as a first step (to disengage from the initial appraisal), and verbal ability as a process to facilitate the generation of new meanings. As discussed above, contextual information may *facilitate* the generative process further.

An adapted two-stage model of reappraisal is proposed here, considering results from the present study and previous findings (Kalisch, 2009; McRae et al., 2012; Ochsner, Silvers,

& Buhle, 2012; Paret et al., 2011; Rowlands et al., 2019; Salas et al., 2013; Salas et al., 2014). See Figure 4. In the first phase, reappraisal *generation,* inhibition is required to disengage from the initial appraisal (1). If successful, the initial meaning and goal of reappraising is kept in mind - supported by working memory (2), and verbal ability and working memory are required to generate re-interpretations of the initial meaning (3).

If the first phase is successful, the second phase of reappraisal *maintenance* is entered. Here, working memory keeps track of the new appraisal (4), protecting it from the automatic appraisal. It is likely that monitoring is then important to track the reappraisal's success, and modify if necessary (5). This process seems mediated by the available contextual information, including the generation and maintenance components. In the absence of contextual information (e.g. impersonal stimuli), participants depend on cognitive control capacities to a higher degree, and draw upon reasoning skills to translate abstract ideas into reappraisals. The reappraisal's success then, in large part, relies on how well the automatic appraisal has been inhibited in the first phase.
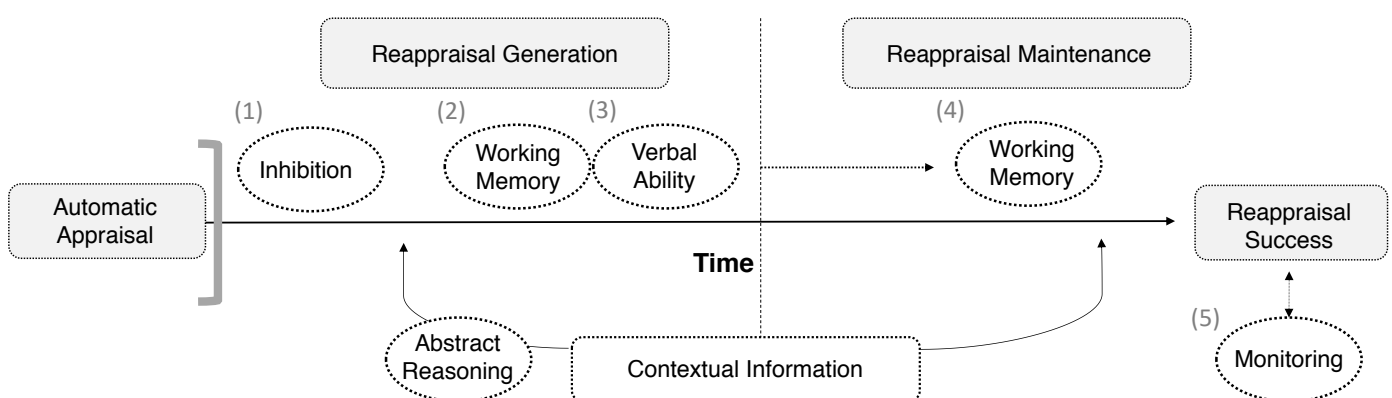
Figure 4. *A proposed model of reappraisal. In the early reappraisal generation phase 1) the automatic appraisal is inhibited (inhibition), 2) the initial meaning and goal of reappraising is kept in mind (working memory), 3) new interpretations are generated (working memory and verbal ability). In the second phase, reappraisal maintenance, 4) the reappraisal is kept in mind and 'shielded' form the initial meaning. The reappraisals' success is monitored and adapted if necessary (monitoring) (5). The process may be facilitated by the available contextual information. In the absence of such information, abstract ideas must be used to facilitate the generation of contesting mental representations (abstract reasoning).*

Implications and Future Directions

The present study's findings are important for neuropsychological *rehabilitation* in two ways. Firstly, by demonstrating that patients with ABI might be vulnerable to reappraisal impairment, in particular in ambiguous situations, or ones in which they must act quickly. This opens the possibility of facilitating the process by changing environmental demands (time) or providing support (contextual information). Secondly, it suggests that, for those with ABI, a cognitively effortful strategy may not be the best choice to modulate feelings. For example, there is evidence to suggest that strategies such as attentional deployment (Isaacowitz, Toner, & Neupert, 2009; Sheppes, Brady, & Samson, 2014) or situation selection (Webb, Kristen, Lindquist, Jones, et al., 2018) might be more appropriate for those low in cognitive resources.

Despite this contribution, the present study has some limitations. One is related to the mixed, and highly varied, sample of participants with ABI. However, this is also *positive* in that it is reflective of the clinical population. Another issue is that the measure of reappraisal effectiveness was dependant on self-report changes in emotional intensity, and therefore may have been vulnerable to experimenter demands. It is important to note, however, that self-report is correlated with physiology during reappraisal (Troy, Wilhelm, Shallcross, & Mauss, 2010). Finally, it is worthwhile to mention that the sample size was relatively small for the multiple regression analyses, in particular for the HC group. It is, therefore, possible that the coefficients are unstable, and may not generalise to other samples. However, bootstrapped techniques were used as a form of model validation.

Conclusion

The findings of the present study enhance the understanding of which tools might be most appropriate to capture elements of reappraisal, and in particular for neurological populations. It is suggested that a personal task (such as the ASRR) may be technically

superior to impersonal stimuli, and cognitively less effortful because it is facilitated by context. However, reappraisal remains a difficult strategy for patients, even when facilitated by personal context. Considered together, the use of a personally-salient task as an assessment tool is highly recommended, in particular for people with ABI. It can also be extended into the realm of intervention, and potentially used as a therapeutic tool, given its salience.

4. Chapter Four

"We were all in the same boat. We could all understand each other"

-    *Meilir (Participant from BISEP)*

4.1 "We can all relate": Patient experience of an emotion-oriented group intervention[1]

4.1.1 Abstract

Group interventions are carried out routinely across neuropsychological rehabilitation services, to improve understanding of brain injury and aspects of impairment. Treatment provided in a group-modality can bring additional benefits, such as co-operative learning. However, there are very few studies which explore patient perceptions and experiences of such interventions. The present study evaluated a group-based educational intervention for the consequences of acquired brain injury (ABI), which had an emphasis on emotion regulation. Using qualitative interviews, the study investigated the lived experience of participating in the seven-session programme, the better to identify the salience and value of individual elements. Twenty participants with ABI took part in individual interviews, after completion of the group programme (the Brain Injury Solutions and Emotions Programme, BISEP). Using a thematic analysis approach, five themes emerged: 1) Long term consequences and psychological needs of survivors; 2) Positive experience of participating in BISEP; 3) BISEP as a social milieu; 4) BISEP as a place to learn; and 5) BISEP as a place to promote positive emotional experiences. Many people reported high acceptability and perceived value of BISEP, and its role in facilitating adjustment and understanding of injury. Of particular importance was the opportunity to socialise with people who *"can all relate"*. The findings especially highlight the relevance of group programmes for ABI, promoting emotion regulation, and practical tools that are delivered optimistically.

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[1] Rowlands, L., Salas, C., Coetzer, R., & Turnbull, O. H. "We can all relate": patient experience of an emotion-oriented group intervention (Manuscript in preparation).

4.1.2 Introduction

Neuropsychological rehabilitation has increasingly been focusing on adjustment and acceptance, consistent with an 'emotional turn', where feelings are placed at the heart of formulation (Bowen, Yeates, & Palmer, 2010; Wilson, Gracey, Evans, & Bateman, 2009; McDonald, 2017; Wilson & Gracey, 2009). Group interventions are promising vehicles to promote understanding of injury, psychological adjustment, and improve aspects of impairment (Patterson, Fleming, & Doig, 2016; Psailia & Gracey, 2009; Wilson, 2017). Evidence points to their efficacy for a range of targeted outcomes, such as cognitive impairment and coping skills (Backhaus, Ibarra, Klyce, Lance, et al., 2010; Patterson et al., 2016, for a review). However, the subjective *experience* of participating in such programmes is an under-investigated element of group intervention development and evaluation (Patterson et al., 2016).

A Holistic Influence

Within neuropsychological rehabilitation, *holistic* approaches have received much attention in the literature (see Ben-Yishay, 2000; Ben-Yishay & Daniels-Zide, 2000; Ben-Yishay & Diller, 2011; Wilson et al., 2009; Trexler, 2000), and are effective (Cicerone, Mott, Azulay, Sharlow-Galella, et al., 2008; Turner-Stokes, Pick, Nair, Disler, & Wade, 2015). Traditionally, holistic approaches involve very intense provision of individual and group interventions, to increase understanding and self-awareness, and address the cognitive, behavioural, and emotional consequences of ABI as a whole, providing compensation strategies to help manage difficulties (Ben-Yishay, 2000; Ben-Yishay & Daniels-Zide, 2000; Ben-Yishay & Diller, 2011; Wilson et al., 2009; Trexler, 2000). Despite their efficacy, the service intensity, and the high staff-to-patient ratio, means that holistic programmes are often expensive and time-limited.

Due to the chronic nature of brain injury, survivors can experience difficulties for many years, highlighting the *continued* role of rehabilitation in the community (Coetzer, 2008; Turner-Stokes et al., 2015). However, the provision of neuropsychological rehabilitation in the chronic phase has been an area of little emphasis in the wider field. There are some reports that holistic approaches can be adapted to overcome barriers in low resource and long-term community settings (e.g. Coetzer, 2008; See Balchin, Coetzer, Salas, & Webster, 2017, for a handbook on this topic). The North Wales Brain Injury Service (NWBIS), UK, is one particular programme which follows the philosophical foundations of the holistic model, have published extensively on this topic. NWBIS provides rehabilitation in a long-term, 'slow stream', out-patient setting, and provides individual rehabilitation and *group* interventions (Coetzer, Vaughan, Roberts, & Rafal, 2003; Coetzer, 2008). Group-based treatment in such services typically consist of several weekly sessions, run over the course of three-weeks to three months (Patterson et al., 2016). Psycho-education about brain injury, compensation strategies for cognitive difficulties, and facilitation of emotional adjustment and awareness, are provided holistically within one programme.

Group interventions

Interventions are carried out routinely in groups across rehabilitation settings (Tyerman & Hucker, 2006). Many, however, adopt a 'home-grown' approach, where interventions have been developed by clinicians at services, but are typically not evaluated empirically. Additionally, a number of published guides can be used to facilitate group programmes (e.g. Powell, 2013; van den Broek & Dayus, 2002; Winson, Wilson, & Bateman, 2017), however these are not always evidence-based and do not have associated empirical data. The existing evidence-base for *empirically-evaluated* group interventions is complex, with large variation in their targeted outcome, setting of delivery, intervention content, and methodological rigour (Patterson et al., 2016). Considered together, quantitative

evidence suggests that group-based treatment is an effective intervention approach (Patterson et al., 2016), however further research is required to establish a more robust evidence-base.

The majority of evaluated group interventions have focused on cognitive difficulties (Patterson et al., 2016). Some have also focused on adjustment and coping (e.g. Backhaus et al., 2010; Bradbury, Christensen, Lau, Ruttan, et al., 2008), and group programmes with a multidisciplinary focus (e.g. Malec, 2001). In addition to targeted outcomes, there are other benefits to group environments in ABI rehabilitation (Winson, Wilson, & Bateman, 2016, p.9). For instance, they provide an opportunity for co-operative learning alongside the formal learning which comes from the facilitators and material, and they are valued by patients and carers (Couchman et al., 2014). Providing *group* rehabilitation also simultaneously provides an opportunity for increasing self-awareness and social support (Anson & Ponsford, 2006; Lundqvist, Linnros, Orlenius, & Samuelsson, 2010), and developing social connections with other survivors to help fight social isolation after ABI (Salas, Casassus, Rowlands, Pimm, & Flanagan, 2018). There are, however, few evaluations of group programmes which consider multiple aspects of ABI consequences, with an underlying holistic philosophical approach. More research is, therefore, necessary to ensure that such education-based group interventions are acceptable to patients, efficacious at improving aspects of impairment, and are an appropriate use of often limited service resources.

Subjective experience

A recent scoping review of group interventions in neuropsychological rehabilitation especially noted an absence of *qualitative* research, that consider participants' perceptions to explore group processes and elements of intervention (Patterson et al., 2016). Understanding the 'user experience', or participants' subjective accounts, in the delivery of neuropsychological interventions are key to develop and improve group programmes. *Qualitative* research has been crucial in developing an understanding of the wider context of

the experience (Graff, Christensen, Poulsen, & Egerod, 2018; Levack, Kayes, & Fadyl, 2010; Wain, Kneebone, & Billings, 2008). One patient's account captured the discrepancy between a lack of improvement on empirical measurements and the feelings of having improved (Wain et al., 2008). This indicates the value and clinical relevance of qualitative patient accounts in refining services and interventions.

Qualitative accounts have also helped to develop an understanding of which 'ingredients' are important components for various rehabilitation outcomes (Couchman et al., 2014; Graff et al., 2018). This includes which factors have positive or negative effects on motivation for rehabilitation, for example adequate provision of information, versus a lack of information or transparency from professionals (Graff et al., 2018; Maclean, Pound, & Rudd, 2000). In a meta-synthesis of qualitative research, external support (such as that provided by rehabilitation programmes) was considered especially important for recovery (Levack et al., 2010). Specifically, survivors discussed the value of learning about the injury, and the 'normalising' effect of interacting with other survivors in community settings (Levack et al., 2010).

A number of interesting themes were also identified, following the qualitative analysis of a multifamily group therapy (Couchman et al., 2014). The attendees expressed a sense of social connection, the enhancement of a sense of self-identity, and the knowledge and understanding which came from the interactions with other members. This is important, because it highlights the value of the *group* environment, and how the informal learning which comes from it was seen as more informative than the content of the intervention. Finally, giving patients an opportunity to participate in rehabilitation activities with other survivors may bring therapeutic gains in terms of support and guidance, social interaction, and engagement (Patterson et al., 2016, for a review).

Emotion Regulation and Neuropsychological Rehabilitation

One aspect of ABI consequences that seems particularly important to include in group programmes is emotion regulation (ER). This is because difficulties with emotion management, or *emotion dysregulation*, may be a key transdiagnostic factor of emotional difficulties after ABI (Shields, Ownsworth, O'Donovan, & Fleming, 2016), and have been identified as a *common* consequence of focal and diffuse brain injury (Bechara, 2004; Beer & Lombardo, 2007; Obonsawin, Jefferis, Lowe, Crawford, et al., 2007). ER refers to processes which can influence emotion type, their intensity, and how they are experienced and expressed (Gross & Thompson, 2007). The most popular model of ER, the Process Model, includes five ER strategies, that can be implemented at key time points (Gross & Thompson, 2007; Gross, 2013). These are: 1) *situation selection*: choosing settings which give rise to desirable, or undesirable, emotions *before* the event; 2) *situation modification:* taking steps which change the external environment to alter the emotional impact of the situation; 3) *attentional deployment*: changing attentional focus, often by focusing on more desirable internal scenarios, 4) *cognitive change (reappraisal):* changing the meaning of a situation to alter its emotional impact, 5) *response modulation:* altering emotional response tendencies once they have been elicited (Gross, 2015; Gross & Thompson, 2007; Werner & Gross, 2010).

Many group interventions include an *element* of ER (Patterson et al., 2016, for review; Winson et al., 2017), including interventions with a Cognitive Behaviour Therapy (CBT) focus (e.g. Aboulafia-Brakha, Greber Buschbeck, Rochat, & Annoni, 2013; Bradbury et al., 2008). However, there is little consistency in the operational definitions of ER, and CBT-based interventions require appropriately trained facilitators. The available studies of targeted ER interventions also appear to be growing, but still remain sparse, and with much variation in their theoretical approaches and success (Cantor, Ashman, Dams-O'Connor,

Dijkers, et al., 2014; Tornås, Løvstad, Solbakk, Schanke, & Stubberud, 2016). An example of a successful ER group programme is that developed by Tsaousides and colleagues (2017). This 24-session, web-based, group intervention conceptualised ER based on the Process Model, and involved training on specific ER strategies. Significant and continued improvement was found on the primary outcome measure of ER difficulties. However, publicly-funded services may not have the resources to carry out 24-sessions of video-conferencing, or allocate clinician time to run interventions that focus *exclusively* on ER. A potential avenue for such settings would be to incorporate a theoretically sound framework of ER in holistic education-based group interventions, alongside the traditional topics that are commonly seen in such programmes.

Little is known about patients' experiences of ER training provided in a group format. There are, however, a few exceptions to this. For example, Tsaousides et al (2017) included very brief qualitative feedback interviews in their online ER intervention, and found that participants considered the programme to be relevant, and enjoyed connecting with other survivors. This is an important finding, because both *experience* and *engagement* in rehabilitation programmes are indicated as crucial components for outcomes (Paolucci, Di, Massicci, Traballesi, et al., 2012; Williams, Rapport, Hanks, & Parker, 2019). Though it is an individualised intervention, Karagiorgou and colleagues (2017) noted how Positive Psychotherapy, and specific components such as making a note of 'Three Good Things' in a day, facilitated positive personal growth. Due to the distressing nature of emotional difficulties after ABI (Levack, Kayes, & Fadyl, 2010; Ownsworth & Fleming, 2005), it is especially important to address these issues in interventions, and understand the role that group programmes may play in facilitating improvement from the patients' perspectives.

The present study

There are three novel elements in the present study. The first is to evaluate a holistically-influenced group programme in a low-intensity, long-term, community rehabilitation setting. Second, is the focus on *subjective experience* as a route to identify the critical 'ingredients' of the programme, and to identify the acceptability, salience, and value of individual programme elements. Third, is a specific investigation of the role of the intervention in improving ER, using the over-arching theoretical Process Model (Gross, 2013; Gross & Thompson, 2007). The present study aims to describe participants' experience of a newly developed education and skills-based group intervention, which emphasised ER, alongside several aspects ABI consequences and psycho-education provided holistically.

4.2 Methods

4.2.1 Participants

Twenty participants with ABI were invited to take part (17 males, 3 females), after first being approached over the telephone approximately two-weeks following attendance of a group psych-education programme at the North Wales Brain Injury Service (NWBIS), Betsi Cadwaladr University Health Board (BCUHB). The average age of the group was 50 (*SD* = 10.24, range 26 - 67). The average time since injury was 7 years (*SD* = 7.54, range 9 months - 32 years). Seven participants had suffered a cerebrovascular accident (CVA), 11 a traumatic brain injury (TBI), one who had an ABI following encephalitis, and one who sustained a hypoxic brain injury. All participants agreed to take part, and nobody withdrew from the study.

4.2.2 Researchers' Reflexivity

The research was led by the first author (LR), who also conducted the interviews. LR, a female PhD student, had previous experience of qualitative research with people with ABI. She also received further training by the third and fourth authors (RC and OT), who have decades experience of clinical research with ABI participants. LR and CS coded the data, and

CS, a clinical Neuropsychologist, had previous experience of conducting qualitative studies with survivors of ABI.

An important consideration was that the interviews were conducted by the BISEP facilitator (LR). The participants were, therefore, familiar with the researcher, and this may have influenced the methodological rigour. In particular, participants may not have disclosed negative comments or critiques, or exaggerated the positive elements. However, an existing bond may have facilitated a conversational style of interviewing, that is recommended for participants with brain injury (Paterson & Scott-Findlay, 2002). The participants were informed that all their experiences and feedback were important for the evaluation, including constructive comments. All effort was made to encourage participants to feel comfortable disclosing issues regarding the intervention and the facilitator.

4.2.3 Procedure

The study was granted Ethical Approval by BCUHB (224613) and the School of Psychology, Bangor University (2017-16048). Participants were invited to attend the 7-session psycho-education group intervention, the Brain Injury Solutions and Emotions Programme (BISEP). The programme was facilitated by the first author (LR), and an additional member of the clinical team at NWBIS. The co-facilitator was kept constant as much as was possible. Each session lasted two hours, with a 15 minute break approximately half-way.

Participants from three waves of BISEP took part in face-to-face qualitative feedback sessions, approximately two weeks after completing the programme. It has been suggested that a minimum of twelve participants are required for data saturation (Guest, Bunce, & Johnson, 2006), however, in the present study, data-saturation was achieved through constant-comparison and analysis of data. Interviews were carried out in a quiet room at Bangor University or NWBIS, and in patients' homes in cases where travel was difficult.

Only the researcher and participant were present for the sessions. The interviews lasted approximately 20 minutes, were audio-recorded, and transcribed *verbatim*. A semi-structured interview format with prompts was used, i.e. "What are your thoughts on the BISEP?", "What did you value most?", "Are there any aspects that could be improved?", "Has the programme helped you understand how to manage your emotions better- in what way?", "Have you used things from the sessions in your day to day life?". Session-by-session prompting was used to assist participants' recall. A collaborative interview approach with scaffolding was used, to help participants develop narratives (Carlsson, Paterson, Scott-Findlay, Ehnfors, & Ehrenberg, 2007; Paterson & Scott-Findlay, 2002, for a review). The questions were selected to be as open as possible, and the interview protocol was pilot tested with the first two participants. No changes were made to the protocol following the pilot testing, and data included in the present study. For interview protocol and additional prompts, see Appendix E

4.2.4 The intervention - The Brain Injury Solutions and Emotions Programme (BISEP)

BISEP, like all such group programmes, has general elements, such as increasing awareness and understanding of injury, and facilitating adjustment. Strategies and compensation methods are also offered to help with common difficulties (e.g. problem solving and executive function, memory, and fatigue). Uniquely, the programme is designed to have a strong emphasis on emotion, ER, and promoting positivity, and these elements are thus threaded throughout the entire programme. For detailed description of BISEP and its development see Appendix F.

BISEP consists of: (1) an introductory session, (2) a session on anatomy and mechanisms of injury, (3) a session on emotional changes, (4) emotion regulation, (5) problem solving, (6) memory, and finally (7) fatigue. Participants receive a workbook every

session, which includes the content, skill building and group exercises, and discussion prompts.

In the 'Emotion Regulation' session, ER strategies from the Process Model (situation selection, situation modification, attentional deployment, and cognitive change[2]) are conceptualised as ones to use 'before' (situation selection), 'during' (situation modification, attentional deployment), and 'after' (cognitive change) an emotional event. The positive element is threaded throughout the *entire* programme, and includes the 'Three Good Things' intervention from the field of Positive Psychology (Seligman, Steen, Park, & Peterson, 2005), as a *daily* homework. This involves making a note of three things that go well each day with a short causal explanation.

4.2.5 Data analysis

A thematic analysis method was used to analyse the data (Braun & Clarke, 2006; Maguire & Delahunt, 2017) using an inductive approach (Strauss & Corbin, 1990). Thematic analysis is considered an appropriate method for a variety of qualitative research questions, across a range of epistemologies (Nowell, Norris, White, & Moules, 2017). After transcribing the interviews *verbatim*, the first step was data familiarisation. This was done by the first (LR) and second author (CS) reading and re-reading the transcripts. Next, the transcripts were exported into an Excel spreadsheet. Preliminary codes were generated to identify features of the data, in three waves. Fifty percent of the data was double coded by two independent coders (LR and CS), who first coded one interview before meeting to discuss the codes. They then independently coded four additional interviews before meeting to discuss and agree on codes once more. Finally, they independently coded five more interviews and met to discuss any disagreements or discrepancies. During each wave of coding checks, the coders

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[2] Response modulation was not included in BISEP, as this strategy involves the regulation of emotional expressions not experience *per se*. There is also evidence that this strategy can be used maladaptively (Gross & John, 2003), and describing when/how to use it in an adaptive way might be confusing for patients.

discussed the inclusion and exclusion criteria, and the interpretation of specific codes, as a form of data validation. The remaining fifty percent of the interviews, which were shorter in duration, were then single coded by the first author.

The next phase involved searching for broad patterns among the codes and structuring categories. The emerging categories were modified using the constant-comparison approach, where researchers compared newly uncovered and pre-existing codes. These categories were then clustered into derived themes and sub-themes. All themes and underlying interview extracts were discussed, reviewed, and refined by both coders. Finally, themes were allocated names which were reflective of the narrative, and example transcripts were chosen. No qualitative analysis software was used on the data. See Table 1 for example of theme development process.

4.3 Results

Five themes were identified in the data, each consisting of two sub-themes. See Figure 1 for visual representation. The names associated with the quotes provided have been changed to protect participants' identities.
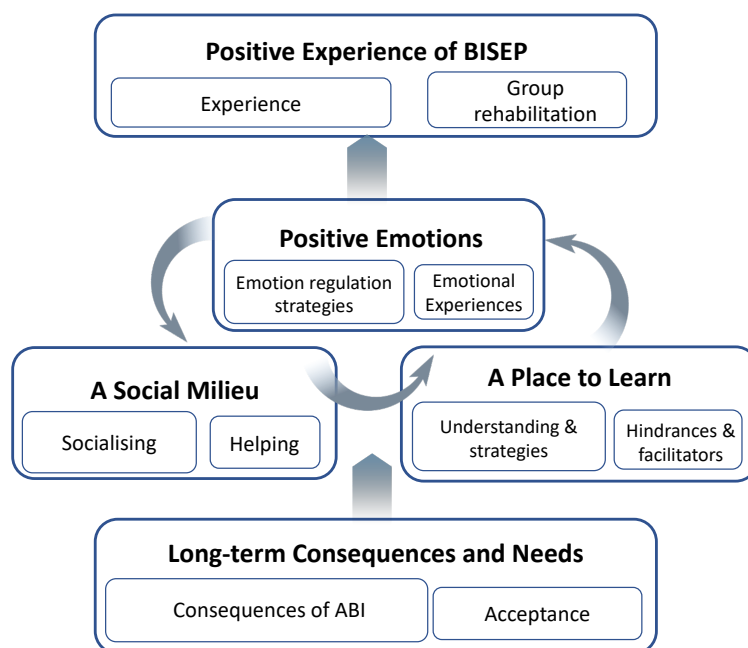
Figure 1. Visual representation of themes, and theme distribution

Table 1. Example of theme development process ('coding tree').

Quotes	Categories	Final Theme
We could all, we were all in the same boat, we could all understand each other	Relating to other members of BISEP	
So, it was good, and so good to see somebody who knows what you're going through.	Relating to other members of BISEP	
Because if someone cuts across when I am talking it knocks me back every time. It didn't happen that much in the group.	Interacting with survivors is different to non-ABI	
If you were a group of normal people, if you like for lack of a better word for it, you know you're going to have to put up with questions and… it's more of a…. strain. Where you're not going to have that quite so much from people undergoing quite a lot of the same problems.	Interacting with survivors is different to non-ABI	BISEP as a social milieu
Being able to share our experiences, our feelings, and strategies was informative, really, very much so.	BISEP as a place to share	
I found that I could share in the group which I thought was quite an achievement in a big group to be able to share things that are quite personal	BISEP as a place to share	
It was good, one could talk a bit more, not just about the accident but talk about the family, and what we've been up to.	BISEP as a place to socialise	
The people that where there made it better, because we had a laugh.	BISEP as a place to socialise	

Theme one: Long term consequences and psychological needs of survivors

This core theme (mentioned by all participants but one) was related to the persistent nature of post-injury impairment. The data show that in the early phases post-injury (9 – 24 months) or even in the chronic phase many decades following the injury, an ABI tends to affect every-day functioning in similar ways.

Two sub-themes were identified. The first related to the *direct* consequences of a brain injury, described by the majority of participants. This included cognitive impairments, fatigue, and difficulties with communication. Such difficulties resulted in some individuals having to *"take a step back"* from engaging in social activities. As described by Emyr:

"…if someone cuts across when I am talking, it knocks me back every time […], so you tend to take a step back from everything because that happens. And like I said, when I am tired and when I have to really think to get the right words and things like that, it really tires me, so I take a step back".

The most common ABI consequence described by participants related to emotional changes and ER difficulties. Many participants reported experiencing low mood, or feeling *"so sad"*. A number also described how anxiety or *"panic"* made it difficult to engage in previously enjoyed leisure activities. Difficulty with *managing* emotions, or using maladaptive ways of coping, were also present in the data.

The second sub-theme related to the process of *acceptance*, and adjusting to the long term consequences described above (described by more than half of the participants). The dramatic change in functioning and identity from pre-injury levels, challenged participants' ways of living, and was a common theme from participants early after injury to the chronic phase. This adjustment was described as analogous to a 'journey'. For Emyr, the stark contrast to his pre-injury function, was difficult for him to *"get over"*.

"I always go back to the same place in my head. Thinking about years ago, and the type of work I did in a day. In the past, if someone had called me saying there was a job in Scotland I would have just gone straight away there. Those things I miss. Those are the things I can't get over at this time. It's all behind me".

Theme two: Positive experience of participating in BISEP

A second core theme related to participants' positive experience of participating in the programme, and various valued elements which contributed to this experience (mentioned by all participants). Group members' accounts especially reflect the relevance of group programmes within neurorehabilitation.

Two sub-themes were, again, identified. The first related to the *positive experiences* of BISEP and various elements of the programme. Group members' narratives suggested that for some it took *"time to get into it"*. As participants relaxed in each other's company many reported that they began to both *"enjoy"* and *"benefit"* from it. BISEP was a place where they felt positive, *"safe"*, free of judgement, and a place where they could benefit in terms of recovery.

Cai: *"We were there in our safe zone, nobody could judge us on anything, and we had a great time".*

For a smaller number of participants, BISEP was a place where they experienced a sense of *"achievement"* or developed *"confidence"*. The positive overall experience of BISEP appeared to become an important part of their routine, and something to *"look forward to"* each week. Half of the group members referred to the role of the facilitators, and their personalities, as especially important for a positive BISEP experience, and *"encourages people to think in [a positive] way"*.

As Iolo describes:

"I think the group, I'd give it like a ten out of ten - it's fantastic. Really everything about it, the people who run it, the personalities, the warmth, the knowledge, the care, the empathy as well […] People really bonded over the humour, and it was all because the whole group was run in such a positive way on every level. […] There was always this positive- it's just walking in that room each week was like walking into a warm, sunny day".

These positive experiences of BISEP stood in contrast to participants' experiences of acute care, and highlight the smaller sub-theme (described by half of the participants), *The relevance of group rehabilitation programmes*. Many participants expressed negative experiences of acute care, and a disconnect when returning to adjust in their community. In the face of these negative reflections, participants emphasised the relevance of group rehabilitation programmes such as BISEP. Individuals expressed that there is a need for the programme to *"continue"*, and participants would like more opportunities to take part in groups. Consider the case of Rhys:

"Get another one sorted. Sort another one as soon as possible. Do anything. And even if a group is set up again, I would attend the meeting".

Theme three: BISEP as a social milieu

The third major theme related to the therapeutic function of socialising with other ABI survivors, within the context of the group rehabilitation programme. This was reported by all participants.

The first sub-theme related to the effect and value of *socialising*. Participants valued the opportunity to be among people that were *"in the same boat"*, and could, therefore, *"understand"* much of their experience. This opportunity to *"share"* with people who can *"relate"*, in a setting of mutual understanding, was of greater value to many participants than *any* other component of BISEP. This appeared to be *"reassuring"* and brought a sense of

normality to the group. For one participant, however, comparison to others was a *difficult* part of relating to other survivors, and contributed to negative emotional experiences.

For Gethin, the biggest value of BISEP was sharing with people who could relate to the effects of brain injury:

"Gethin: Exchanging stories with the other people really. Yeah, we all have something in common, that's the main point.

LR: At a level that maybe other people don't?

Gethin: Yeah. Especially from the invisible injury side. Because we can all relate to each other in that respect."

BISEP opened up the possibility for people to *"enjoy a social setting in a managed way"*. That is, the positive experience of interacting with members of BISEP stood in stark contrast to their experiences of people who do not have a brain injury. Some participants reported difficult experiences of interacting with people. As described by Morgan, *"People that don't know that you've cracked your head, they look at you and they treat you like you're a bit of a, I don't know, a bit of a retard"*. Peredur and Emyr both experienced pressures to act *"normal"* from people in the 'outside', which were substantially reduced when interacting with people in BISEP:

Emyr: "I could tell people 'I've had a brain injury', but it just isn't the same as if someone had broken a finger or arm, it just doesn't ever go away. And people from outside think 'Oh, he looks ok now, he must be better, he is better now'. But it isn't like that… So, in the groups, you come across people who understand, and are the same".

A smaller sub-theme, reported by few of the participants, was the opportunity to *help* other group members through sharing their experiences. For these participants, being in a position where they could help somebody else resulted in a positive emotional response.

Helping others, or being able to *"contribute"* to the group, appeared to serve a positive function.

Theme four: BISEP as a place to learn

A key theme, reported by all participants consisted of the *learning* which took place during BISEP, and the many dimensions of that learning process. Two sub-themes were identified. The first, *developing an understanding of ABI and learning strategies to manage difficulties*, was mentioned by the majority of participants.

Participants' narratives suggest that the content was *"very informative"* and *"relevant"*. For many, BISEP was a place to learn about *"how the brain works"*, and through developing an understanding of brain injury they became *"less confused"* about their situation.

Angharad: "Even though I knew bits from [previous career in medicine], I didn't know it for me. I had never put me in that brain".

Participants also discussed learning specific *"strategies"* to help manage difficulties. The patients especially valued suggestions about *"tools for every-day life"*, and that adopting strategies could make *"life easier"*. Not only did participants value the learning which came from the content and the facilitator, but participants were able to learn from each other. Survivors were seen as a source of help similar to that provided by professionals. In the case of Aled:

Aled: The information definitely was comprehensive and very informative. I've taken on board quite a few of the strategies. And the strategies I've picked up off different clients. We were able to learn off each other and take information off each other. There's so many different things you've mentioned that I've implemented really to make life easier for yourself. And it certainly does make life easier, and much more comfortable within yourself doing different things, having adopted strategies".

The second sub-theme related to things that *hindered* or *facilitated* learning in BISEP, described by three-quarters of participants. ABI consequences, such as difficulty with memory, or concentrating, could act as barriers to learning or engaging during BISEP. Related to this, three participants stated that there was *"too much information"* in sessions for it all to be digested.

Participants also suggested that certain existing elements of the programme *facilitated* learning, and helped *compensate* for challenges with the learning process. One such element was the use of 3D models of the brain and skull during the session about anatomy. Another essential component of BISEP that half of the participants found helpful was the handouts/booklets that they received with each session. These acted as a transitional resource, so that participants could *"refer back to"* and *"refresh"* their memories. This resource also allowed learning to continue even after BISEP has finished. Finally, some participants suggested that they would like even *more* sessions to go through things further, or to have an opportunity to revisit.

For Arwyn:

"As I've said before, I often refer to the notes I've been given, and I refer to the notes that I personally take to refresh my memory, and also to think in different ways. It's an on-going thing really".

Theme five: BISEP as a place to promote positive emotional experiences

The final theme related to the emotional changes experienced through participating in BISEP, described by all the group members. For many, the programme was associated with enhanced positive emotions, fewer experiences of negative emotions, and increased ability to *"manage"* emotional difficulties in daily life.

Two-sub themes were identified. The first, *emotion regulation strategies,* related to the use of strategies to manage emotional difficulties in daily life. Of the ER strategies

included in BISEP, thinking of *"positive things"* was the most commonly reported helpful strategy, which was related to the 'Three Good Things' activity. Making a note of good things each day got *"people to talk and focus on the good"*, and *"engaged positive thought"*. The important thing, however, was the positive effect of doing this activity on mood, which appeared to continue following the programme. For many, doing this helped them to *"notice positive things"* after BISEP, and encouraged *"positive thinking"*.

Twelve participants discussed the benefits of using ER strategies based on the Process Model, conceptualised in BISEP as tools to use 'Before', 'During', and 'After'. The data indicated that the in the moment ('During') strategies were especially useful for many participants. This mainly consisted of distracting activities such as *"going for a walk"* to improve low mood, or *"moving away"* from overwhelming or anxiety-inducing situations. The 'Before' strategies seemed particularly salient for the few people who discussed them. By thinking things through beforehand, they could *"foresee [their] situation and predict where it's going"*. Finally, a small number of participants described the benefits of the 'After' strategy of reappraisal for *"turning a negative in to a positive"*.

The second sub-theme related to the *emotional experiences* that were related to the generic elements, and the philosophical approach, of BISEP. Participating in the programme appeared to have beneficial effects on attendees' emotional well-being, with one reporting *"feeling better"* after BISEP. For some individuals, they felt *"less aggressive"* after the group, or *"less critical"* of themselves and their progress.

As described by Iolo:

Iolo: Ermm … [BISEP] helped me to be more aware of my emotions. And it's helped me try and work through those emotions […] Ermm…things like even feeling low or whatever. I do something positive. Think of something positive, focus on the positive. The group helped you to look at that, remember that, focus on that. […] So, when bad emotions come along

hopefully the positive will pull you out. But, the shopping one is probably most important […]
Since I took the advice on shopping: Go to the shop, at a quieter time, go to a quieter shop.
That was the -… things went a lot smoother for me in the shop".

4.4 Discussion

Long-term difficulties need long-term support

Participants' accounts emphasised the chronic nature of ABI in the *long-term*, consistent with previous literature (Colantonio, Ratcliff, Chase, Kelsey, et al., 2004; Dikmen, Machamer, Powell, & Temkin, 2003; Hoofien, Gilboa, Vakil, & Donovick, 2001; Salas et al., 2018). The findings also suggest that participants frequently disengage, or take a *"step back",* from leisure pursuits and socialising, as a means of coping with the long-term difficulties (Fleming, Braithwaite, Gustafsson, Griffin, et al., 2011; Kersey, Terhorst, Wu, & Skidmore, 2019, for a review), and may indicate a potential mechanism to address social isolation in rehabilitation. A recurrent element in the interviews was that survivors were at various stages of adjusting to changes in identity, or are on a different part of the 'journey' of acceptance, similar to themes identified by Couchman and colleagues (2014). Interestingly, emphasising the metaphor of a 'journey' might, in itself, be a tool which has important clinical implications (Huang & Aaker, 2019).

The persistent nature of participants' difficulties, sometimes decades after the injury, highlight the important role of long-term community rehabilitation services (Coetzer et al., 2018; Wade, 2003), and group programmes, in assisting patients with the adjustment process (Lexell, Alkhed, & Olsson, 2013; Lundqvist et al., 2010). The findings also contribute to the idea that addressing how survivors experience their 'new self' in rehabilitation might generate more positive adjustment (Carroll & Coetzer, 2011; Gracey, Palmer, Rous, Psaila, et al., 2008).

Important elements of BISEP

An important component of BISEP for all participants, was that socialising with, and relating to, other survivors appeared to be a powerful, therapeutic experience (Salas et al., 2018). Being able to *"share"*, and relate to the experiences of people *"in the same boat"*, was something which connected the group members, and facilitated a sense of unity or cohesion (Couchman et al., 2014; Lexell et al., 2013; Salas et al., 2018). Existing holistic approaches traditionally include some emphasis on social interaction within rehabilitation. However, it is only more recently that this element has received appreciation as a greater priority (Gracey, Yeates, Palmer, & Psaila, 2010). For instance, Douglas and colleagues (2015) describe the need to emphasise social and relational approaches in neurorehabilitation, and promoting a sense of meaning and belonging after ABI. Participants' interviews extend this idea by highlighting the potential benefit of developing a social milieu in promoting positive emotional experiences and a sense of connectedness (i.e. the feeling that they are *"not alone"*).

A second major component of BISEP was that it provided a platform for *learning* to take place, consistent with previous literature (Couchman et al., 2014; Lexell et al., 2013). Attendees valued learning tools, or *"strategies"*, that could be used in their daily lives to manage various difficulties (e.g. memory, fatigue). This contributes to a well-established literature on compensation strategies (Tsaousides & Gordon, 2009; Wilson, 2000). Participants especially appreciated the strategies that they *"picked up off different clients"*, and the data suggests that other survivors can be a source of help similar to that provided by professionals.

Some participants described the consequences of ABI as *barriers* to learning in the programme (e.g. *"sometimes things didn't sink in"*). Rehabilitation has many ways to address deficits in learning and memory following brain injury (Evans, Wilson, Schuri, Andrade, et

al., 2000; Fish & Brentnall, 2016; Kessels & Haan, 2003; Wilson, Baddeley, Evans, & Shiel, 1994). The data from the present study especially suggest that providing survivors with handouts or booklets is particularly helpful in facilitating learning, and allows learning to continue following programme completion.

The final important element was the ER strategies, and positive philosophy of BISEP. The participants especially valued the 'Three Good Things' activity to manage low mood, and promote positive thinking. Previous literature has also indicated how making a note of 'good things' can help promote positive feelings (Andrewes, Walker, & O'Neill, 2014; Karagiorgou, Evans, & Cullen, 2018), further highlighting the relevance of this activity in neurorehabilitation (Evans, 2011). Further, due to its simplicity it may be an especially beneficial tool for people with ABI.

In the context of the strategies based upon the Process Model (Gross, 2013), the 'During' strategies were frequently reported as effective for managing emotional difficulties in daily life. These 'in the moment' tools are based upon 'situation modification' (modifying the *external* environment to manage emotional responses) and 'attentional deployment' (changing the *internal* environment to more favourable thoughts). Participants' narratives suggest that these were useful for improving low mood, and managing anxiety or overwhelming situations. This is consistent with evidence in neurologically healthy participants, indicating that attentional deployment may be useful for those low in cognitive resources (Lohani & Isaacowitz, 2014; Sheppes, Brady, & Samson, 2014).

Additionally, some participants described the relevance of the 'Before' strategies: the forward-thinking strategy of 'situation selection'. Through *"analysing"* and predicting the potential difficulties of various situations, participants reported being better able to manage their difficulties in daily life. This provides further evidence that situation selection may be

particularly effective for people who struggle to regulate their emotions (Webb, Lindquist, Jones, Avishai, & Sheeran, 2018).

The 'After' strategies (reappraisal in the Process Model), was only explicitly described by three participants. However, there is some overlap between thinking of the positives generally with 'Three Good Things', and using positive things to change the meaning of a situation (as in reappraisal). Reappraisal is a cognitively effortful strategy; which research suggests is impaired in patients with ABI (Salas et al., 2014; Rowlands et al., 2019). It is possible that this strategy remains difficult to use, even after training, and that 'Three Good Things' may be a simpler approach to promote positive thinking.

Participants reported positive emotional experiences and changes, that were related to *generic* elements of the programme. This emphasises the role that a group programme, with a positive philosophical approach, can have in improving emotional well-being following brain injury. The present study's findings provide further support that group rehabilitation programmes can be a promising vehicle to promote adaptive ER and emotional well-being (Tsaousides, et al., 2017; Tornås et al., 2016).

Acceptability of BISEP and the role of group programmes

BISEP was perceived as a valuable, beneficial, and positive experience, similar to previous studies of group programmes (Couchman et al., 2014; Lexell et al., 2013). The narrative especially suggests that enjoying the sessions played a central role in engagement, and participants' motivation to attend the programme until it was completed (*"I'm sad to see it end"*). The positive experience of participating in BISEP allowed participants to *"benefit"* in terms of their recovery (similar to Couchman et al., 2014; Lexell et al., 2013). A final point which deserves attention is the facilitators' role in fostering the positive rehabilitation experience. This contributes to well-established qualitative evidence, which points to the therapeutic relationship as a potential mechanism to promote rehabilitation engagement

(Bright, Kayes, Worrall, & McPherson, 2015; Lawton, Haddock, Conroy, & Sage, 2016), and demonstrates that it is not only *what* clinicians do that is important, but *how* they do it (Bishop, Kayes, & McPherson, 2019; Bright et al., 2015; Kayes & McPherson, 2012).

Survivors described the relevance of group programmes, such as BISEP, for community rehabilitation services. The lack of information provided at the organisational level in acute services resulted in feelings of disconnect after returning home, something which has been reported elsewhere (Abrahamson, Jensen, Springett, & Sakel, 2017; Graff et al., 2018; Piccenna, Lannin, Gruen, Pattuwage, & Bragge, 2016). The limited level of information provided to participants highlights how community services broadly, and group programmes specifically, can help with progression through the rehabilitation pathway.

Limitations

The results of the present study are promising. A noteworthy limitation, however, is that the interviewer (LR) was also the person who facilitated the programme. Future research would benefit from having an interviewer who was not the facilitator of the programme, and to conduct interviews at an additional time point to track changes over time. It would also be interesting to interview family members or care-givers, to obtain an additional perspective. These aspects were beyond the scope of the current research project. An additional limitation is that the individuals who completed BISEP *chose* to enrol on a group programme. The results would then be less generalisable to all survivors of ABI.

Clinical Implications

Participant narratives suggest several important clinical implications. 1) *Build long term:* The findings provide clear support of the role of 'slow stream' holistic rehabilitation services in the *long term,* to help survivors with issues related to adjustment, acceptance, and identity. 2) *A social space:* The data highlight the importance of group programmes in forming a *"safe"* and relational space, where participants can experience the therapeutic

benefits of socialising with similar others. Additionally, by placing the focus of rehabilitation programmes in the relational space between people, it provides a platform to learn from their peers, in addition to the formal content. 3) *Provide strategies:* Suggesting practical tools and strategies may be a promising approach in rehabilitation programmes. 4) *Focus on positives:* The present study suggests that BISEP (and other group programmes) are promising vehicles for promoting positive emotional experiences, and adaptive ER skills. Participants especially noted the relevance of the 'Three Good Things' activity, in addition to the underlying principle of 'promoting a positive outlook' across all sessions.

Conclusion

The majority of rehabilitation research has focused on post-acute services and individualised treatment (e.g. Cicerone, Langenbahn, Braden, Malec, et al., 2011). The present findings suggest that group programmes are not simply an expedient tool to save money or clinician time. Group interventions, such as BISEP, have benefits through the powerful therapeutic effect of shared experience. Patients identified therapeutic gains which the clinician themselves could not provide, but only facilitate. Finally, traditional rehabilitation interventions have tended to focus on cognitive impairment. The emphasis on emotion regulation and optimism, had benefits which are arguably more important in patients' lives. In sum, rehabilitation services may benefit from placing an emphasis on group programmes, continued treatment in the chronic phase, and simple, practical tools that are delivered optimistically.

5. Chapter Five

"I think BISEP was a shot of social interaction. It encouraged that positive thinking more clearly. It just takes time doesn't it?"

- *Osian (Participant from BISEP)*

5.1 Focus on Feelings: An evaluation of an emotion-oriented group intervention after acquired brain injury[1]

5.1.1 Abstract

Difficulties with emotion regulation (ER) are common consequences of acquired brain injury (ABI), and a key transdiagnostic element of global distress. The Brain Injury Solutions and Emotions Programme (BISEP) is a group intervention, with the principal aim of improving ER skills and emotional distress (depression and anxiety symptoms). The present non-randomised 'phase one' study aimed to evaluate initial efficacy and feasibility of BISEP. Additionally, this study was the first to establish the importance of individual therapeutic alliance and 'group attraction' for improvement. Forty-five participants with an ABI took part in 7-sessions of BISEP, and 14 were included in the treatment as usual control group. Participants completed an ER task, and questionnaires measuring ER, depression, anxiety (at three time-points), therapeutic alliance, and 'group attraction'. The findings demonstrated significantly improved performance on all components of the ER task, and on the ER questionnaire, and in some respects for depression and anxiety. Based on the findings, a future randomised control trial is warranted and deemed feasible, with a larger sample and multiple study sites. An additional finding was that 'group attraction' was the only significant positive predictor of improvement. The findings suggest that an easy to implement and free to access programme, such as BISEP, may be an effective vehicle for promoting adaptive ER skills, and improving emotional distress. However, further investigation is required to determine effectiveness.

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[1] Rowlands, L., Coetzer, R., & Turnbull, O. H. (Under Review). Focus on Feelings: An evaluation of an emotion-oriented group intervention after acquired brain injury. *NeuroRehabilitation*

5.1.2 Introduction

Emotional disturbances after acquired brain injury (ABI) have long been recognised as common and persistent consequences (Gainotti, 1993; Kreutzer, Seel, Gourley, 2001; Williams & Evans, 2003). Depression and anxiety are especially prevalent (Bryant, O'donnel, Creamer, McFarlane, et al., 2010; Morton & Wehman, 1995; Scholten, Haagsma, Cnossen,Olff, et al., 2016), and can have a profound effect on long-term adjustment and functional outcomes (Ponsford, Draper, & Schönberger, 2008; Ownsworth & Fleming, 2005). Additionally, high levels of emotional distress can have an aversive impact on community integration (Kersey, Terhorst, Wu, & Skidmore, 2019), and rehabilitation participation (Skidmore, Whyte, Holm, Becker, et al., 2010). Addressing emotional difficulties after ABI is now, therefore, a greater emphasises within neuropsychological rehabilitation (Wilson, 2008).

Emotion Regulation after Brain Injury

There is a large neuropsychological literature which has addressed various emotional processes following brain injury (e.g. perception and experience) (Bornhofen & McDonald, 2008, for review; de Sousa, McDonald, & Rushby, 2012). Of increasing interest is how brain injury might compromise the ability to *regulate* emotions (Salas, Gross, & Turnbull, 2019, for review). Emotion management skills enable people to be flexible, and modify feelings based on situations and individual goals (Gross, 2013). This is especially relevant because emotion regulation (ER) may be an underlying and transdiagnostic factor for a *range* of neurobehavioral difficulties (e.g. anxiety, depression, aggression, frustration) and global distress (Shields, Ownsworth, O'Donovan, & Fleming, 2016). A limitation of the literature, however, is that many studies of emotion dysregulation after brain injury have neglected to take into account the psychological *processes* that allow feelings and experiences to be managed (Salas et al., 2019).

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Outside neuropsychological rehabilitation, the field of ER is well-developed, especially with the influential Process Model (Gross, 2013; 2015; McRae & Gross, 2020). According to this, ER is defined as the *processes* by which emotions and their intensity are influenced, as well as how and when they are experienced and expressed (Gross, 2015), and includes five strategies: *situation selection, situation modification, attentional deployment, cognitive change,* and *response modulation*. By far, the strategy which has received most attention in the literature is that of reappraisal (part of cognitive change) (Buhle, Silvers, Wager, Lopez, et al., 2014, Zilverstand, Parvaz, & Goldstein, 2017, for reviews). This involves re-interpreting an emotional event in less negative, or more positive, terms (Gross, 2015), and may be an especially effective and adaptive strategy (McRae, 2016; Troy, Wilhelm, Shallcross, & Mauss, 2010). Growing evidence indicates that participants with ABI are impaired in their ability to use ER strategies to manage their feelings (Salas et al., 2019), especially the strategy reappraisal (Rowlands, Coetzer, & Turnbull, 2019; Salas, Turnbull, & Gross, 2014).

Emotion Regulation in Neuropsychological Rehabilitation

The range of difficulties that are associated with ER impairment highlight the need for targeted neuropsychological interventions to improve ER awareness and skills (Salas et al., 2019). Common aims of existing interventions are psychological distress, or *specific* emotional problems (e.g. anxiety or anger) (Ashman, Cantor, Tsaousides, Spielman, et al., 2014; Hart, Vaccaro, Hays, & Maiuro, 2012; Medd & Tate, 2000; Stalder-Lüthy, Messerli-Bürgy, Hofer, Frischknecht, et al., 2013). Although such interventions are beneficial for the target emotional outcome, it has been suggested that such specific interventions may not generalise to *other* affective difficulties (Waldron, Casserly, & O'Sullivan, 2013). A more promising target, therefore, may be *ER*. However, only a small number of intervention studies have explicitly aimed to improve ER skills (Salas et al., 2019, for a review).

There have been a small number of group interventions which have addressed ER, although this was not the principal aim of a number of these programmes (Cantor, Ashman, Dams-O'Connor, Dijkers, et al., 2014; Tornås, Løvstad, Solbakk, Schanke, & Stubberud, 2016; Tsaousides, Spielman, Kajankova, Guetta, et al., 2017). These interventions have also approached the question from various stand-points, and were not based on the Process Model. For example, ER training, based on a cognitive-behaviour perspective (Cantor et al., 2014) had no beneficial effects on ER. Goal Management Training with an ER module, however, had significant beneficial effects on several measures of ER (Tornås et al., 2016). A final ER group intervention of note is a web-based programme specifically aimed at improving ER (Tsaousides et al., 2017). This 24-session group intervention was provided by video-conferencing, and included psycho-education and skill building. Participants were taught skills and strategies to manage emotions, in line with the Process Model. Significant improvements (with large effect sizes) were reported for ER, with continued benefit at follow-up.

Considered together, it is difficult to draw an overall picture of the effectiveness of these interventions, because, as previously mentioned, they lack an over-arching framework (Salas et al., 2019). Without a unified definition, and a solid theoretically-driven approach, it is difficult to develop sound neuropsychological interventions to improve regulatory skills. Similar to executive function interventions, that are based upon models of frontal lobe function (Stuss & Alexander, 2007), ER interventions must also be based upon strong foundations. Indeed, as emphasised by Wilson and Gracey (2009), an understanding of theories and models is crucial to successfully rehabilitate emotional functioning.

Group Interventions

Providing interventions for ER impairment may be especially effective when provided in the *group* modality. Research has shown that *group* ER interventions can bring

about positive change (Tornås et al., 2016; Tsaousides et al., 2017), but providing an opportunity for survivors to learn in a social setting may bring *additional* benefits (Anson & Ponsfod, 2006; Couchman, McMahon, Kelly, & Ponsford, 2014). In a group, survivors can develop a greater understanding of their emotional difficulties (Psaila & Gracey, 2009), and experience self-acceptance through the safe environment. Group education-based interventions have been shown to bring clinically significant changes in psychological distress and coping skills (e.g. Anson & Ponsford, 2006; Backhaus, Ibarra, Klyce, Lance, et al., 2010; Rath, Simon, Langenbahn, Sherr, & Diller, 2003). *Qualitative* evidence also suggests that survivors develop knowledge and understanding through social interactions, and that forming social connections can bring important therapeutic gains (Couchman et al., 2014).

Education-based interventions have been described as a 'cornerstone' of effective healthcare after ABI (Lukens & McFarlane, 2004; Smith & Testani-Dufour, 2002). They are carried out routinely across neuropsychological rehabilitation services. However, *specific* programmes are not often evaluated empirically. In line with this, the brain injury rehabilitation guidelines (Harley, Allen, Braciszeski, Cicerone, Dahlberg, & Evans, 1992), have been criticised for being based more upon expert opinion than empirical evidence (Cappa, Benke, Clarke, Rossi, Stemmer, & Van Heugten, 2003). This is because of the major challenges faced in this area of research, including rehabilitation taking longer than most funding resources allow, and difficulty conducting randomised controlled trials (Turner-Stokes, Pick, Nair, Disler, & Wade, 2015). This highlights the importance of carrying out robust pilot testing of interventions, to provide a sound foundation for well-designed and controlled further research.

It is also notable that there is a lack of a systematic, or unified, approach to delivering such group interventions. A number of manuals exist, but with wide variation in their content,

length, and format (e.g. Backhaus & Ibarra, 2012; Powell, 2013; Winson, Wilson, & Bateman, 2017). The Brain Injury Rehabilitation Workbook (Winson et al., 2017) is the most extensive (280 pages), and is a guide to delivering a group programme based upon the *holistic* approach: involving intense service provision, which addresses emotional, cognitive, and community integrative factors together, provides compensatory strategies, and promotes awareness and adjustment (Ben-Yishay & Daniels-Zide, 2000; Ben-Yishay & Diller, 2011; Wilson, Gracey, Evans, & Bateman, 2009). Typically, this provision can be expensive, but the underlying philosophy can be adapted for 'slow stream', and under-resourced settings (Coetzer, 2008; Balchin, Coetzer, Salas, & Webster, 2017).

The literature of group programmes in neuropsychological rehabilitation has not adequately addressed therapeutic predictors of outcome. Two therapeutic processes may be especially importantly. Firstly, there is a long standing literature on individual psychotherapy in neurotypical participants, which indicates that the *therapeutic alliance* is a robust predictor of outcome (Hovarth & Symonds, 1991; Martin, Garske, & Davis, 2000, for meta-analyses). The alliance refers to the collaboration and bond between patient and therapist, and agreement on tasks and goals to be completed, and is relevant in any activity which involves a process of change (Bordin, 1979). Research of the therapeutic alliance in ABI remains relatively modest, and has emerged as a complex process which appears to influence rehabilitation outcomes (Stagg, Douglas, & Iacono, 2019, for a review). Secondly, a consistent body of qualitative evidence indicates that *group* therapeutic processes, such as cohesion, is especially valued by patients (Couchman et al., 2014; Levack, Kayes, & Fadyl, 2010). In addition, in group psychotherapy (in neurotypical adults), elements of group cohesion have been shown to predict outcome (Burlingame, McClendon, &Yang, 2018, for meta-analysis; Crowe & Grenyer, 2008).

Building an implementable programme

Intensive rehabilitation is not available for everyone, and many survivors live in the community, with long-term difficulties (Coetzer, 2008; Colantonio, Ratflicc, Chase, Kelsey, et al., 2004; Hoofien, Gilboa, Vakil, & Donovick, 2001), including ER impairment. There are many variations of group interventions run clinically within rehabilitation settings (Patterson, Fleming, & Doig, 2016; Turner-Stokes et al., 2015). Unfortunately, these are not often evaluated or published. There are an even smaller number of published *guides*, which have not been evaluated empirically as stand-alone treatments, only as part of an overall rehabilitation programme (e.g. Cicerone, Langenbahn, Braden, Malec, et al., 2011; Rohling, Faust, Beverly, & Demakis, 2009; Wilson, 2013). In addition, not all services have the resources or staff to run groups which focus *exclusively* on ER, or to deliver extensive video-conferencing (c.f. Tsaousides et al., 2017). However, providing a group intervention with the *principal* aim of improving ER skills, which also holistically addresses other common difficulties, may be a promising way forward (Mateer, Sira, & O'Connell, 2005; Prigatano, 1997; Wilson, 1997).

There have been no published studies of 'in-person' group neuropsychological rehabilitation programmes, with the *primary* aim of improving ER (based on the Process Model framework). The present 'phase one' study had three objectives:

Initial efficacy of BISEP. A principal objective was to evaluate initial efficacy of a new education and skills-based group intervention (The Brain Injury Solutions and Emotions Programme, BISEP) to improve ER skills and emotional distress after ABI. It was hypothesised that the intervention group would show significant improvement on self-report reappraisal use, would generate reappraisals significantly quicker, produce a significantly greater number of reappraisals, and significantly more effective reappraisals on an ER task following BISEP, compared to a treatment as usual (TAU) control group (primary outcome

measures). Multiple primary outcomes were included to enable selection of primary outcomes for a future trial. As regards secondary outcomes, it was hypothesised that the intervention group would show significant improvement in anxiety and depression symptoms following the intervention, compared to the TAU control group.

Feasibility of BISEP. A second aim was to investigate the feasibility of facilitating BISEP in an outpatient setting, and for a future randomised control trial (RCT) (including the required sample size).

Therapist and group predictors of improvement. A third aim was to establish individual (therapeutic alliance) and group predictors of improvement following the programme. It was hypothesised that therapeutic alliance and 'group attraction' would positively predict post-intervention improvement (for the intervention group alone).

5.2 Methods

5.2.1 Participants

Participants had a confirmed ABI (as per North Wales Brain Injury Service [NWBIS] criteria; Coetzer, Vaughan, Roberts, & Rafal, 2003), and were recruited over the telephone, following referrals from clinicians' active case-loads at NWBIS. Inclusion criteria were: duration of nine months or greater since injury, and sufficient language ability for the intervention. Exclusion criteria were inability to give informed consent, and the presence of a neurodegenerative condition, learning disability, or psychiatric disorder in need of acute care. Participants did not have to present with emotional distress to be recruited because BISEP is involved in promoting adaptive ER and positivity for all, regardless of baseline symptoms. Participants were recruited, by convenience sampling, in six waves. See Figure 1 for overall participant enrolment and participation. For demographic and injury information see Table 1.
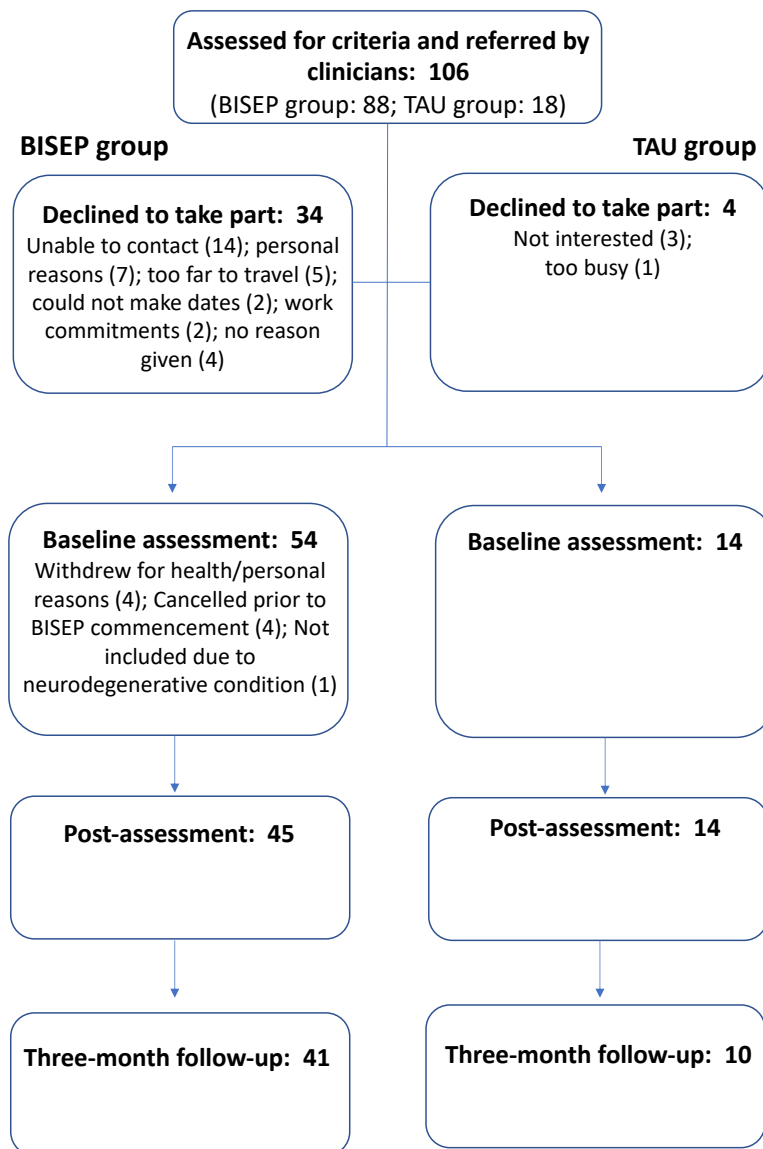
Figure 1. Flowchart of participant enrolment and flow through study.

Table 1. Participant injury and demographic information.

Group	Pathology	Mean time since injury (years) (SD, Range)	Mean age (SD, Range)	Gender	Years in education (SD, Range)
Intervention Group (*n* = 45)	TBI (*n* = 17) CVA (*n* = 21) Encephalitis (*n* = 3) Hypoxia (*n* = 1) Hydrocephalus (*n* = 1) Radiation (*n* = 1) Tumour (*n* = 1)	5.5 (8, 9 months – 32)	52 (12, 26 – 86)	M (*n* = 34) F (*n* = 11)	13.5 (2.15, 10 – 20)
Control Group (*n* = 14)	TBI (*n* = 4) CVA (*n* = 9) Hypoxia (*n* = 1)	7 (5.5, 9 months – 16)	44 (15, 22 – 74)	M (*n* = 11) F (*n* = 3)	13 (2.15, 10 – 16)

TBI: traumatic brain injury, CVA: cerebrovascular accident, M: Males, F: Females.
*There were no significant differences between groups on time since injury or education, however the control group were significantly younger ($Z = -2.11, p = .035$).

The aim of the present study was to estimate *initial* efficacy for the purposes of designing a future randomised control trial. The sample size was, therefore, not calculated but determined by the recruitment constraints. The intervention group was larger, to give as many participants as possible the opportunity to benefit from the treatment. Unfortunately, it was not possible to recruit equal group sizes due to recruitment difficulty. However, a minimum sample size of 12 can be considered appropriate for a 'phase one' study (Julious, 2005).

5.2.2 Design

Initial efficacy of BISEP. The present study involved quasi-experimental design where participants were allocated to one of two groups with convenience sampling (non-randomised), and performance on tasks compared between groups at three time-points (baseline, post-assessment, and three-month follow-up).

Feasibility of BISEP. Feasibility study design was used to inform the development of a future trial.

Therapist and group predictors of improvement. This third study aim was addressed using correlational design and regression analyses.

5.2.3 Measures

Initial Efficacy of BISEP: Primary Outcomes

The Emotion Regulation Questionnaire (ERQ-CA)

The ERQ-CA (Gullone & Taffe, 2012), is an adapted version of the well-validated emotion regulation questionnaire (Gross & John, 2003), simplified for children and adolescents. It was chosen as previous work in our lab observed difficulties among ABI survivors in grasping the language of the original. It measures self-report use of the ER strategy of reappraisal, to manage emotions in daily life, and includes six items that are scores on a 7-point Likert scale. This questionnaire is based upon the Process Model framework, and reports good internal consistency (α = .86) and validity.

Reappraisal task

To measure the skill of reappraisal, an experimental task, the Affective Story Recall Reappraisal (ASRR) task was used. This has been described in detail elsewhere (Rowlands et al., 2019). The task was carried out on a 13 inch laptop. Participants were shown emotion words ('sad', 'scared', 'angry' and 'neutral'). They were required to describe a personal event which evoked that congruent emotion. After their story recall, participants indicated emotional intensity on a zero to ten scale. They were then cued with the text 'Think aloud about the positive sides. Try to be quick', and were required to generate as many positive sides (i.e. reappraisals) as they could. Following this, they rated emotional intensity again. The task consisted of eight trials, with each emotion word appearing twice.

The task was audio-recorded and transcribed *verbatim*. Three measurements of reappraisal were produced by this task: *reappraisal productivity* (the total number of reappraisals produced across the task), *reappraisal difficulty* (the average time taken to

generate a first reappraisal), and *reappraisal effectiveness* (the average difference in emotional intensity ratings before, and after, reappraising) (Rowlands et al., 2019).

Initial Efficacy of BISEP: Secondary Outcomes

The Hospital Anxiety and Depression Scale (HADS)

The HADS (Zigmond & Snaith, 1983) consists of 14 items, and two sub-scales measuring depression and anxiety. It has been reported to be valid for use with people with ABI (Dawkins, Cloherty, Gracey, & Evans, 2006; Schönberger & Ponsford, 2010). Participants indicate their agreement with each statement, on a 4-point scale.

Therapist and group predictors of improvement

Therapeutic Alliance

Participant and group facilitator ratings of the strength of the therapeutic alliance was measured using the Working Alliance Inventory short form (WAI-S) (Tracey & Kokotovic, 1989). This is a widely used measure, including for participants with ABI (Schönberger, Humle, & Teasdale, 2006; Rowlands, Coetzer, & Turnbull, 2020). Parallel patient and therapist versions were used, to gain both perspectives. Both forms report high reliability (patient version, $\alpha = .95$, therapist version, $\alpha = .97$), and include 12 items which are scored on a 7-point Likert scale. The highest possible alliance rating is 84 (range 12-84).

Group attraction

To measure whether 'group attraction' had an effect on intervention outcome, the Group Attitude Scale (Evans & Jarvis, 1986) was used. This scale consists of 20 items, responded to on a 9-point Likert scale, to capture group members' perceptions and attraction towards each other, as well as factors such as being able to identify and feel accepted among their peers. This scale has sound validity and reliability ($\alpha = .90 - .97$). The highest possible 'group attraction' score is 180 (Range 20-180).

The Intervention

The Brain Injury Solutions and Emotions Programme (BISEP) is a seven session education and skills based group programme, with a strong emphasis on emotion and ER, carried out across two hour weekly sessions by a primary facilitator (LR) and a co-facilitator (a member of the clinical team). It is not *exclusively* an ER intervention, suggesting solutions and compensation strategies to other common difficulties (e.g. memory, problem solving, fatigue). However, ER was the focus of the present research study. Attendees completed BISEP in groups of between six and 12. See Table 2 for further session information, and Appendix F for a detailed description of BISEP.

Table 2. Intervention Components

Session	Main Activities
(1) Introduction	• Introduction to programme, group members, and end-of-programme party. • Introduction to the 'Three Good Things' activity. • Discussion about compensation methods. • Group discussions to promote group cohesion.
(2) What is Brain Injury?	• 'Three Good Things' sharing activity. • Basic anatomy, mechanisms of injury, and different types of injury (facilitated with brain and skull models). • Discussion about importance of goals and compensation.
(3) Emotional Changes	• Normalising emotions by discussing their functions. • Emotions at different levels, goal is to find a healthy level. • Group activity to encourage experiential elements of basic emotions. • Suggestions on ways to help decrease negative, and promote positive, emotions. • 'Traffic light' activity introduced – being aware of emotions as they arise at low levels. • Group activity to recognise emotions from case vignettes. • Group to work on a case study together to identify ways to help manage emotions.
(4) Emotion Regulation	• To introduce three time points to manage emotions • Description of 'good outcome' (activity with feelings) and 'bad outcome' (feelings stop activity). • Describe each time point to manage emotions in detail. • 'S.O.S' mantra explained (stop, to be aware of emotions as they arise at low levels, and think of solutions based on the 'time point' descriptions. • Work through examples for each 'time point' as a group. • Group activity – work through group members' difficulties together.
(5) Problem Solving	• To introduce some executive functions. • Executive functions important for four areas of 'managing feelings', 'understanding', 'doing', and 'thinking' – group discussion. • Focus on problem solving and introduce the problem solving cycle (Pause, identify the problem, think of solutions, and check if it worked). • Reflective activity on problem solving in real life. • 'Give your goal a chance' introduced – think of goals not problems, and be open minded about how to achieve them.

	• Group members encouraged to think of 'half way house' to goals, and solutions to help them get there. • Group activity of working through a problem solving cycle together. • Group case study activity.
(6) Memory	• Some facts about memory. • Introduce time points that memory can break down – attention, storing, retrieving, and ways to help at each point. • Series of strategies introduced to help memory (e.g. smart phone, diary, lists, memory box, noticeboards), and advice on each. • Group case study activity.
(7) Fatigue	• Discussion about depression and fatigue. • Some advice for managing depression. • Discussion of different elements of fatigue (hard to start things, hard to sustain things, taken longer to recover). • Solutions introduced for each element (e.g. chunking and pacing). • Group discussion about group members' personal experiences of fatigue. • Group case study activity.

BISEP is theoretically-driven, and has been influenced by research from the field of ER (Gross, 2013; Salas et al., 2019), affective neuroscience (Tracy & Randles, 2011, for a review), Positive Psychology (Andrewes, Walker, & O'Neill, 2014; Gable & Haidt, 2005; Seligman, Steen, Park, & Peterson, 2005), and holistic rehabilitation principles (Ben-Yishay & Diller, 2011; Wilson et al., 2009). The emotional and positive element is threaded throughout all the sessions, and participants completed the 'Three Good Things' Positive Psychology micro-intervention as a homework, every day throughout the programme. Each session began with a sharing of one of the 'Good Things'.

In the 'Emotion Regulation' session, participants were taught how to use the strategies from the Process Model. These strategies were simplified as ones for use 'before' (situation selection), 'during' (situation modification, attentional deployment), and 'after' (cognitive change) an emotional event. ER skills were developed again through case studies, group work, and informal discussions. BISEP is free to access by contacting the first author (LR) for the download link.

5.2.4 Procedure

The study was granted ethical approval by the institution (2017-16048) and the health board (224613). Participants who met criteria were initially referred to the first author (LR) by members of the clinical team. Participants were contacted over the telephone, and arranged a meeting at NWBIS, Bangor University, or participants' homes. Following written informed consent, participants were assessed on several measures, as part of a wider research project. The baseline assessment included the ERQ-CA, HADS, and the reappraisal task in random order. Two weeks following baseline assessment, participants attended the 7-session group intervention (in addition to treatment as usual), in groups of between 6 and 12. The present data set consists of six separate 'waves' of BISEP. Participants in the control group continued with TAU for seven weeks. This was not standardised, with varied psychological input between participants.

After completion of the programme, participants in the intervention group and the primary facilitator (LR), rated their perceptions of the strength of the therapeutic alliance (Working Alliance Inventory-Short), independently at NWBIS. Participants were assisted in completing the form by a member of the clinical team, and were told that their answers would be anonymised. A research intern anonymised and analysed the therapeutic alliance data.

Approximately two weeks after completion of the programme or TAU, participants completed the reappraisal questionnaire, HADS, and the reappraisal task once more, in random order, at post-assessment. The intervention group also completed the Group Attitude Scale. Approximately three months after post-assessment, participants completed the reappraisal questionnaire, HADS, and reappraisal task at follow-up. All efforts were made so that assessment sessions were as similar as possible between groups, and bias reduced by following the assessment protocol.

5.2.5 Data Analyses

Initial efficacy of BISEP. The intervention group's performance on all measures were compared across time points (baseline, post-assessment, and follow-up) relative to the TAU control group. The groups were unequal in size and deviated from normality, therefore, a series of *robust* mixed analysis of variance (ANOVA) analyses were carried out (Field & Wilcox, 2017, for review), with 20% trimmed means, using the 'bwtrim' function (WRS2 package, Mair & Wilcox, 2019) on R software (R Core Team, 2016). This was followed-up with Bonferroni corrected ($\alpha = .006$) confidence intervals, based on 20% trimmed means and 2000 bootstrapped samples, to compare each possible group and time point comparison ('yuentbt' and 'yuend' functions; WRS2). Missing data at follow-up (time point three) ($n = 4$ intervention group, $n = 4$ control group) were replaced with the mean of the group. To calculate effect sizes for the non-normally distributed data, normal approximation tests were used on rank data, and the Z score converted to r (Field, 2013; Pallant, 2007).

Feasibility of BISEP. For feasibility statistics, the required sample for a larger RCT was calculated using G*Power software, with the effect size calculated as above, and retention/attrition rates calculated using percentages.

Therapist and group predictors of improvement. To explore how important the therapeutic alliance and 'group attraction' were for improvement following the intervention (i.e. at post-assessment), a number of robust multiple linear regression analyses were carried out using the 'lmrob' function (Robustbase package; Rousseeuw, Croux, Todorov, Ruckstuhl, et al., 2009), with 2000 bootstrapped samples as model validation (Babyak, 2004; Efron, 2003). Separate regression models were carried out for each measure, with an improvement score as the outcome variable (baseline - post-assessment score). Predictor variables included the patient therapeutic alliance ratings, the facilitator therapeutic alliance

ratings, the 'group attraction' score, and the baseline score as a covariate. Missing data for one person on 'group attraction' was omitted.

5.3 Results

Initial efficacy of BISEP

There are several ways to judge whether the intervention was efficacious. The primary outcomes: 1) reappraisal using a self-report questionnaire; 2) a reappraisal task (the ASRR) with three measures (reappraisal productivity, difficulty, and effectiveness); and the secondary outcomes measuring 3) depression, and 4) anxiety. For descriptive statistics of performance on all tasks and questionnaires, see Table 3.

Table 3. Descriptive statistics of participant performance on questionnaires and tasks across three time points (raw, untrimmed means)

		Baseline M (SD)	Post-assessment M (SD)	Follow-up M (SD)
Measure	**Group**			
ERQ-CA	Intervention	23.78 (7.68)	30.58 (6.70)	28.60 (6.96)
	Control	24.64 (8.37)	23.43 (7.11)	23.29 (4.62)
Reappraisal Productivity	Intervention	15.60 (6.37)	18.53 (5.63)	17.40 (4.16)
	Control	11.71 (3.95)	13.14 (6.02)	13.14 (4.85)
Reappraisal Difficulty	Intervention	9.16 (2.51)	7.97 (2.17)	8.09 (2.39)
	Control	8.63 (4.11)	9.84 (5.32)	9.86 (3.74)
Reappraisal Effectiveness	Intervention	2.43 (2.39)	3.23 (1.82)	3.02 (1.76)
	Control	2.10 (1.65)	1.44 (1.84)	1.85 (1.16)
Depression	Intervention	9.16 (3.75)	7.74 (3.75)	7.22 (4.08)
	Control	7.21 (4.64)	7.57 (4.99)	7.21 (4.32)
Anxiety	Intervention	11.27 (3.44)	8.96 (3.21)	8.67 (3.75)
	Control	8.21 (4.54)	10.07 (4.80)	9.79 (3.14)

Primary outcome measures

1) Self-report Reappraisal (ERQ-CA)

Scores on the ERQ-CA across time points, relative to the TAU control group, were compared. As can be seen in Figure 2, the intervention group showed sustained improvement on the self-report measure of reappraisal.
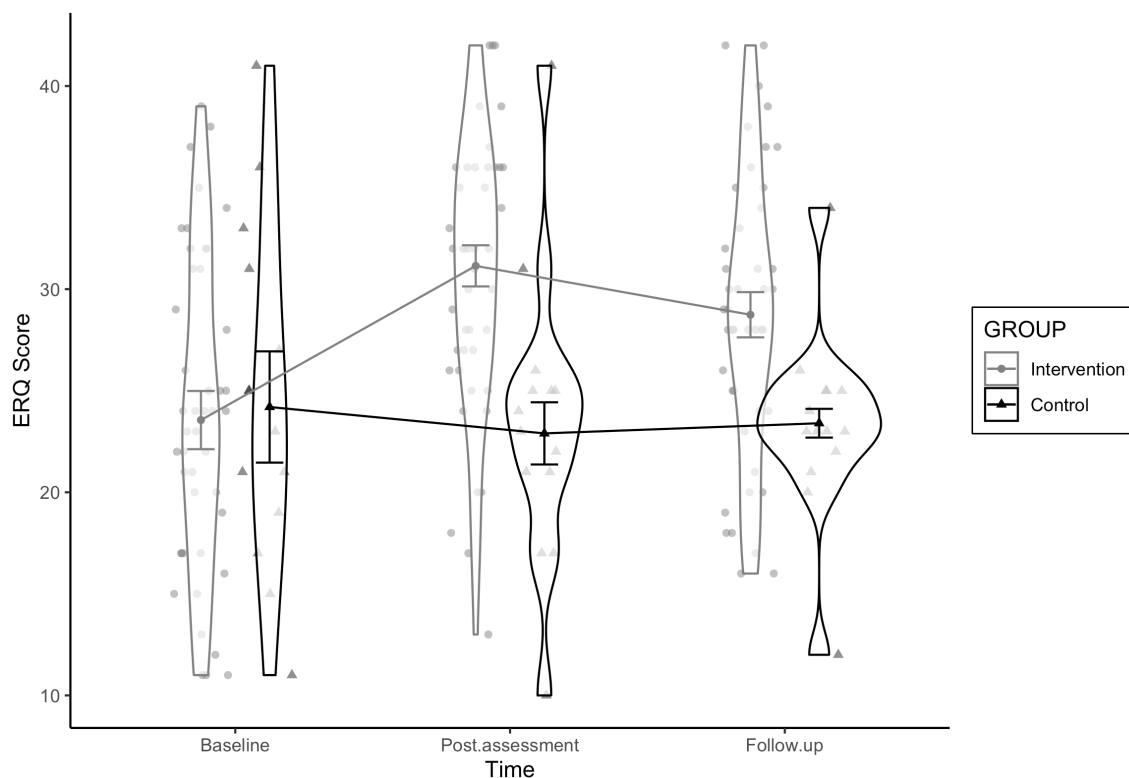
Figure 2. Line Graph demonstrating ERQ-CA scores across each time point, for both the intervention group (grey lines, round jitter) and control group (black lines, triangle jitter), based on 20% trimmed means. Violin plot based on raw data. Error bars represent Standard Error.

The results demonstrated a significant main effect of time ($Q = 6.46$, $p = .004$), and group ($Q = 7.42$, $p = .009$). The interaction effect (group*time) was highly significant ($Q = 13.27$, $p < .001$), and therefore main effects should be interpreted with caution.

The interaction term was followed up by computing comparisons between the intervention group and control group for each time point. Bonferroni corrected ($\alpha = .006$) bootstrapped confidence intervals, based on 20% trimmed means, demonstrated no

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significant differences between groups on the ERQ-CA at *baseline* (M_{diff} = -0.64 [-6.45, 5.16], Y_t = -0.21, p = .822, r = .04). Participants in the intervention group had significantly higher ERQ-CA scores, compared to the control group, at *post-assessment* (M_{diff} = 8.25 [5.08, 11.42], Y_t = 4.49, p < .001, r = .44), and at the three-month *follow-up* (M_{diff} = 5.34 [2.91, 7.77], Y_t = 4.05, p < .001, r = .36). This measure clearly suggests that the intervention successfully improved reappraisal performance, and sustained at follow-up with moderate effect sizes.

2.1) Reappraisal Productivity (Reappraisal Task)

The intervention group showed sustained improvement on reappraisal productivity as measured by the task, meaning that they generated *more* reappraisals (see Figure 3).
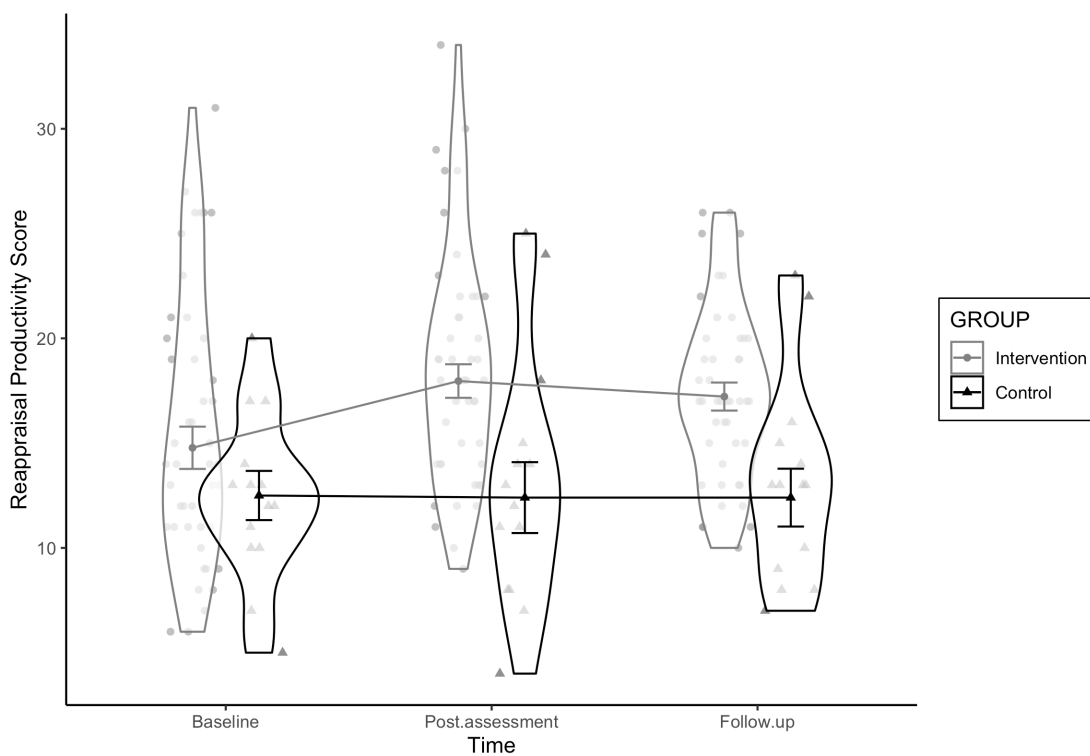
Figure 3. Line Graph demonstrating mean reappraisal productivity across each time point, for both the intervention group (grey lines, round jitter) and control group (black lines, triangle jitter), based on 20% trimmed means. Violin plot based on raw data. Error bars represent Standard Error.

The results demonstrated a significant main effect of group (Q = 13.71, p = .001), and no main effect of time (Q = 2.13, p = .132), or an interaction (Q = 2.42, p = .101). To explore

these results further confidence intervals were computed to compare reappraisal productivity scores, between groups, at each time point. There were no significant differences in the total number of reappraisals produced at *baseline* (M_{diff} = 2.23 [-0.73, 5.28], Y_t = 1.47, p = .131, r = .26). The intervention group, however, produced significantly more reappraisals on the task, compared to the control group, at *post-assessment* (M_{diff} = 5.56 [2.16, 9.01], Y_t = 2.97, p = .003, r = .38), and at three-month follow-up (M_{diff} = 3.14 [2.01, 7.64], Y_t = 3.14, p = .002, r = .35). This suggests sustained improvement on this measure, again with moderate effect sizes, following BISEP.

2.2) Reappraisal Difficulty (Reappraisal Task)

As can be seen in Figure 4, the intervention showed gradual improvement in the time taken to generate a reappraisal (reappraisal difficulty) on the task.
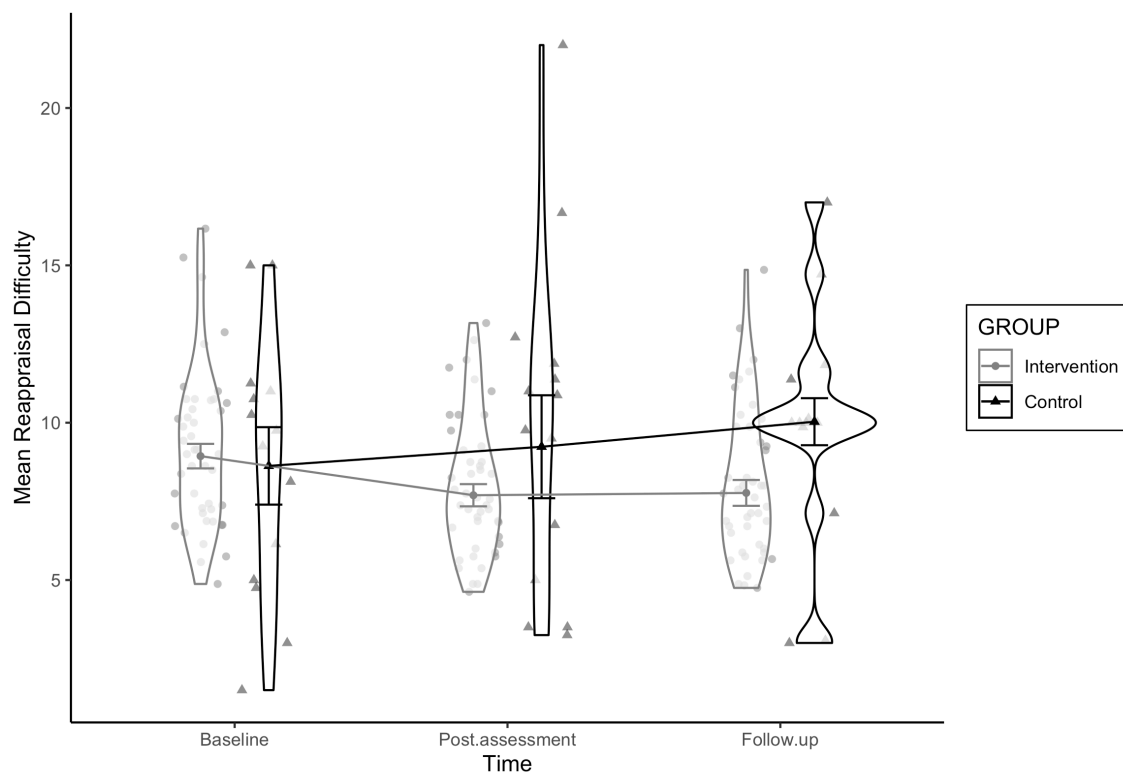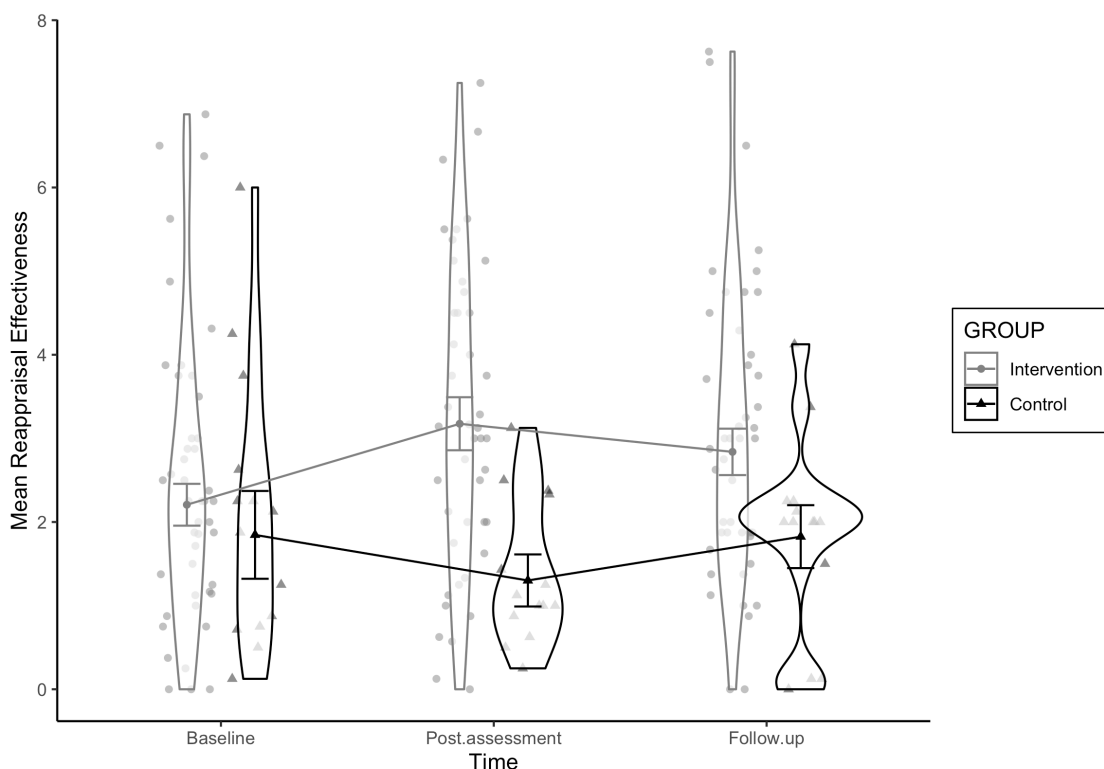

Figure 4. Line Graph demonstrating mean reappraisal difficulty across each time point, for both the intervention group (grey lines, round jitter) and control group (black lines, triangle jitter), based on 20% trimmed means. Violin plot based on raw data. Error bars represent Standard Error.

The results demonstrated no main effect of group ($Q = 1.50$, $p = .229$), or time ($Q = 0.32$, $p = .730$). A significant interaction was present ($Q = 3.93$, $p = .029$). Further comparisons demonstrated no significant difference in time taken to produce a reappraisal at *baseline* ($M_{diff} = 0.31$ [-2.34, 2.97], $Y_t = 0.24$, $p = .786$, $r = .02$), or at *post-assessment* ($M_{diff} = -1.54$ [-5.14, 2.06], $Y_t = -0.92$, $p = .321$, $r = .16$). The intervention group was significantly quicker, compared to the control group, at generating a first reappraisal at the three-month *follow-up* ($M_{diff} = -2.65$ [-3.75, -0.77], $Y_t = -2.65$, $p = .005$, $r = .27$). This finding suggests that the intervention successfully improved this measure at follow-up with a small effect size, and that this is a skill which requires time to develop.

2.3) Reappraisal Effectiveness (Reappraisal Task)

As can be seen in Figure 5, the intervention group showed higher reappraisal effectiveness scores at post-assessment, which is somewhat maintained at follow-up.

Figure 5. Line Graph demonstrating mean reappraisal effectiveness across each time point, for both the intervention group (grey lines, round jitter) and control group (black lines, triangle jitter), based on 20% trimmed means. Violin plot based on raw data. Error bars represent Standard Error.

The results demonstrated a significant main effect of group ($Q = 8.10$, $p = .006$), and a significant interaction ($Q = 6.10$, $p = .005$). There was no main effect of time ($Q = 0.98$, $p = .385$). Between-group comparisons indicated no significant difference between groups at *baseline* ($M_{diff} = 0.36$ [-0.73, 1.45], $Y_t = 0.62$, $p = .485$, $r = .10$). The intervention group reported significantly more effective reappraisals, compared to the control group, at *post-assessment* ($M_{diff} = 1.87$ [0.96, 2.78], $Y_t = 4.22$, $p < .001$, $r = .45$). This was somewhat maintained at *follow-up*, with a non-significant trend ($M_{diff} = 1.01$ [0.08, 1.94], $Y_t = 2.17$, $p = .038$, $r = .23$). The results suggest that the intervention successfully improved reappraisal effectiveness, especially immediately following intervention.

Secondary outcome measures

3) Depression Scores (HADS)

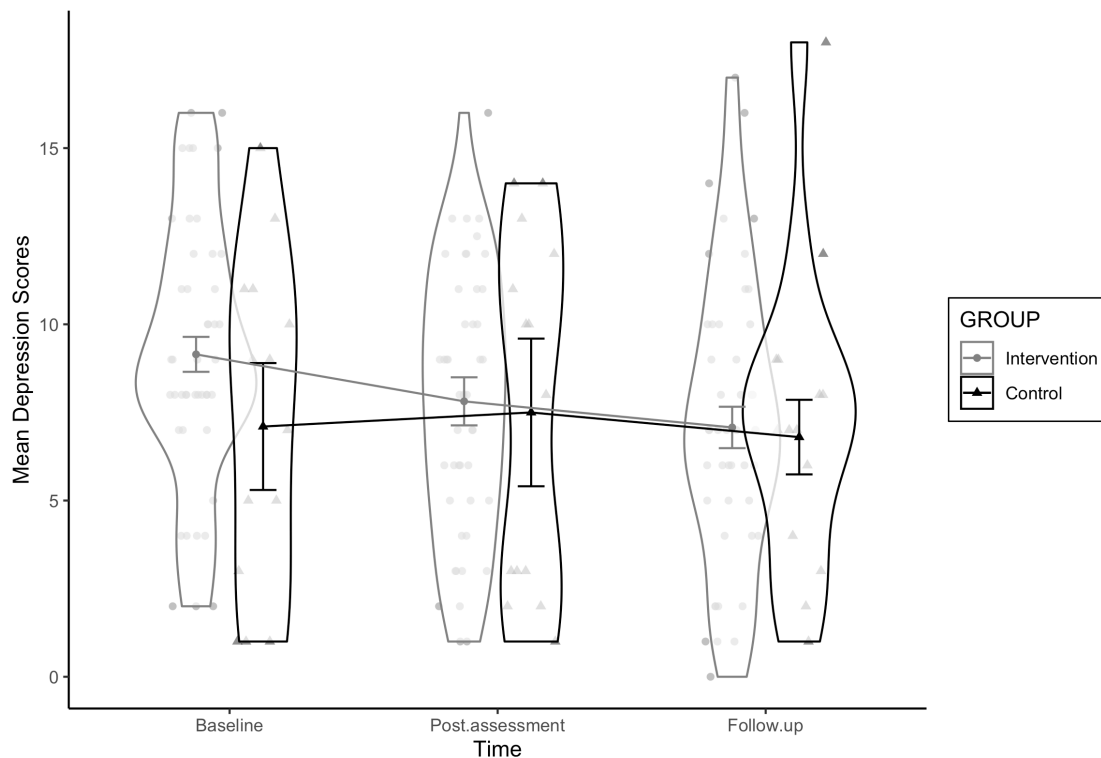The intervention group showed gradual and modest reduction of depression over time (see Figure 6).

Figure 6. Line Graph demonstrating mean depression scores across each time point, for both the intervention group (grey lines, round jitter) and control group (black lines, triangle jitter), based on 20% trimmed means. Violin plot based on raw data. Error bars represent Standard Error.

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The results demonstrated a significant main effect of time ($Q = 3.93$, $p = .028$), and a significant interaction ($Q = 3.95$, $p = .027$). There was no main effect of group ($Q = 0.36$, $p = .552$). Between-group comparisons demonstrated no significant differences in depression at *baseline* ($M_{diff} = 2.05$ [-1.70, 5.79], $Y_t = 1.10$, $p = .236$, $r = .16$), *post-assessment* ($M_{diff} = 0.14$ [-4.10, 4.73], $Y_t = 0.31$, $p = .866$, $r = .01$), or at three-month *follow-up* ($M_{diff} = 0.23$ [-2.10, 2.65], $Y_t = 0.23$, $p = .817$, $r = .01$).

To understand these main effects further, *within-group* comparisons were computed for both groups separately. The intervention group showed significant improvement on depression scores from *baseline* to *follow-up* ($M_{diff} = 2.07$ [1.00, 3.14], $Y_t(26) = 3.98$, $p < .001$, $r = .50$), and a non-significant trend between *baseline* and *post-assessment* ($M_{diff} = 1.33$ [0.19, 2.48], $Y_t(26) = 2.40$, $p = .023$, $r = .48$). No differences were found between *post-assessment* and *follow-up* ($M_{diff} = 0.74$ [-0.25, 1.74], $Y_t(26) = 1.53$, $p = .138$, $r = .21$). The control group showed no significant differences between any time points (all p > .05). This finding suggests that the intervention may have improved depression gradually over time with a large effect size, but not relative to the control group.

4) Anxiety Scores (HADS)

As can be seen in Figure 7, the intervention group showed a reduction in anxiety, which appeared to be maintained at follow-up. The control group showed increase in severity of anxiety.

The results demonstrated a highly significant interaction ($Q = 18.91$, $p < .001$), and no main effect of time ($Q = 0.01$, $p = .992$), or group ($Q = 0.13$, $p = .720$). To explore the interaction further, separate between-group comparisons were carried out for each time point. Unfortunately, the intervention group had higher anxiety scores compared to the control group at *baseline* (non-significant trend) ($M_{diff} = 2.33$ [0.65, 6.23], $Y_t = 2.33$, $p = .026$, $r =$

.32). There were no significant differences in anxiety scores between both groups at *post-assessment* (M_{diff} = -1.24 [-4.43, 1.95], Y_t = -0.79, *p* = .384, *r* = .12), or at *follow-up* (M_{diff} = -1.31 [-2.77, 0.52], Y_t = -1.31, *p* = .178, *r* = .14).
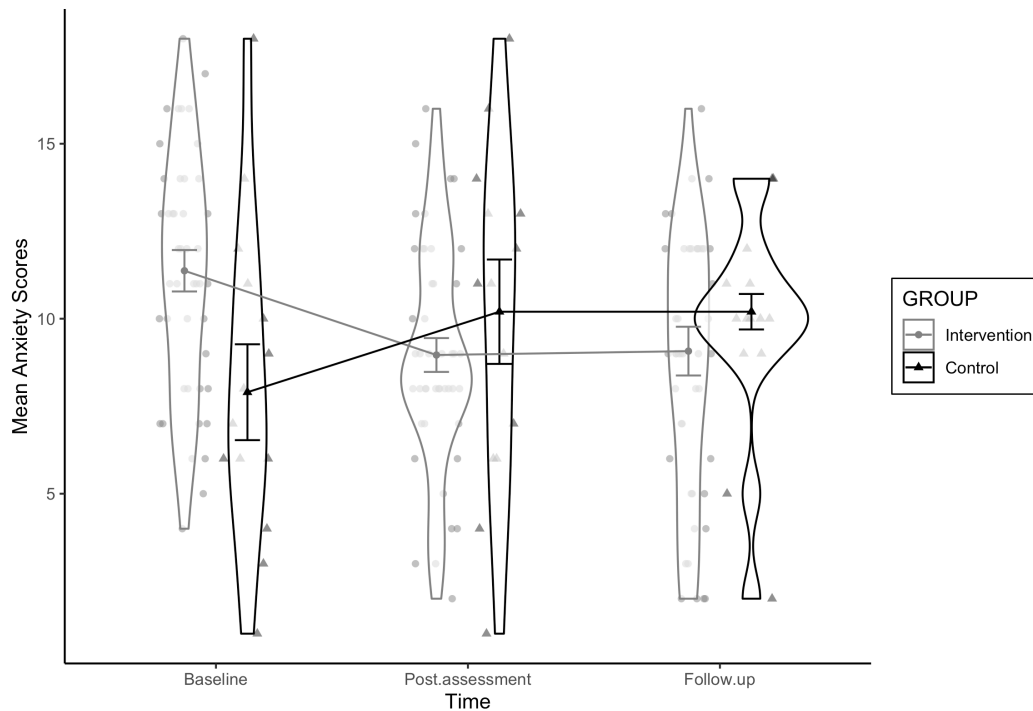
Figure 7. Line Graph demonstrating mean anxiety scores across each time point, for both the intervention group (grey lines, round jitter) and control group (black lines, triangle jitter), based on 20% trimmed means. Violin plot based on raw data. Error bars represent Standard Error.

Due to the between-groups difference in anxiety scores pre-intervention, it was difficult to interpret any change in anxiety for the intervention group, and a series of within-group comparisons were computed. The intervention group showed highly significant improvement on anxiety scores from *baseline* to *post-assessment* (M_{diff} = 2.41 [1.41, 3.41], $Y_t(26)$ = 4.95, *p* < .001, *r* = .66), and from *baseline* to *follow-up* (M_{diff} = 2.30 [1.13, 3.46], $Y_t(26)$ = 4.04, *p* < .001, *r* = .65). No differences were observed form *post-assessment* to *follow-up* (M_{diff} = -0.11 [-1.30, 1.08], $Y_t(26)$ = -0.19, *p* = .850, *r* = .10). For the control group, anxiety scores were *worse* at *post-assessment* compared to *baseline* (M_{diff} = -3.14 [-3.96, -0.64], $Y_t(9)$ = -3.14, *p* = .012, *r* = .68), and at *follow-up*, showing non-significant trends (M_{diff}

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= -2.55 [-4.34, -0.26], $Y_t(9) = -2.55$, $p = .031$, $r = .46$), with no differences between *post-assessment* and *follow-up* ($M_{diff} = 0.00$ [-2.40, 2.40], $Y_t(9) = 0.00$, $p = >.999$, $r = .12$). This suggests that the intervention may be effective at improving anxiety scores, and maintaining improvements at follow-up with large effect sizes, but not relative to the control group.

Feasibility of BISEP

The intervention sessions were consistent with the treatment protocol, as all sessions were carried out by the same principal facilitator (LR), who also developed the intervention, and followed a scripted facilitation guide (which had room for flexibility). There were low attrition rates in the BISEP intervention group (four withdrew, 8%), with 92% retention from baseline to the post-assessment, and 84% retention from baseline to the follow-up assessment. The majority of participants attended 100% of the sessions, and eight participants attended over 75% of the sessions. This highlights the feasibility of carrying out this group intervention within services. However, attrition was higher for the TAU control group, where four were lost at the follow-up assessment (retention from baseline to post-assessment:100%; retention from baseline to follow-up: 71%). Every session finished within its allocated two hours, with a 15 minute variation in time. Unfortunately, no formal measure of homework completion was taken, which would need to be considered in a future trial.

In terms of a future randomised control trial, such an evaluation would need to include multiple study sites as a cluster-randomised trial. This is because the present 'phase one' trial was initially planned with group randomisation. However, due to the nature of the 'slow stream' small community setting, it was not possible to recruit adequate numbers of participants to randomise at one time, hence why the present sample was recruited in waves, and the groups were unequal.

Effect sizes at the three month follow-up were chosen for a sample size calculation, due to their indication of a more sustained benefit compared to the immediate post-

intervention assessment. Based on the effect sizes of between-group comparisons, the primary outcome measure of interest in a future RCT would be the self-report use of reappraisal in daily life on the ERQ-CA ($r = .36$). G*Power analyses indicated a required total sample of 56 across the three time points (alpha = .05, power = .80), assuming 71% retention, a total of 79 participants would be required. It would, however, be valuable for a future RCT to have an active control arm, which may have non-specific benefits. Therefore, a smaller increase in ERQ-CA scores would be expected, and a larger sample would be required. If a small effect size is assumed ($r = .25$) and 71% retention, then a total of 175 participants would be required.

Therapeutic and group predictors of improvement

There were only three models which contained significant predictor variables that were not covariates. See Table 4 for details of all regression models, only notable findings are discussed here. As expected, the covariate for each model (i.e. baseline scores) was a significant and strong predictor of improvement, therefore only *individual* predictors of interest are discussed here.

Reappraisal Effectiveness. Of the predictor variables of interest, only 'group attraction' significantly predicted improvement in reappraisal effectiveness ($\beta = 0.04$, $p = .014$), suggesting that a unit increase in 'group attraction' would result in a 0.04 increase in the magnitude of reappraisal effectiveness improvement.

Table 4. Table of all regression models, for improvement on each measure as separate outcome variables.

Model	R²	F	p (sig.)	β coefficients (bootstrapped)	p (sig.)	95% CIs
ERQ-CA	.45	35.80	<.001***			
Patient TA rating				0.20	.074	-0.07 – 0.49
Facilitator TA rating				-0.19	.200	-0.51 – 0.22
Group attraction				0.07	.181	-0.08 – 0.20
Baseline ERQ-CA (covariate)				-0.63	.001**	-0.96 – -0.29
Anxiety (HADS)	.29	15.83	.003**			
Patient TA rating				-1.12	.511	-0.15 – 0.15
Facilitator TA rating				-7.98	.485	-0.31 – 0.26
Group attraction				3.72	.112	-0.03 – 0.09
Baseline Anxiety (covariate)				3.40	.002**	0.15 – 0.63
Depression (HADS)	.28	12.52	.014*			
Patient TA rating				-0.15	.009**	-0.30 – -0.03
Facilitator TA rating				0.07	.217	-0.14 – 0.24
Group attraction				0.07	.042*	-0.01 – 0.14
Baseline Depression (covariate)				0.33	.003**	0.09 – 0.60
Reappraisal Productivity	.32	21.25	<.001***			
Patient TA rating				0.02	.452	-0.24 – 0.24
Facilitator TA rating				0.02	.452	-0.50 – 0.52
Group attraction				-0.01	.460	-0.19 – 0.19
Baseline Productivity (covariate)				-0.48	.025*	-0.95 – -0.00
Reappraisal Difficulty	.44	45.08	<.001***			
Patient TA rating				0.03	.257	-0.06 – 0.12
Facilitator TA rating				-0.09	.033*	-0.19 – 0.01
Group attraction				-0.00	.500	-0.38 – 0.95
Baseline Difficulty (covariate)				0.56	<.001***	0.35 – 0.83
Reappraisal Effectiveness	.44	17.35	.002**			
Patient TA rating				-0.00	.421	-0.81 – 0.05
Facilitator TA rating				0.02	.280	-0.05 – 0.10
Group attraction				0.04	.014*	0.01 0.09
Baseline Effectiveness (covariate)				-0.49	.009**	-0.81 – -0.11

*<.05, **<.01, ***<.001; Patient therapeutic alliance $M = 72.80$, $SD = 9.83$ (range 51 – 84), facilitator therapeutic alliance ratings $M = 69.49$, $SD = 7.77$ (range 46 – 82), Group attraction ratings $M = 156.05$, $SD = 16.27$ (range 120 – 180)

Depression Scores (HADS). Of the predictor variables of interest, the patient perceptions of the therapeutic alliance were a significant negative predictor of improvement in depression scores (β = -0.15, *p* = .009), and, unexpectedly, suggests that a unit increase in patient therapeutic alliance ratings would result in a 0.15 reduction in magnitude of improvement. In contrast, 'group attraction' was a significant positive predictor within the model (β = 0.07, *p* = .042), suggesting that a unit increase in 'group attraction' scores would result in a 0.07 increase in the magnitude of improvement in depression scores.

Reappraisal Difficulty. Of the predictor variables of interest, the facilitator perceptions of the therapeutic alliance were, again, unexpectantly a significant *negative* predictor (β = -0.09, *p* = .033). A unit increase in facilitator ratings of the alliance would result in a 0.09 reduction in the magnitude of improvement for reappraisal difficulty.

Summary of Results

As regards *reappraisal,* the intervention group showed improvements on all primary outcome measures: significant improvement at post-assessment on self-report (ERQ-CA), and able to generate *more* reappraisals, more *effective* reappraisals, and were *faster* at generating reappraisals at follow-up. The picture is less clear for emotional distress (depression and anxiety). *Within-group* comparisons suggest a gradual improvement in depression, and sustained improvement in anxiety, with large effect sizes, but need to be interpreted with caution. As regards feasibility, a full-scale RCT is warranted, however would require a larger sample and multiple study sites.

As regards the predictors of improvement, it is notable that patient and facilitator perceptions of the alliance were not associated with improvement for any measure, or even negatively associated. In contrast, 'group attraction' was significantly predictive of improvement in depression and reappraisal effectiveness.

5.4 Discussion

This 'phase one' study aimed to evaluate initial efficacy of BISEP, and feasibility for a future RCT. This was also the first study to investigate the importance of individual therapeutic alliance, and 'group attraction', as predictors of improvement following a group education intervention after ABI.

Does the intervention improve reappraisal?

Following BISEP, participants improved on all primary outcome measures of reappraisal, with some variations among the time points. The observed improvement on self-report, and experimental measures, suggest that BISEP encouraged *adaptive* use of reappraisal in daily life, and improved the *skill* of reappraisal. This is consistent with the widely-acknowledged idea that skills developed in neuropsychological rehabilitation must be transferable, and apply to a person's real life (Wilson, 2013).

There have been many attempts at measuring the effectiveness of *overall* post-acute multi-component programmes, such as holistic rehabilitation (Cicerone et al., 2011). However, such an approach makes it difficult to evaluate the specific and individual interventions that are delivered *within* such programmes. Additionally, such studies have not directly measured ER as an outcome (c.f. emotion symptomatology and quality of life, Svendsen & Teasdale, 2006). There have also been attempts at measuring *specific* ER group interventions, although this remains a modest body of literature (Salas et al., 2019 for a review). Previous work have shown mixed results, but overall suggest that ER training provided in a group modality can be effective (Tornås et al., 2016; Tsaousides et al., 2017). The present findings provide further support that group interventions are promising vehicles to improve adaptive ER skills, which are also transferable to daily life.

The improvement in reappraisal is likely due to key elements of BISEP. Firstly, group members were trained how to reappraise, and this was reinforced through case studies,

activities, and group discussions. Secondly, 'Three Good Things' was included in BISEP as a daily homework, so that a focus on positive things was consistently reinforced. It is possible that this increases one's cognitive repertoire for reappraisal ('Broaden and Build' theory; Fredrickson, 2001). Finally, promoting positivity was an underlying philosophy, and was threaded throughout the programme. Qualitative data (Chapter 4), is an alternative source which directly emphasises these 'key ingredients'. It is, however, important to acknowledge that the results may have also been influenced by methodological issues (e.g. selection bias, non-randomisation, no blind assessments, floor effects in the control group), and a future trial would need to address these concerns.

Does the intervention improve depression and anxiety?

The present study provides some preliminary evidence that BISEP may improve core emotional distress, but do need to be interpreted with caution. *Independently* of the control group, patients reported *sustained* reduction in anxiety, and *gradual* reduction in depression, consistent with previous emotion-focused group interventions (Bradbury, Christensen, Lau, Ruttan, et al., 2008; Stalder-Lüthy, Messerli-Bürgy, Hofer, Frischknecht, et al., 2016; Waldron, Casserly, & O'Sullivan, 2013). A number of elements of BISEP may have contributed to the gradual improvement in depression symptomatology. In addition to the previously mentioned factors, it is possible that the social aspect may have also had a positive influence on depression. Qualitative research points especially to the value of interacting and relating to other survivors in formal rehabilitation settings (Couchman et al., 2014; Patterson et al., 2016; Salas, Cassassus, Rowlands, Pimm, & Flanagan, 2018). Socialising with other survivors may bring reassurance and can prevent social isolation (Salas et al., 2018). This element of BISEP, and other group interventions, may also facilitate improvement in mood (see more below).

As regards anxiety, *within-group* improvement is likely related to the adaptability of the ER strategies to manage environmental triggers of anxiety. There is some evidence, in neurologically healthy participants, that these situational strategies may be especially helpful for those with high levels of anxiety, and those who struggle to manage their emotions (Webb, Lindquist, Jones, Avishai, & Sheeran, 2018). Qualitative evidence of BISEP (Chapter 4) also emphasised the role of situational strategies to manage anxiety in real life. The present study's findings suggest that focusing on situational strategies within interventions may be beneficial in managing emotional difficulties in patients with ABI.

Feasibility

Important information regarding recruitment and study design was captured through the present study. For instance, despite initial plans to have participants randomised to groups, this was not possible in the present setting alone. Future work would require multiple sites, and a team of investigators for blinded assessment to minimise potential bias. Despite some difficulty with recruitment, it is concluded that a full-scale RCT of BISEP is justified and feasible, with some modifications to the secondary outcome measures (as described below in 'limitations and future direction'), but an identical treatment package. The primary outcome measure for future research would be the ERQ-CA, and a larger sample would be required.

Are improvements driven by individual or group processes?

The most important finding, related to the third aim, was that positive feelings towards their peers, and feelings of unity and acceptance among the group (i.e. 'group attraction' ratings), were predictive of greater improvement in depression and better reappraisal effectiveness. These findings are consistent with a large body of qualitative research in group programmes for ABI, which emphasise the important role and value of group processes, such as cohesion and interaction, for patients' experience of interventions

(Couchman et al., 2014; Patterson et al., 2016). The literature highlights that the *social* factor is often the most powerfully reported element of group programmes (Couchman et al., 2014).

This finding is also consistent with the psychiatric literature on group psychotherapy, where *group* processes have been identified as important positive predictors of outcome (Burlingame et al., 2018; Crowe & Grenyer, 2008). This effect has not been well-investigated in ABI. However, it has been suggested that support groups can facilitate change to a similar level to a *targeted* group intervention (Backhaus, Ibarra, Parrott, & Males, 2016). The present findings emphasise that group processes are important for intervention *outcome*.

Notably, *individual* perceptions of the strength of the alliance were not positively predictive of improvement. Unexpectedly, in some cases the strength of the alliance was a *negative* predictor of improvement (depression and reappraisal difficulty). This is in contrast to well-established evidence in individual psychotherapy (Martin et al., 2000, for meta-analysis). The literature is less conclusive in neuropsychological rehabilitation; however, the alliance may well be a factor which influences individual rehabilitation outcomes (Stagg, Douglas, Iacono, 2019). It may be that the alliance has important effects on other aspects of the programme, such as promoting group cohesion and engagement (Bishop, Kayes, & McPherson, 2019; Bright, Kayes, Worrall, & McPherson, 2015, for a review).

Why might individual perceptions of the alliance be a negative predictor? As regards depression, two possible explanations are suggested. Firstly, this finding could be related to outliers in the data. There were four participants who reported the alliance to be the highest possible (84/84), who also reported higher depression scores post-intervention, and this may have skewed the data. A second explanation is that a stronger therapeutic alliance may have improved self-awareness, which in turn may have increased depression (Lucas & Fleming, 2005 for a review). As regards the negative relationship between alliance and reappraisal difficulty, this may be reflective of greater *caution* when generating new interpretations

(McRae, Jacobs, Ray, John, & Gross, 2012). Facilitators of programmes may benefit from using the individual therapeutic alliance to promote group cohesion, as such processes might influence outcome.

Limitations and Future Direction

Randomised-control trials are difficult to conduct in neurorehabilitation, highlighting the importance of preliminary testing to investigate initial efficacy. This 'phase one' study has some limitations, most notably, that the person facilitating the intervention also carried out the assessments, potentially leading to bias. In addition, the TAU control group did not take part in a parallel, active, programme, and groups were not randomised. All efforts were made to reduce the magnitude of potential favourable bias to the intervention group. Nonetheless, these findings lay important foundations for a future multi-centre randomised trial, with an active control group, subject to financial support. Future investigation may also benefit from measuring all aspects of the ER strategies offered by the intervention (not only reappraisal), could include several measures of behavioural manifestations of emotion dysregulation, well-being, quality of life, and additional family/care-giver perspectives.

Clinical Implications

The present study has several implications for neuropsychological rehabilitation.

1) *Groups are good*. The findings especially highlight the relevance of group interventions in rehabilitation, and suggest that such programmes may be effective vehicles for improving emotional distress and ER. Interventions delivered in a group modality are also time and cost effective, as groups of between six and 12 patients receive the seven sessions at the same time. The findings especially support BISEP, as an efficacious, easy to implement, and free to access programme.

2) *Expanding the Evidence.* There are many tools and interventions that have been developed in neuropsychological rehabilitation. These are, however, difficult to evaluate.

There is a need to further develop neuropsychological rehabilitation science, and conduct initial evaluations as a foundation to build larger-scale evidence-based interventions. Professionals should work together across centres to better evaluate a smaller number of interventions, which have an initial evidence-base following published pilot testing and 'phase one' evaluations.

3) *Focus on Feelings.* The findings support the focus on the emotional aspects of post-injury impairment. Traditionally, cognitive consequences have taken precedence in neurorehabilitation programmes. However, with a large literature reporting a high incidence of emotional difficulties after ABI (Kreutzer et al., 2001), there is now a greater focus on socio-emotional adjustment (Wilson, 2008). The findings contribute to this line of research.

4) *Building a Community.* The present study provides evidence that group processes, such as 'group attraction', positive feelings towards the group, and feeling accepted by the group, can contribute to positive outcomes. A core part of the facilitator's role within group programmes may be to promote 'group attraction', and ensure that patients engage with enriching activities which generate cohesion.

Conclusion

BISEP was developed to address common difficulties after ABI, with a strong emphasis on ER. In addition, it was developed specifically to fit within community rehabilitation services, and to be easily implementable. The present study provides promising evidence that BISEP may be an efficacious vehicle to promote adaptive reappraisal and ER skills, and may have benefits in terms of improving low mood and anxiety. Based on these findings, a full-scale RCT is justified and feasible for a larger team and a multi-centre approach. The findings highlight that an active 'ingredient' for improvement may be 'group attraction'. Clinicians may, therefore, benefit from actively promoting social connection and dynamics within group programmes, as these may influence outcome. Programmes such as

BISEP represent a promising future direction, especially for services that seek interventions that are appropriate for patients' emotional lives, implementable at scale, and with sound empirical foundations to build future investigations.

6. Chapter Six

"I had weaknesses in the group. I got tired after about an hour and a half in, I became very tired and withdrawn a little bit. It got better as the weeks went on. I rested in the morning".

- *Iolo (Participant from BISEP)*

6.1 Building the Bond: Predictors of the Alliance in Neurorehabilitation. [1]

6.1.1 Abstract

Neurorehabilitation services are often delivered through group psycho-education programmes. However, little is known about the therapeutic process at work during such sessions. The present study is the first to gain insight into the *therapeutic alliance* and 'group attraction', during a seven session group programme. Specifically, cognitive, emotional, and demographic predictors of the alliance and 'group attraction' were investigated, together with predictors of patient engagement. Forty-five participants with an acquired brain injury completed a series of questionnaires, and neuropsychological assessment, following group psycho-education. The group facilitator completed a parallel therapeutic alliance questionnaire, and rated participants' engagement. Results demonstrated that a strong alliance can be formed in seven group sessions. Notably, no demographic or cognitive factors appeared to pose a barrier to developing a therapeutic alliance, nor to group attraction. High levels of depression, however, may be a challenge, and clinicians may need to tailor their clinical skills to ensure a good therapeutic relationship with such patients. To promote engagement, clinicians may also need to provide additional support to patients with lower levels of education, working memory, and episodic memory impairment.

6.1.2 Introduction

Acquired brain injury (ABI) is a leading cause of disability worldwide (WHO, 2000-2012), with survivors experiencing a range of complex cognitive and psycho-social changes that can last a lifetime (Draper, Ponsford & Schönberger, 2007; Ponsford, Draper, & Schönberger, 2008). Post-injury impairments often represent a dramatic change in functioning (Colantonio, Ratcliff, Chase, Kelsey, et al., 2004; Ponsford et al., 2008), highlighting the importance of neurorehabilitation services in adjustment to the long-term consequences (Coetzer, 2008). Indeed, the chronic nature of impairment is acknowledged by the National Service for Long Term Conditions (Coetzer, Roberts, Turnbull, & Vaughan, 2018; Department of Health, 2005). Successful rehabilitation inevitably depends on the multi-disciplinary professionals within services, with whom survivors interact (Bright, Kayes, Worrall, & McPherson, 2015; Stagg, Douglas, & Iacono, 2019). The collaborative nature of the client-therapist relationship, more commonly described as the *therapeutic* or *working alliance*, appears to act as a vehicle to promote positive rehabilitation outcomes (Stagg et al., 2019). Within the literature on ABI, it is poorly understood how specific features of the population might pose unique challenges to developing a strong alliance (Stagg et al., 2019).

The therapeutic alliance (TA) is a term describing the *relational* processes which unfold during clinical interactions, and its roots are well-established in the psychotherapy literature (Horvath & Luborsky, 1993; Horvath & Symonds, 1991). Bordin (1979) provides the most influential theoretical framework to follow, consisting of three underlying dimensions, which are important for the TA. These are: 1) the client and therapist agreement on the *tasks* to be completed as part of therapy; 2) agreement on the *goals* and expected outcomes; and 3) the interpersonal and emotional *bond* between client and therapist (Bordin, 1979). Within psychotherapy, the TA has been shown to be a reliable and moderate predictor

of outcome (Hovarth & Symonds, 1991; Martin, Garske, & Davis, 2000, for meta-analyses). However, the current literature in the field of *neurorehabilitation* provides only limited insight into this issue.

The therapeutic alliance in brain injury rehabilitation

More recently, the TA has been identified as having an enhancing effect on outcomes across rehabilitation and medical contexts (Hall, Ferreira, Maher, Latimer, & Ferreira, 2010, for a review). For example, improving symptoms in multiple sclerosis (Rosti-Otajärvi, Mäntynen, Koivisto, Huhtala, & Hämäläinen, 2014), a range of outcomes in the physical rehabilitation of cardiac and musculoskeletal conditions (Hall et al., 2010), and in the treatment of chronic pain (Ferreira, Ferreira, Maher, Refshauge, Latimer, & Adams, 2013). In stroke rehabilitation, some patients perceive the quality of the client-therapist partnership to be of primary importance, above that of the therapy's content or duration (Peris, Taylor, & Shields, 2012). Despite only limited research into the role of the TA in ABI rehabilitation, the emerging idea is that it shapes outcomes, and is influenced by several factors present in the rehabilitation environment (Stagg et al., 2019, for a review).

The majority of empirical investigations of the role of the TA in rehabilitation *outcomes* have focused on vocational issues (work, work prospects, school), and have demonstrated positive associations (Evans, Sherer, Nakase-Richardson, Mani, & Irby, 2008; Klonoff, Lamb, & Henderson, 2001; Lustig, Strauser, Weems, Donnell, & Smith, 2003; Schönberger, Humle, Zeeman, & Teasdale, 2006a; Stagg et al., 2019, for a review). Important *clinical* outcomes include improved independence and social interactions, and reduced communication difficulties and somatic problems (on the European Brain Injury Questionnaire) (Schönberger, Humle, & Teasdale, 2006b).

Finally, it has been demonstrated that the TA promotes patient *compliance* with a holistic rehabilitation programme, through its impact on self-awareness (Schönberger,

Humle, & Teasdale, 2006c). That is, the TA enhances patient awareness, and those who are aware of their difficulties comply and engage in rehabilitation (Schönberger et al., 2006c). Patient engagement with the rehabilitation process is thought to play an important role in its success and adherence (Bright, Kayes, Worrall, & McPherson, 2015, for a review; Lenze, Munin, Quear, Dew, et al., 2004). The patient-therapist relationship is a potential mechanism to *enhance* engagement, with the majority of evidence from qualitative accounts (Bishop, Kayes, & McPherson, 2019; Bright, Kayes, Cummins, Worrall, & McPherson, 2017; Lawton, Haddock, Conroy, & Sage, 2016). The *direct* role of the TA on engagement, however, remains unclear.

Predictors of the therapeutic alliance

If the TA is considered a crucial component of rehabilitation by patients and professionals (Lawton et al., 2016), careful attention needs to be paid to the factors which might impede (or facilitate) the development of this process. This is especially relevant in the context of ABI, where the nature of impairment may place unique demands on the TA. For example, a number of interesting interpersonal factors have been identified through qualitative work, including a genuine bond within the therapeutic rapport, and professional collaboration (Bishop, Kayes, & McPherson, 2019; Lawton et al., 2016). Additional insights from qualitative research identify a range of *cognitive* consequences as the most frequently reported challenges in developing an alliance, followed by *emotional* factors, and *behavioural* disinhibition (Judd & Wilson, 2005).

Quantitative research provides modest insight into the factors which promote positive perceptions of the TA, for both patients and professionals (Stagg et al., 2019). For example, studies have demonstrated that younger patient age (Schönberger et al., 2006c) and greater years in education (Sherer, Evans, Leverenz, Stouter, Irby, et al., 2007) positively influenced the strength of the alliance. In terms of injury-specific factors, the influence of *cognitive*

difficulties has been reported to be weak in nature, and differentially associated to therapist and client perceptions (Schönberger, Humle, & Teasdale, 2007). For instance, poor attentional impairment may influence the strength of the alliance *negatively*, whereas poorer performance on a memory task may have a *positive* influence, albeit *weakly* (Schönberger et al., 2007). The authors reported that, out of the several higher cognitive functions explored, *verbal fluency* and IQ (Information sub-test of the Wechsler Adult Intelligence Scale) was found to be positively related to aspects of the TA. It is noteworthy, however, that the findings of these correlational analyses were not subject to an alpha adjustment, and should be interpreted with caution.

Most of the work investigating the TA in neurorehabilitation has focused on holistic (and intense) programmes, and are correlational in nature (Stagg et al., 2019). However, in a recent study, Zelencich and colleagues (2019) aimed to address these gaps by using regression analyses to explore the predictors of the TA in the context of cognitive behaviour therapy (CBT) for people with brain injury. In contrast to previous work (Schönberger et al., 2006c Sherer, Evans, Leverenz, Stouter, et al., 2007), no demographic factors were found to have an influence, however greater *time* since injury was predictive of a stronger TA. Interestingly, no measure of memory or executive function was predictive of the strength of the therapeutic relationship (Zelencich, Kazantzis, Wong, McKenzie, et al., 2019). This robust empirical finding is suggestive that an ABI, and related cognitive impairment, does *not* necessarily pose a barrier to developing an effective TA, at least in the context of CBT.

Emotional predictors of the therapeutic alliance

One aspect of brain injury that may pose a barrier to the TA, but has not received much attention in the literature, are the emotional consequences. It is widely acknowledged that a brain injury often results in a range of emotional difficulties, most commonly depression and anxiety (Hiott & Labbate, 2002; Jorge, Robinson, Moser, Tateno, et al., 2004;

Kreutzer, Seel, & Gourley, 2001). Such difficulties can impact upon many aspects of life

(Ponsford et al., 2008), are a significant source of care-giver burden (Ergh, Rapport,

Coleman, & Hanks, 2002), and compromise socio-emotional functioning (Ownsworth &

Fleming, 2005). It seems, therefore, possible that emotional factors may also play a role in

rehabilitation engagement and the therapeutic *relationship*, especially given that the

establishment of an emotional bond is a core component of the TA (Bordin, 1979).

Additionally, emotional factors such as depression are known to effect motivation (Smith,

2013), which may in turn influence task and goal agreement (additional dimensions of the

TA). Indeed, qualitative evidence points to the limiting effect of emotional consequences on

developing a strong patient-therapist bond (Judd & Wilson, 2005). Only two studies have

directly explored the influence of emotional distress (Evans et al., 2008; Sherer et al., 2007),

with one demonstrating a significant association between higher alliance ratings and lower

levels of depression (Evans et al., 2008). The other, however, found no significant role

(Sherer et al., 2007). Both studies were limited, in that all measures were collected within the

first two weeks of therapy, when sufficient time had not passed to develop the alliance

(Schönberger et al., 2006c)

Therapeutic alliance across rehabilitation settings

Another issue which has not been previously investigated is how the TA, and factors

affecting it, might play out in various rehabilitation settings. As previously mentioned, the

existing studies have predominantly focused on holistic post-acute services, which are

typically intense in nature (e.g. a number of sessions a week for several months). Intensive

rehabilitation is not available for everyone, and service provision remains under-developed in

many locations (Krug & Cieza, 2019). Many community services, therefore, seek out *cost-effective* theoretically driven models to rehabilitate their patients (Coetzer, et al., 2018). One

such component of community services includes *group* psycho-education, to improve ABI

consequences and understanding of injury (Backhaus, Ibarra, Klyce, Trexler, & Malec, 2010; Coetzer, 2008; Couchman, McMahon, Kelly, & Ponsford, 2014). Such programmes are common across services (Tyerman & Hucker, 2006), but there has been no previous investigation of the TA (and influencing factors) with the facilitators of group psycho-education programmes in low intensity settings.

According to Bordin (1979) the TA is relevant across *all* settings which involve a process of change, and that each new environment may bring to light factors which could shape its strength. Given the role of the alliance in rehabilitation outcomes (Stagg et al., 2019), and the benefit of group psycho-education programmes within services, it is important to develop an understanding of influencing factors within this context. Additionally, one of the biggest values of group programmes for patients is the quality of the group interaction, and the informal learning which stems from it (Anson & Ponsford, 2006; Lundqvist, Linnros, Orlenius, & Samuelsson, 2010). A member's feelings towards their group contributes to a number of important processes (Yalom & Rand, 1966), including outcome (Crowe & Grenyer, 2008; Marziali, Munroe-Blum, & McCleary, 1997). Factors affecting the strength of the *group* attitude may, therefore, be additional components worthy of investigation.

The present study aimed to investigate facilitator and patient perceptions of the strength of the alliance, from a short-term group psycho-education programme. Uniquely, it also aimed to investigate how *emotional* factors, as well as cognitive and demographic factors[1], might influence the formation of both the therapeutic relationship and 'group attraction'. Finally, the present study aimed to investigate whether the factors of TA, 'group attraction', and emotional, cognitive, and demographic variables (age and education) were predictive of patient engagement within the group programme. Such data would allow

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[1] Time since injury was not considered due to the highly skewed and bimodal nature of this variable within the sample.

clinicians to identify which patients may be vulnerable to experiencing challenges in forming a strong TA or poor programme engagement, allowing them to tailor their clinical and interpersonal skills accordingly (Bishop et al., 2019).

6.2 Methods

6.2.1 Participants

Forty-five participants with an ABI were included in the present study. Each had successfully completed a seven-week group psycho-education programme (The Brain Injury Solutions and Emotions Programme, BISEP) at a community outpatient rehabilitation unit, the North Wales Brain Injury Service, Betsi Cadwaladr University Health Board (NWBIS, BCUHB). The sample consisted of 11 women and 34 men, ranging from 26 to 86 years old ($M = 52$, $SD = 12$), with mixed pathology, reflective of the rehabilitation environment. It included 21 people who had suffered a cerebrovascular accident (CVA), 17 who had suffered a traumatic brain injury (TBI), four who had an ABI following encephalitis, one following hypoxia during cardiac arrest, one following tumour recession, and one from the effects of radiation therapy. Participants ranged from nine-months following injury to 32 years ($M = 5$ years, $SD = 8$ years). Participants were referred to BISEP by a NWBIS clinician, and consisted of those with confirmed ABI (as per NWBIS criteria, Coetzer, Vaughan, Roberts, & Rafal, 2003), duration of at least nine months or greater since injury, and sufficient language ability to benefit from a language-based intervention. Exclusion criteria were inability to give informed consent, and the presence of a neurodegenerative condition (one participant excluded based on this criterion), learning disability, or psychiatric disorder in need of acute care.

6.2.2 Measures

Therapeutic Alliance

The present study used the shortened version of the Working Alliance Inventory

(WAI-S) (Tracey & Kokotovic, 1989), originally developed by Horvath and Greenberg

(1989). This measure is based upon Bordin's pantheoretical model (1979) of TA and is

widely used, including in studies on brain injury (Schönberger et al., 2006c). The measure

includes parallel client and therapist versions, with reports of high reliability (α = .95 for

therapist ratings, α = .97 for therapist ratings) (Tracey & Kokotovic, 1989). The WAI-S scale

ranges from 12 (lowest alliance) to 84 (highest alliance), and includes 12 items which are

responded to on a seven-point scale. Although this measure includes subscales capturing the

three dimensions of the alliance, the aim of the present study was to investigate the *overall*

alliance score (considered the most valid way to represent the measure, Tracey & Kokotovic,

1989). Patient and therapist versions were administered, to capture both perceptions. These

were completed by all patients, and by the programme facilitator, immediately after the last

session of BISEP, to allow sufficient time to develop the alliance over the seven session

programme (Schönberger et al., 2006c). It was explained that participants and facilitator

ratings would remain confidential, and data were anonymised by a research intern, prior to

the analyses. If needed, participants were assisted in completing the form by a member of the

NWBIS clinical team. Participants especially benefitted for an awareness of the two items on

the scale that were reverse-scored.

'Group Attraction'

Within psychotherapy, aspects of the group dynamic (e.g. conflict and collaboration)

have been shown to predict outcome within group programmes (Crowe & Grenyer, 2008).

The present study, therefore aimed to capture members' perceptions and attraction towards

their group, and investigate potential barriers. To do this, the Group Attitude Scale was used

(Evans & Jarvis, 1986). The Group Attitude Scale is a 20 item measure, scored on a 9-point Likert scale, where higher scores indicate more positive attitude towards their group. It reports high validity and reliability (α = .90 - .97), and is considered reliable within the present sample (α = .81). This measure was chosen as it captures members' desire to identify with, and be accepted by, their group. This element, *relating* to other survivors, is perceived as an important component of group interventions by people with ABI (Couchman et al., 2014; Levack, Kayes, & Fadyl, 2010; Salas, Casassus, Rowlands, Pimm, & Flanagan, 2018).

Engagement

Patient engagement with the programme was defined as 'deliberate effort and commitment' to partake in the goals and activities of the programme, demonstrated through active participation in the learning process, intervention activities, and group discussions (Lequerica & Kortte, 2010). Similar to Schönberger et al (2006a), engagement was rated by the BISEP facilitator on a five-point scale: 1) little or no activity, 2) activity when supported, 3) active without participation, 4) active and prepared, and 5) active, independent and spontaneous input.

Emotion symptomatology

To measure anxiety and depression symptoms the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983) was used, which includes two sub-scales. The HADS and has been validated in people with ABI (Dawkins, Cloherty, Gracey, & Evans, 2006; Schönberger & Ponsford, 2010). Participants indicate, on a 4-point scale, agreement with statements such as "I still enjoy the things I used to enjoy".

Cognitive measures

Three tasks were chosen to measure *higher* cognitive functions. These include: 1) *Inhibition,* which was measured with the Hayling sentence completion task from the Hayling and Brixton tests (Burgess & Shallice, 1997). This reports high sensitivity (Burgess &

Shallice, 1997), and validity in a sample of people with brain injury (Odhuba, van den Broek, & Johns, 2005). 2) *Working Memory* was assessed using the Digit Span sub-task from the Wechsler Adult Intelligence Scale (WAIS IV) (Wechsler, 2008), widely used in individuals with ABI (Millis, Rosenthal, Novack, Sherer, et al., 2001). 3) *Verbal Ability* was measured using the Letter Fluency sub-task from the Delis-Kaplan Executive Function system (D-KEFS) (Delis, Kaplan, & Kramer, 2001), which is thought to be one of the strongest predictors of cognitive control (Henry & Crawford, 2004). Finally, memory was assessed using the Logical Memory sub-tasks from the Wechsler Memory Scale (immediate and delayed recall) (WMS-IV, Wechsler, 2009). This is an 'industry standard' test of memory widely used in clinical practice and research within the context of ABI.

6.2.3 Procedure

The study was granted ethical approval by the School of Psychology, Bangor University (2017-16048), and BCUHB (224613). Participants were referred to BISEP by their clinician, and attended the programme in addition to their usual care at the community outpatient service. Approximately two weeks before programme commencement, participants completed the HADS and neuropsychological assessment in random order, as part of a larger research project, and had the opportunity to ask questions about the BISEP. This was done by the first author (LR) at the NWBIS, Bangor University, or patients' homes. Group members had no *therapeutic* contact with the programme facilitator outside BISEP. The psycho-education and skills-based intervention forms a seven session programme, where members met once a week for two hours. It was run by a main facilitator (the first author, LR) and a co-facilitator (an additional member of the clinical team, which was held constant as much as possible). BISEP topics include an introductory session, and sessions on anatomy and mechanisms of injury, emotional changes, emotion regulation, memory, problem solving, and

fatigue. Patients received handouts to provide structure, and each session involved a mixture of formal learning, compensatory strategies, skill building, and group discussions.

Group members and the programme facilitator completed the TA questionnaires (WAI-S) following the last session, and the facilitator rated group members on their overall engagement. To encourage group members to answer honestly, they were informed that the facilitator would not see the data. A research intern anonymised data prior to analysis. Participants completed the Group Attitude Scale independently of their group members soon after programme completion (within two-weeks).

6.2.4 Design and Data Analysis

This non-experimental correlational design study used a series of *robust* multiple linear regressions, given the assumption of residual normality was not met. This was done using 'R' software, with the additional packages 'Robustbse', 'Complmrob', and 'Stats'. Robust regressions were performed with 'MM' method (Salibián-Barrera, Aelst, & Willems, 2008), and bootstrapped coefficients from 999 bootstrapped samples (as a form of model validation) (Babyak, 2004; Efron, 2003). A number of separate regression models were carried out, with 1) demographic predictor variables (age and education), with 2) cognitive predictors (logical memory immediate recall, delayed memory recall, working memory, verbal ability, and inhibition), and with 3) emotional predictors (anxiety and depression scores). These were entered into regression models for 1) patient TA ratings, 2) programme facilitator (therapist) alliance ratings, and 3) 'group attraction' scores as separate outcome variables. Additionally, a number of regression analyses were carried out for the outcome variable of patient engagement, with demographic, cognitive, and emotional predictors (as above), and an additional regression for alliance as predictors (patient ratings, therapist ratings, and 'group attraction'). Missing data for one participant on 'group attraction' (the Group Attitude Scale) was omitted.

6.3 Results

The present study aimed to increase understanding of patient and facilitator perceptions of the strength of the alliance, in a short-term (seven week) psycho-education group programme (analysed under "*The therapeutic alliance for group psycho-education*"). A second aim was to investigate demographic, emotional, and cognitive predictors of the alliance and 'group attraction' (see "*Predictors of the therapeutic alliance and group attitude*"). A final aim was to explore potential predictors of patient engagement with the programme (see "*Predictors of patient engagement*"). For descriptive statistics see Table 1.

Table 1. Descriptive Statistics

Variable	M	SD	Mdn	Range
Age	52.34	11.98	54.00	26 - 86
Education	13.57	2.14	13.00	10 - 20
Anxiety (HADS)	11.20	3.46	11.00	4 - 18
Depression (HADS)	9.14	3.79	8.50	2 - 16
Inhibition (Hayling task)	4.70	1.83	5.00	1 - 8
Verbal ability (D-KEFS)	6.82	3.62	6.00	1 - 19
Working memory (Digits WAIS)	7.18	2.62	7.50	3 - 13
Logical memory 1 (WMS)	6.18	2.81	5.00	1 - 11
Logical memory 2 (WMS)	5.68	2.84	6.00	1 - 11
Patient TA ratings	73.30	9.36	74.50	52 - 84
Therapist alliance ratings	67.45	7.63	69.00	46 - 82
Group attitude ratings	156.05	16.27	157.50	120 - 180
Engagement	3.41	1.25	4.00	1 - 5

The therapeutic alliance for group psycho-education

Patient and facilitator perceptions of the strength of the alliance was high overall, with a *median* rating of 74.50 for patients, and 69 for facilitators (from a maximum of 84). No rating was below 52 (patient ratings) and 46 (facilitator ratings). Importantly, 36% of the patients rated the alliance as 80 or above, with 16% of those as rating the alliance as the highest possible (84/84). The percentage of facilitator ratings above 80 was less high (9%). For patient ratings, over 50% of the sample reported their perceptions of the strength of the alliance to be over 74, and for the facilitator ratings over 50% were higher than 69. Patient ratings of the strength of the TA were significantly higher than facilitator ratings (Z = -2.787, p = .005). Notably, patient and facilitator ratings were strongly correlated (r = .71, p <.001, see Figure 1). The results indicate that a strong alliance can be achieved within the context of a short-term group rehabilitation programme.

Figure 1.
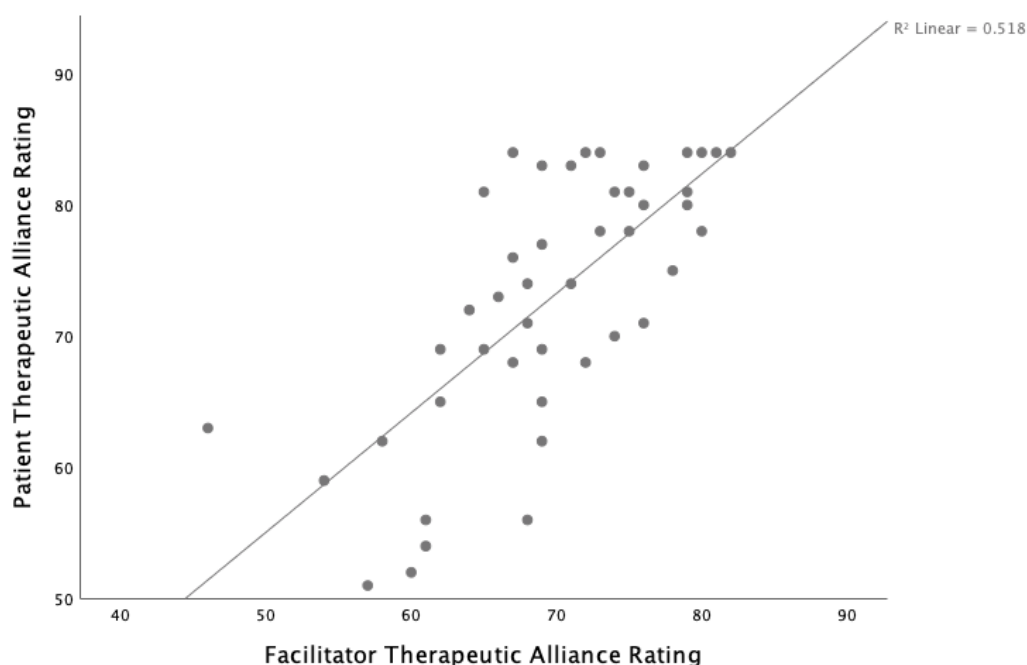
Figure 1. Scatter plot demonstrating the correlation between patient and facilitator perceptions of the strength of the alliance.

***Predictors of the therapeutic alliance and group attitude**

Patient perceptions of the alliance

Three robust regression models were carried out (for demographic, cognitive, and emotional predictors), see Table 2 for details. According to these models, demographic variables (age and education), cognitive (inhibition, working memory, verbal fluency, memory 1 and 2), and emotional (anxiety and depression) predictor variables provided a very low explanation of variance of the patient TA ratings, and none significantly improved prediction.

Table 2. Robust Multiple Linear Regression results for the patient therapeutic alliance ratings (outcome variable)

Model	R^2	F	p (sig.)	β coefficients (bootstrapped)	p (sig.)	95% CIs
Demographic predictor variables	.05	2.28	.321			
Age				-0.01	.475	-0.25 - 0.24
Education				1.07	.083	-0.63 - 2.49
Cognitive predictor variables	.14	5.96	.310			
Inhibition				-0.83	.174	-2.59 - 1.05
Working memory				-0.42	.313	-1.82 - 1.17
Verbal ability				-0.44	.167	-1.38 - 0.56
Memory 1				-1.58	.153	-3.91 - 1.55
Memory 2				1.77	.144	-1.44 – 4.30
Emotional predictor variables	.06	2.42	.300			
Anxiety				-0.02	.501	-1.01 – 1.04
Depression				-0.65	.076	-1.63 – 0.23

Data is presented for three regression models containing 1) demographic predictor variables, 2) cognitive predictor variables, and 3) emotional predictor variables. *<.05 **<.001

Therapist perceptions of the alliance

For the facilitator's ratings, the model containing *emotional* predictor variables (anxiety and depression) explained 16% of the variance, and significantly improved prediction of the facilitator's perceptions of the strength of the TA (R^2 = .16, $F(2,44)$ = 17.11, p <.001). Bootstrapped coefficients demonstrated that depression scores (HADS) were the only significant predictor within the model (β = -0.83, p = .002), and that a unit increase in depression scores would result in a 0.83 decrease in facilitator TA ratings. The models with demographic, and cognitive, predictor variables did not significantly improve prediction of TA. See Table 3 for further details. The results indicate that cognitive impairment is no barrier to developing a working alliance.

Table 3. Robust Multiple Linear Regression results for the facilitator therapeutic alliance ratings (outcome variable)

Model	R^2	F	p (sig.)	β coefficients (bootstrapped)	p (sig.)	95% CIs
Demographic predictor variables	.00	0.17	.921			
Age				-0.02	.413	-0.19 – 0.22
Education				0.24	.381	-0.09 – 1.38
Cognitive predictor variables	.11	4.16	.526			
Inhibition				0.22	.442	-1.18 – 1.47
Working memory				-0.76	.074	-1.29 – 0.37
Verbal ability				-0.27	.261	-0.27 – 0.64
Memory 1				-0.53	.285	-0.53 – 1.39
Memory 2				0.58	.284	0.58 – 2.24
Emotional predictor variables	.16	17.11	< .001**			
Anxiety				0.24	.176	0.24 – 0.82
Depression				-0.83	.002*	-0.83 - -0.33

Data is presented for three regression models containing 1) demographic predictor variables, 2) cognitive predictor variables, and 3) emotional predictor variables. *<.05 **<.001

'Group attraction'

The regression model containing the *emotional* predictor variables (anxiety and depression) explained 14% of the variance, and significantly improved prediction of 'group attraction' (R^2 = .14, $F(2,44)$ = 9.48, p = .008). The results suggest that depression scores were the only significant predictor within the model (β = -1.61, p = .006), suggesting that a unit increase in depression scores would result in a 1.61 decrease in participants' 'attraction' to their group. No other regression model significantly improved prediction of participants' scores on the group attitude scale. Verbal ability was, however, a marginally significant predictor within the cognitive model (β = -1.57, p = .049), suggesting it may play a small role (See Table 4 for details).

Table 4. Robust Multiple Linear Regression results for patients' 'group attraction' scores (on the Group Attitude Scale) (outcome variable)

Model	R^2	F	p (sig.)	β coefficients (bootstrapped)	p (sig.)	95% CIs
Demographic predictor variables	.03	2.78	.249			
Age				0.26	.269	-0.50 – 0.26
Education				1.43	.061	-0.65 – 3.21
Cognitive predictor variables	.11	5.66	.340			
Inhibition				-0.03	.425	-4.40 – 3.57
Working memory				0.27	.456	-2.79 – 4.30
Verbal ability				-1.57	.049*	-3.25 – 0.33
Memory 1				-0.44	.428	-5.16 – 5.00
Memory 2				1.31	.344	-5.34 – 6.93
Emotional predictor variables	.14	9.48	.008*			
Anxiety				-0.06	.515	-1.14 – 1.31
Depression				-1.61	.006*	-2.76 - -0.54

Data is presented for three regression models containing 1) demographic predictor variables, 2) cognitive predictor variables, and 3) emotional predictor variables. *<.05 **<.001

Predictors of patient engagement

Four robust regression models were carried out to investigate demographic, cognitive, emotional, and alliance predictors of patient engagement with the programme. The results demonstrated that the *demographic* predictor model (containing age and education) explained 14% of the variance (as rated by the facilitator), and significantly improved prediction of patient engagement ($R^2 = .14$, $F(2,44) = 7.84$, $p = .020$). Patients' years in education was the only significant predictor within the model ($\beta = 0.22$, $p = .005$), suggesting that a 1 year increase in education would result in a 0.22 increase in (the 5-point) engagement scores.

The regression model containing the cognitive predictors (inhibition, working memory, verbal fluency, immediate memory recall, and delayed memory recall) explained 19% of the variance, and significantly improved prediction of patient engagement ($R^2 = .19$, $F(5,44) = 13.49$, $p = .019$). Working memory was a significant predictor within the model ($\beta = 0.18$, $p = .018$), suggesting that a unit increase in working memory would again result in a substantial 0.18 increase in engagement. Interestingly, immediate memory recall was a significant *positive* predictor of engagement ($\beta = 0.29$, $p = .033$), whereas delayed recall was a significant *negative* predictor ($\beta = -0.26$, $p = .037$). This suggests that a unit increase in immediate memory recall would result in a 0.29 *increase* in engagement, but a unit increase in delayed memory recall would result in a 0.26 *decrease* in engagement.

The model containing emotional and alliance predictors did not significantly improve prediction of engagement, and had low explanation of variance (See Table 5).

Table 5. Robust Multiple Linear Regression results for patient engagement (outcome variable)

Model	R^2	*F*	*p* (sig.)	β coefficients (bootstrapped)	*p* (sig.)	95% CIs
Demographic predictor variables	.14	7.84	.020*			
Age				-0.02	.189	-0.05 – 0.02
Education				0.22	.005*	0.06 – 0.39
Cognitive predictor variables	.19	13.49	.019*			
Inhibition				-0.11	.127	1.42 – 4.36
Working memory				0.18	.018*	0.02 – 0.33
Verbal ability				-0.07	.121	-0.20 – 0.05
Memory 1				0.29	.033*	-0.01 – 0.49
Memory 2				-0.26	.037*	-0.48 – 0.03
Emotional predictor variables	.02	1.00	.610			
Anxiety				0.04	.302	-0.09 – 0.16
Depression				-0.04	.196	-0.16 – 0.06
Alliance and group attraction predictor variables	.21	5.90	.116			
Patient alliance ratings				0.01	.407	-0.07 – 0.08
Facilitator alliance ratings				0.05	.108	-0.03 – 0.12
Group attraction scores				0.01	.206	-0.02 – 0.04

Data is presented for four regression models containing 1) demographic predictor variables, 2) cognitive predictor variables, 3) emotional predictor variables, and 4) therapeutic alliance and 'group attraction'.
*<.05 **<.001

6.4 Discussion

A strong alliance can be developed surprisingly quickly

Importantly, these findings suggest that a strong TA *can* be achieved in a short-term group psycho-education programme. This conclusion stems from the observation that 50% of alliance ratings were over 74 (patient ratings) and 69 (therapist ratings). As discussed above, previous work has focused mainly on intense holistic rehabilitation (Stagg et al., 2019, for a review). This finding, in a short-term group programme, is consistent with the idea that the alliance is relevant across settings involving a process of change (Bordin, 1979), especially for patient perceptions.

Previous work has suggested that the strength of alliance is dependent upon the quantity of therapeutic contact, and develops over time (Schönberger et al., 2006c). The present study's findings suggest that a strong TA can be developed over seven short sessions. It may, therefore, be the *quality* of the therapeutic contact that is most important (Bishop et al., 2019; Lawton et al., 2016). In addition, an essential component of the therapeutic relationship is person-centredness (Bishop et al., 2019; Lawton et al., 2016), something which may have been considered difficult to achieve in a *group* setting. These findings suggest that this is *not* the case, and providing rehabilitation in a group setting is not necessarily a barrier to developing an alliance with the members. It has been suggested that this effect is due to a clinician's skill in recognising variability among patients, and tailoring their approach accordingly (Bishop et al., 2019; McCormack, Karlsson, Dewing, & Lerdal, 2010). These results should be encouraging for all those who engage in short-term group rehabilitation programmes.

Cognitive and demographic variables are not predictors of alliance

Another important finding is that demographic and cognitive variables do *not* appear to influence the strength of the alliance (for facilitator or patient perceptions), or the patients'

'attraction' towards their group. Similar to previous studies, this finding suggests that *age* (Sherer et al., 2007) and *education* (Zelencich et al., 2019), do not pose a barrier to developing a strong therapeutic relationship with ABI survivors. This can only be seen as a positive for rehabilitation, because of the wide range of brain injury demography: young adults and the elderly, and all levels of education.

Surprisingly, no *cognitive* factors were identified as having an influence on patient or therapist perceptions of the TA, in contrast to *qualitative* accounts (Judd & Wilson, 2005). This particular finding contributes to an emerging picture in the quantitative literature, that cognitive impairments in the ABI population do *not* necessarily pose a challenge in developing a therapeutic relationship (Stagg et al., 2019; Zelencich et al., 2019). Of particular relevance for this idea is a recent detailed description of the inter-personal psychotherapeutic process, which remains intact with a profoundly amnesic patient (Moore, Salas, Dockree, & Turnbull, 2017). The facilitator's skills in circumventing cognitive difficulties (Judd & Wilson, 2005; Schönberger et al., 2007), and specific elements of BISEP (e.g. handouts and prompts) (Judd & Wilson, 2005), may also play a part.

Additionally, no cognitive factor was found to play a role in participants' 'attraction' towards their group. It is important to note that this specific measure captures important elements of the group interaction, such as relating to the experiences of other group members, and a feeling of unity (Evans & Jarvis, 1986). One may have expected cognitive difficulties to negatively impact this group element, given their substantial role in social skills (Muscara, Catroppa, & Anderson, 2008; Salas, Casassus, Rowlands, Pimm, & Flanagan, 2018), and psycho-social outcomes (Draper, Ponsford, & Schönberger, 2007). However, given that cognitive impairment is often a feature of a brain injury, and an element which unites the group members, participants likely did not see this as a barrier (Salas et al., 2018). The high scores on this measure indicate that participants were not only able to relate to one another,

but that they also *enjoyed* the group experience, regardless of age, education, and cognitive abilities.

It is noteworthy that a number of qualitative factors, not investigated in the present study, might play a part in the alliance (Lawton et al., 2016 for review), and 'group attraction'. For example, the fostering of a personal connection, humour, empathy (Bishop et al., 2019), trust, and being treated as an individual (Lawton et al., 2016 for review). Considered together, it is possible that a number of personal and professional characteristics, independent of injury-related factors, underlie these complex therapeutic processes. Again, these findings are encouraging for those who work with patients from a range of demographic backgrounds, with cognitive impairment.

Depression is a significant predictor, but not in all cases

A key finding is that depression scores negatively predicted firstly, the *facilitator* perceptions of the alliance, and may, therefore, be a *barrier* to developing a strong therapeutic relationship. This idea is consistent with previous findings (Evans et al., 2008), and qualitative evidence, which suggests that emotional difficulties are often a challenge to developing an alliance (Judd & Wilson, 2005). It is widely acknowledged that emotional distress can impact on processes important in rehabilitation (Coetzer et al., 2018), such as motivation (Siegert & Taylor, 2004) and appraisals of impairment (Byrne, Coetzer, & Addy, 2017). The present study's findings extend this idea, by providing direct evidence that depression also negatively impacts the development of the TA.

What might explain this effect? Referring back to Bordin's pantheoretical framework (1979), it is possible that depression may have affected the dimensions of the TA differentially. For instance, depression may have influenced the more *active* components of the TA, such as agreement on tasks and goals. Notably, depression symptoms may decrease motivation and self-efficacy (Maddux & Meier, 1995; Smith, 2013), and in turn may make

participants more passive in task agreement (Gibbon, 2004; Lawton et al., 2016 for a review; Rhode, Townley-O'Neill, Trendall, Worrall, & Cornwell, 2012). Interestingly, depression was not predictive of *patients'* perceptions of the alliance, possibly due to poor awareness (Prigatano, 2005), or general positive perceptions leading to high ratings within a narrow range.

A second finding on this topic is that depression also negatively predicted participants' 'attraction' towards their group. It has been long acknowledged that emotional distress can play a role in social functioning (Gainotti, 1993; Morton & Wehman, 1995; Weddel, Oddy, & Jenkins, 1980). Within the context of rehabilitation programmes, depression may impact upon the group dynamic in a number of ways. Firstly, high depression symptoms may lead to a negative bias (Peckham, McHugh, & Otto, 2010; Watkins, Vache, Verney, Muller, & Mathews, 1996), whereby participants' overall views of the group experience may be influenced by a preoccupation with instances of negative interactions. Secondly, as previously mentioned, depression may lead to poor motivation (Smith, 2013) to connect with the group. A final issue is how depression might compromise a person's sense of identity (Cruwys, Haslam, Dingle, Haslam, & Jetten, 2014). Due to a sense of threat to the self, a person might use maladaptive strategies, such as avoidance, as a way of coping (Riley, Brennan, & Powell, 2004). That is, they may stay on the outskirts of the group, and avoid becoming actively involved in relational elements that are important for developing a strong group bond (e.g. discussions, activities, sharing their own stories). This has important clinical implications as discussed below.

Education is the biggest predictor of engagement

Within neurorehabilitation, a person's level of *education* has been identified as a factor which positively influences outcome (Ponsford, Draper, & Schönberger 2008), including employment and fewer depressive symptoms (Whelan-Goodinson, Ponsford,

Schönberger, & Johnston, 2010). It is, therefore, not surprising that the findings suggest that higher levels of education are also predictive of *engagement*, consistent with previous research in acute inpatient rehabilitation (Ramanathan-Elion, McWhorter, Wegener, & Bechtold, 2016).

The majority of studies of rehabilitation engagement have investigated the role of psychological variables, such as hope and denial (Ramanathan-Elion et al., 2016), but factors contributing to this process remain poorly understood. Lequerica and Kortte (2010) provide a useful model, whereby engagement is dependent upon interacting personal and environmental factors. The present study's findings suggest that the level of education may also play a part in the underlying factors, possibly through perceived self-efficacy (Lequerica & Kortte, 2010). It is, therefore, important for clinicians to actively promote engagement in group members with lower levels of education.

Some cognitive abilities are important for engagement

Another key finding is that aspects of *cognition* are important for engagement. Though this area of research is in its infancy, these findings are in line with previous research on *participation* in rehabilitation, a related and overlapping construct to engagement (Skidmore, Whyte, Holm, Becker, et al., 2010). This presumably relates to the idea that cognitive impairment presents a hindrance to engaging in every-day life, and in social adjustment (Salas et al., 2018).

Of the cognitive factors explored, the present study is the first to demonstrate that good *working memory* significantly predicted higher levels of engagement. One can see why intact levels of this limited-capacity ability would be beneficial within the context of a group psycho-education programme, where one must follow the content, listen to the group members' accounts, take part in programme activities, all the while keeping track of the overall narrative of each session (Mcallister, Flashman, Sparling, & Saykin, 2004, for a

review). When this system becomes overloaded, participants may well disengage from the sessions, as a way to avoid a catastrophic reaction (Goldstein, 1965; Salas, 2012). The findings suggest that those with marked working memory difficulties might need additional support to maintain engagement.

A peculiar finding is related to episodic memory (Logical Memory, WAIS). The present study suggests that poorer *immediate* memory recall is predictive of *lower* engagement, but poorer *delayed* memory recall is predictive of *higher* engagement. For the former, it is likely that those who cannot remember the content as it progresses during each session may disengage. A possible explanation for the latter is that patients who are aware of delayed memory impairment may engage more during future sessions in an attempt to compensate. Previous work by Schönberger et al (2007) found that poorer memory was associated with better patient perceptions of the alliance, it's possible that this too was due to increased engagement with the therapeutic process. It is not easy to interpret these complex findings, but encouraging patients to take notes, and providing information in 'bite sized' chunks, would be practical suggestions to promote engagement.

Therapeutic alliance may not predict engagement

The therapeutic *alliance* was not a predictor of engagement in the present study. However, this stands in sharp contrast to previous qualitative work, which have described the therapists as having a 'pivotal' role in encouraging patient engagement, and that the alliance might be a mechanism by which to promote participation (Bright et al., 2015; Lawton et al., 2016, for reviews). It is likely that, in a group setting, engagement is dependent on personal characteristics (e.g. education), psychological factors, and the programme itself, more so than the therapeutic relationship. Engagement is a complex phenomenon; to better understand the process it is important to use both quantitative and qualitative approaches from the same data set. This seems to be the most sensible way forwards, because at the moment these methods

seem to be producing different results. In addition, future work may benefit from following a model of therapeutic engagement more closely (e.g. Lequerica & Kortte, 2010).

Future directions

A possible limitation of the present study is that the focus upon the *overall* alliance prevents more detailed analysis of the three underlying dimensions, especially as these develop over multiple time points. As regards cognitive skills, a variable which may be important to consider in future studies is sustained attention (Leclercq, Deloche, & Rousseaux, 2002). This impairment, commonly described as *distractibility*, might play a role in participants' engagement with rehabilitation programmes and with the therapeutic relationship (Schönberger et al., 2007).

Implications for neurorehabilitation

The present study has several implications for rehabilitation professionals, of which the most important may be that cognitive impairment following ABI does not pose a barrier to developing an alliance with their clients. The relevance of depression symptoms is also a clinically important finding, and suggests that rehabilitation professionals should identify those vulnerable to poorer alliance and group connection. Facilitators can then pay extra attention to participants with high levels of depression, and provide scaffolding and encouragement to help them with tasks and activities. Additionally, clinicians may need to actively help such patients to bond with the group, by drawing them into group discussions, and help them move past maladaptive ways of coping (e.g. avoidance, as discussed above) (Riley et al., 2004). Professionals may wish to tailor their approach according to known factors contributing to engagement, especially lower levels of education, poorer working memory skills, and poorer episodic memory.

Conclusion

The findings demonstrate that a good alliance can be achieved despite short duration, demographic variation, and cognitive impairment. Some barriers to the alliance, patient engagement, and 'group attraction' have, however, been identified. The present study provides direct evidence that *depression* negatively influences the strength of the alliance, and participants' 'attraction' towards their group. To promote engagement, clinicians may need to provide additional support to patients with lower levels of education, working memory, and episodic memory impairment. Practical solutions have been suggested which can address these challenges. Given the financial and workload advantages of short-term group interventions, these positive findings encourage the continued use of group programmes for neurorehabilitation services.

7. Chapter 7

"I think [BISEP]'s been part of the healing process […] the groups definitely helped. I've made progress. […] The time business… it takes time to heal, it does. And even if my healing process stops now, I can live with it".

- *Gethin (Participant from BISEP)*

7.1 General Discussion

Neuropsychological rehabilitation has seen enormous advancement over the past century, with important research contributions informing clinical practice and improving patients' lives (Wilson, 2017, for a review). Research in this field is notoriously difficult. Methodological issues, such as difficulty conducting randomised control trials and recruiting larger numbers of participants, can result in a number of challenges to forming a robust and extensive knowledge-base (Turner-Stokes, Pick, Nair, Disler et al., 2015). This means there are still many aspects of this field that have been subject to much less empirical exploration. For instance, the asymmetry in emphasis on comprehensive post-acute, and often expensive, rehabilitation, compared to long-term community rehabilitation in rural and under-resourced settings (e.g. Coetzer, 2008). Additionally, in line with an 'emotional turn' in neurorehabilitation (Wilson, Gracey, Evans, & Bateman, 2009; McDonald, 2017; Wilson & Gracey, 2009), there is a need to continue building the underlying theoretical foundations of emotional difficulties after brain injury, and develop easy-to-implement interventions to address patient distress.

This thesis aimed to address five core areas in need of research development (see introduction): long-term community rehabilitation, evaluating group interventions, a focus on feelings, including patient perspectives in intervention evaluations, investigating predictors of outcome and underlying processes. This closing section brings together the main findings of the thesis, and their implications for neuropsychological rehabilitation. Expanding on the conclusions of the individual chapters, this discussion will address the most important overarching principles observed across the collective body of work. These are: emotion regulation difficulties after ABI (based largely on Chapters Two and Three), evaluation of BISEP (based on Chapters Four and Five), value of shared experience (Chapters Four and Five), and suggested clinical guidance for services and facilitators (based largely on Chapter

Six, and ideas from the entire thesis). Finally, the section will discuss the thesis limitations, and make recommendations for future research.

7.1.2 Emotion Regulation Difficulties after ABI

It is widely acknowledged among the neuropsychological rehabilitation community that patients with acquired brain injury (ABI) often have difficulties with emotion regulation (ER) (Salas, Gross, & Turnbull, 2019). However, the *mechanism*s by which emotions are regulated have been largely under-investigated (Salas et al., 2019). By using the well-established Process Model (Gross, 2013), Chapters Two and Three focused on one particular strategy to manage emotions: Cognitive reappraisal. Chapters Two and Three of this thesis were the first to investigate multiple aspects of the reappraisal process in people with ABI (the generative components and the effectiveness).

Chapter Two investigated the important, and previously unaddressed, question of reappraisal across discrete emotions (Rowlands, Coetzer, & Turnbull, 2019). A range of emotional difficulties are frequently reported after an ABI, such as anger or low mood. A discrete emotion approach provided an opportunity to understand how reappraisal might differ across emotions, which has implications for clinical practice. Chapter Three investigated a different aspect of reappraisal, by exploring distinctions between personal and impersonal stimuli. This represents the first direct investigation of the role of personal context for reappraisal. Both chapters investigated the underlying neuropsychological mechanisms for reappraisal, and provided a model of 'cognition and context' to better understand the process. However, these aspects, which are less novel, will not be discussed further here (see Discussion sections in Chapters Two and Three for such details, and the model provided in Chapter Three).

Patients are especially poor at reappraisal generation

An important finding across both chapters is that a brain injury may increase one's vulnerability to reappraisal *generation* impairment. That is, a brain injury appears to compromise the ability to generate and construct new meanings of events, and to do so quickly. This confirmed and substantiated existing findings at the case and group level (Salas, Turnbull, & Gross, 2014; Salas, Gross, Rafal, Viñas-Guasch, & Turnbull, 2013; Salas, Radovic, Yuen, Yeates, et al., 2014b).

Previous research has largely neglected the generative aspect of the reappraisal process, with the assumption that neurotypical people are able to achieve this easily, and the conceptualisation of reappraisal as a global ability. The findings of these two chapters (Two and Three) suggest that reappraisal has distinct early and late components, similar to the 'two-stage' model of reappraisal (Kalish, 2009; Salas et al., 2014). Additionally, these chapters provide evidence that generating reappraisals, and doing so quickly, is a complex skill that requires effort, cognitive ability, and perhaps flexible or abstract thinking. These factors may increase vulnerability to reappraisal generation difficulty after an ABI.

This impairment, in the generative aspect of reappraisal, appears to be a global difficulty, that is not related to any *specific* emotion (Rowlands et al., 2019). This means that people with ABI may be less able to generate new meanings of events, regardless of which emotion is to be regulated. However, Chapter Three demonstrated that this difficulty is further exacerbated when the topic of the initial appraisal is ambiguous or impersonal. This is likely because context facilitates the reappraisal process, and, in its absence, people must think hypothetically about how abstract ideas can change the situation's meaning.

What is especially important to note is that reappraisal generation impairment is distinct from reappraisal effectiveness. This suggests that people with ABI are equally able to

down-regulate negative emotions as long as an acceptable reappraisal was generated. The implications of this is that recommendations can be made to *facilitate* the construction of new meanings. For example, this can be done through *extrinsic* ER, where a family member, care-giver, or professional, could manage the individual's feelings from the outside, by supporting and scaffolding the generation of reappraisals.

The concept of self-other or extrinsic regulation is well-established in the developmental literature (Calkins & Hill, 2007, for a review), whereby in the early phase of development an adult typically regulates a child's emotions externally. However, this concept has also been highlighted in relation to ER impairment after ABI (Salas, 2012 for a review), and emphasises the potential role of another person in facilitating disengagement from the initial appraisal through providing prompts (Salas et al., 2013). In addition, another person may facilitate 'cognitive engagement', where efforts are made to change the way the individual thinks about an event or scenario (i.e. external reappraisal) (Niven, Totterdell, & Holman, 2009; Salas et al., 2013; 2014b). This highlights how extrinsic and interpersonal regulatory strategies may compensate for intrinsic ER failure, and provides a potential framework for family-oriented intervention.

Reappraisal is less effective for positive emotions
An especially notable finding from Chapter Two was that patients' reappraisals were less effective when attempting to up-regulate neutral events into more intense positive emotions. This suggests that reappraisal may not be an effective strategy to enhance positivity, and identifies a potentially impaired underlying mechanism of emotional difficulties after ABI. The finding is *broadly* related to a recent line of evidence which suggests that the effectiveness of various ER strategies, including reappraisal, are not necessarily stable across all emotions (Southward, Heiy, & Cheavens, 2019).

The finding that patients with ABI found positive emotions especially difficult to up-regulate is novel, and a number of potential reasons for this are discussed in Chapter Two. It is, however, relatively clear that reappraisal modulates discrete negative emotions (sadness, anger, and fear) to a similar level, therefore suggesting a different neural mechanism for up-regulating positive emotion, which is vulnerable after an ABI. Notably, the finding also affirms that there is a need to address this area of functioning in neurorehabilitation. For example, by incorporating reappraisal for positive emotions into interventions (such as the Brain Injury Solutions and Emotions Programme [BISEP]; Chapters Four and Five), or finding less challenging ways to promote positivity.

There are a number of benefits to enhancing and fostering positivity, and focusing on this particular aspect of ER difficulty, after ABI. For example, protecting and improving mental and physical health, life satisfaction, and broadening one's repertoire of thoughts and actions (Fredrickson & Cohn, 2008; Fredrickson, 2001; 2004; Quoidbach, Berry, Hansenne, & Mikolajczak, 2010). It would be beneficial for patients if ER strategies and methods to promote positive feelings were placed on an equal level to managing negative affect within neurorehabilitation and self-management advice. This could be done through focusing attention and savouring positive things, and promoting engagement with positive activities (e.g. within behavioural activation; Ekers, Webster, Van Straten, Cuijpers, et al., 2014; Hart, Vaccaro, Collier, Chervoneva, & Fann, 2019). The use of Positive Psychology (PP) techniques and micro-interventions, such as 'Three Good Things' (Mongrain, Anselmo-Matthews, 2012; Seligman, Steen, Park, & Peterson, 2005), can also be incorporated into neurorehabilitation (Andrewes & O'Neill, 2014; Evans, 2011), as was done with BISEP (Chapters Four and Five).

Reappraisal is less effective for impersonal stimuli

Another key finding regarding ER mechanisms, from Chapter Three, is that there are strong context effects for reappraisal (Aldao, 2013), and especially after ABI. In particular, personal context, and thus adequate situational information, *facilitates* the reappraisal process. An especially interesting idea from Chapter Three is that contextual information is used to build *credible* reappraisals, and the effectiveness of this ER strategy depends on the realism of the new meanings. That is, it is not always enough to generate a reappraisal, one must accept and believe it for it to have an effect on emotional intensity. In this study, this effect was especially strong in the ABI group. This may be because they failed to use abstraction to construct *credible* new appraisals in the absence of contextual information. The finding contributes to a developing line of research which indicates that reappraisal is dependent on various contextual elements (Aldao, 2013; Southward et al., 2019; Troy, Shallcross, & Mauss, 2013). Additionally, it challenges the previous notion that reappraisal is always an adaptive ER strategy (McRae, Jacobs, Ray, John, & Gross, 2012; Webb, Miles, & Sheeran, 2012), by suggesting that it may not be the most effective approach in new or ambiguous situations (especially for those with ABI).

Neurorehabilitation professionals may benefit from introducing a *range* of ER strategies to their patients, and embedding a number of adaptive approaches within already established interventions (as was done in BISEP). Reappraisal is central to many therapeutic processes (e.g. Cognitive Behaviour Therapy; CBT), however such a cognitively effortful and context-dependent strategy may not always be the best choice for patients. The Process Model framework provides additional strategies, which have not been investigated to the same extent as reappraisal, but may be especially useful. For example, recent evidence in neurotypical participants (Lohani & Isaacowitz, 2014; Sheppes, Brady, & Samson, 2014; Webb, Lindquist, Jones, Avishai, & Sheeran, 2018) and the qualitative data presented in

Chapter Four, suggest that situational or attentional strategies could be effective in situations where reappraisal might not be appropriate.

7.1.3 Evaluation of BISEP

The field of neuropsychological rehabilitation has seen increasing focus on the emotional and social difficulties of ABI (Wilson, Gracey, Evans, & Bateman, 2009; McDonald, 2017; Wilson & Gracey, 2009). However, the evidence-base for specific *group* interventions which address emotional consequences is at present relatively small and inconclusive, and there are very few evaluations which focus on the subjective experience of participating in them (Patterson, Fleming, & Doig, 2016). Additionally, a number of interventions include an 'emotion' element, however this is typically not the central focus. Interventions are not always strongly grounded in clinical neuroscience theory. There are published reports of targeted interventions (e.g. Tsousides, Spielman, Kajankova, Guetta, et al., 2017), but they are not always appropriate for under-resourced 'slow stream' settings.

In line with the holistic approach, BISEP was developed to address emotions and ER, together with other common consequences of ABI (e.g. memory, fatigue, problem solving, and understanding of injury). This also means that under-resourced settings are more likely to have the capacity to carry out an intervention which addresses several aspects of ABI together. Importantly, promoting positivity and adaptive ER skills are elements which are threaded throughout the *entire* BISEP, and is part of the underlying philosophy. Therefore, it is conceptualised as an emotion-based intervention, as opposed to a general intervention with an 'emotion' element. This thesis was thus the first to evaluate an 'in person' group intervention with ER at its core, based on a sound theoretical framework (i.e. the Process Model).

BISEP was evaluated in two ways. Chapter Four focused on a *qualitative* evaluation of the entire programme, using participant interviews. Such an approach was found to be very informative in exploring the subjective experience of participating in BISEP, and allowed for the identification of especially salient individual elements and contributors of change. At a policy level, a key action of the Neurological Conditions Delivery Plan 2017 (Wales) is to include more patient perceptions in neurorehabilitation service evaluation, and the approach used in this chapter contributes to this Government strategy. Chapter 5 focused on the *quantitative* evaluation, and feasibility of a future large-scale trial. Specifically, the quantitative evaluation aimed to investigate the efficacy of BISEP at improving emotional distress (depression and anxiety) and the ER strategy of reappraisal.

BISEP is Efficacious

A key finding across Chapters Four (qualitative evaluation) and Five (quantitative evaluation) was that BISEP had beneficial effects for patients' emotional lives, regardless of how it was measured. Specifically, BISEP was effective at improving the skill and effectiveness of reappraisal, and its self-reported use in daily life, and symptoms of depression and anxiety to some extent (within-group only). Notably, participants' subjective experience indicated that BISEP was an *"important part of the recovery process"*, and a programme which they *"benefitted from"*. Attendees expressed concrete gains, such as learning strategies to manage mood, and philosophical changes, including promoting a more positive outlook on life, acceptance, and their recovery. The benefits expressed were broad ranging, and included benefitting emotions, as well as wider adjustment, compensation strategies, and recovery.

An important aspect of the evaluation was the *magnitude* of reported experiences of improvement in emotional well-being, and ability to manage emotions. This is further

supported by the anecdotal feedback that clinicians received unprompted by BISEP attendees during individual therapy:

"The group meetings have had an amazing effect on myself and my outlook to life. The weekly sessions of sharing information and being given so much wonderful advice is priceless, and I cannot thank Leanne and her lovely team enough".

"[BISEP] was a huge turning point in my life. It was when I really started making sense of my difficulties and my experience. It's this programme that was the beginning of me 'accepting'. Until then, I just couldn't accept what had happened to me. How could I have accepted something I didn't understand? So, as the programme went on, I understood how my brain injury was affecting me, and my head became lighter with this understanding. I am in a place where I am happier, I have accepted, and I am moving on. Accepting is massive, and it's very hard. It hasn't changed my pain or my brain injury, but it has changed my perspective".

The qualitative data suggests a *clinically meaningful* change attributed to BISEP. Although clinically relevant changes are usually considered from calculated quantitative outcome scores (Page, 2014), the relevance of patients' subjective experience is especially important and informative of patient acceptability. The richness of participants' accounts in the evaluation of BISEP is a powerful indicator of its value and acceptability to patients. The moderate and large effect sizes for the changes observed, across several measures, are also indicators of clinical significance. In terms of depression and anxiety scores (where clear clinical boundaries are present in the measure), the mean difference took the intervention group from the 'borderline abnormal' range to the boundary of 'normal' for depression symptomatology, and from the 'abnormal' range to the 'borderline abnormal' range for anxiety.

The existing evidence-base for emotion-oriented group interventions remain modest, and difficult to evaluate together, due to heterogeneity in their approaches and definition of ER. However, this body of work contributes to a small and developing line of evidence that group-based interventions can be effective vehicles to promote ER (Tornås, Løvstad, Solbakk, Schanke, & Stubberud, 2016; Tsaousides et al., 2017). Only one previous group

intervention evaluation has been based upon the Process Model, and this was delivered online

through group video-conferencing (the Online EmReg intervention) (Tsaousides et al., 2017).

Similar to the quantitative 'phase one' evaluation of the present thesis, the Online EmReg

programme found moderate and large effect sizes for improvement across several measures,

that were sustained at a 12-month follow-up. The results of Online EmReg, however, do need

to be interpreted with some caution, given the pre-post design which did not include a control

group. BISEP may also be more appropriate for community neurorehabilitation services than

Online EmReg. This is because it is implementable by staff that are part-way through training

(e.g. Assistant and Trainee Psychologists) and does not require video conferencing resources,

or technological ability. It also allows for 'in person' processes to take place, which as

highlighted in the qualitative accounts of Chapter Four, was especially valuable to the

attendees.

The data from this thesis have important clinical implications. Most notably, for

under-resourced settings, where easy-to-implement and cost-effective interventions need to

be appropriate to embed within service approaches. BISEP was developed specifically to sit

within a community service, so that it could easily become an evidence-based intervention

that is offered as part of the long-term outpatient care pathway. By following the robust

Process Model theoretical framework, this thesis proposes practical ways to incorporate ER

training and emotion-based compensation methods as therapeutic tools in a psychological

intervention. The 'phase one' evaluation and rich qualitative accounts suggest that a multi-

centre larger-scale randomised control trial (RCT) is warranted. This would have benefits in

terms of delivering an emotion-based intervention at scale, as well as building a research

community. Results suggest that BISEP is efficacious and valued by patients, and would be a

promising programme to fit into standard clinical care within long-term community services

(subject to further investigation). This is especially true for services in Wales, which are

typically very under-resourced, and where the provision of *bilingual* resources is required by law (The Welsh Language Act, 1993). BISEP is the only empirically evaluated group intervention for ABI that has a Welsh-language resource counterpart, and thus should be offered by all community neurorehabilitation services in Wales.

Promoting Positivity and Adaptive Emotion Regulation

One aim of the evaluation, in particular the qualitative analysis, was to identify the mechanisms by which ER and emotional distress were improved by BISEP, and the strategies or elements that were especially salient. A stand-out element from the participants' accounts (Chapter Four) was the usefulness and benefits of doing the 'Three Good Things' activity, to encourage people to focus on positive experiences and promote positive thinking. This is consistent with previous findings that this activity can have beneficial effects on mood (Gander, Proyer, Ruch, & Wyss, 2013; Mongrain & Anselmo-Matthews, 2012; Proyer, Gander, Wellenzohn, & Ruch, 2014; Seligman et al., 2005). The present study extends this line of working by demonstrating that 'Three Good Things' can be incorporated into neuropsychological rehabilitation with excellent acceptability to patients.

The 'Three good Things' diary was used as a tool which appeared to have immediate and longer-term benefits. That is, it helped attendees to feel more positive about each day, as well as more likely to notice and evaluate things as positives in their lives, and be more *open* to experiencing positive events. 'Three Good Things' may improve mood by encouraging a positive *memory* bias (where people remember more positive things), and a positive *attentional* bias (where people notice more positive things) (Carter, Hore, McGarrigle, Edwards, et al., 2016). Changes in attentional biases have been shown to influence behaviour changes (Hakamata, Lissek, Bar-Haim, Britton, et al., 2010; Kakoschke, Kemps, & Tiggemann, 2014), potentially encouraging engagement in positive activity. This tool may

have been especially effective in BISEP, as it was completed as a *daily* homework for seven weeks, allowing time for the underlying processes to become embedded.

An interesting and novel idea is that 'Three Good Things' may have also acted as bonding and motivational tool, because participants looked forward to share one of their good things with the group each week. This idea is currently only anecdotal, however future investigation may benefit from exploring the impact of a group-based version of 'Three Good Things', for positive personal growth and interpersonal cohesion. A final idea regarding positivity promotion is that participants valued the philosophical approach of developing a positive outlook, suggesting that building optimism into interventions can have beneficial effects in patients' emotional lives. As described by Iolo (Chapter Four):

"If I'm feeling low or whatever. I do something positive. Think of something positive, focus on the positive. If I'm feeling low, the group helped me to feel the positive, getting up in the morning and being alive. It's so important. The group helped you to look at that, remember that, focus on that. […] So, when bad emotions come along hopefully the positive will pull you out".

In terms of ER strategies from the Process Model, it is clear that not all strategies are equally effective. The quantitative analysis, which focused exclusively on the ER strategy of *reappraisal*, demonstrated significant improvements in both self-reported use in daily life, and the skill and effectiveness of reappraisal. In this regard, it is interesting that in the *qualitative* analysis very few people explicitly mentioned reappraisal as a way to manage emotions following BISEP. This could be because they are *instructed* to reappraise in the experiential task. It does not then follow that they would choose to use it for everyday 'real life' emotional difficulties. This is consistent with the idea that adaptive ER is not simply about the effectiveness of a particular strategy, but also the awareness of when to choose and apply one successfully (i.e. the selection stage) (McRae & Gross, 2020). In addition, the self-report use of reappraisal in daily life may be subject to a degree of desirability bias, as the

person administering the questionnaire was also the programme facilitator. However, the most likely explanation (as suggested by the patients themselves) for this discrepancy is that other Process Model strategies were simply more useful and effective for patients than reappraisal.

From the patients' perspectives, the situational strategies and attentional strategies offered in BISEP were considered far more effective and useful for managing emotions in their daily lives. These involve choosing situations beforehand based on their likely emotional outcome (situation selection), changing the external environment (situation modification), and modifying the internal environment (attentional deployment). Patients reported the use of positive distracting activities (e.g. going for a walk), creating physical and psychological distance from the situation, and taking practical steps to decrease the chances of anticipated emotional difficulties in situations (e.g. going shopping at quieter times of day).

These strategies have been subject to much less empirical investigation than reappraisal (McRae & Gross, 2020; Webb et al., 2012). However, *situational* strategies may be particularly useful for those who struggle to manage their emotions (Webb, Lindquist, Jones, Avishai, & Sheeran, 2018), because they may be cognitively less effortful. Situation selection also has the advantage of being a 'forward-thinking' strategy, with fewer environmental demands (i.e. time), and opportunities to seek external support from others. Situation selection may be a promising approach to regulate instances of negative emotion, but also to increase positive emotion. Engaging in meaningful positive activities can boost long-term positive emotions, and evidence suggests that providing people with strategies to promote participation in such activities is a robust route to lasting happiness (Quoidbach, Mikolajczak, & Gross, 2015, for a review).

It is noteworthy, however, that due to 'impact bias' people can often overestimate the intensity of emotional responses (Gilbert, Driver-Linn, & Wilson, 2002), and so may influence whether situations are approached or avoided (Dunn & Laham, 2006, for a review). In people with ABI, the use of situation selection may also be difficult for those with severe episodic memory impairment (Salas, Gross, & Turnbull, 2019, for a review). In addition, there are a number of barriers to engaging in meaningful activities after ABI, such as access, motivation, fatigue, and cognition (Jamieson, Jack, O'Neill, Cullen, et al., 2020). Clinicians, care-givers, and friends should therefore assist in managing a patient's expectations of situational strategies, encourage engagement with assistive technologies, and provide external motivation (Jamieson et al., 2020). The findings from this thesis suggest that offering strategies to modify the environment adaptively can also be an effective approach to compensate for ER impairment and promote positivity.

In a clinical context, these findings especially highlight the acceptability and efficacy of an ER training approach in neuropsychological rehabilitation interventions such as BISEP. Importantly, the effectiveness of rehabilitation services may be especially enhanced by encouraging the use of situational strategies to engage meaningful activity, to promote positivity on a philosophical and inter-related level, and by providing light touch interventions, such as 'Three Good Things'. The strategies offered during BISEP were presented as concretely as possible, with real-world examples, and interactive group exercises using attendees' own personal difficulties to apply strategies. This *applied* and *adaptive* approach was reflected in participants' qualitative accounts, where they described the strategies through their application in 'real life'. As discussed by Wilson (2013), strategies must be transferable to patients' everyday lives to make meaningful changes. In this regard, interventions (such as BISEP) must be of adequate length so that the application of strategies can be learned, embedded, and reinforced, through repetition and many concrete examples.

Training manuals should be developed with these concepts in mind. Just as "concrete patients need concrete therapists" (Salas, Vaughan, Shanker, & Turnbull, 2013, p.27), survivors of ABI also need 'concrete strategies'.

7.1.4 Value of Shared Experience

Group delivered interventions have been shown to improve various target outcomes after ABI (Patterson, Fleming, & Doig, 2016, for a review). However, the impact of the *group* as a modality of intervention delivery has not been widely investigated. A recent review especially highlights the need for research which focuses on participant perceptions to explore group processes, participation, and the impact of peer-interaction (Patterson et al., 2016). This thesis explored the role of group processes in two ways. Firstly, Chapter Four explored patient perspectives of BISEP, which shed light on the perceived benefits of socialising with others in a neurorehabilitation setting. Secondly, Chapter Five was the first to investigate 'group attraction', together with individual therapeutic alliance, as predictors of improvement following BISEP. A clear stand-out finding across both of these chapters (Four and Five) is that there is a powerful therapeutic effect of shared experience.

The qualitative accounts of Chapter Four describe BISEP as a social space, which can function as a 'milieu' with therapeutic benefits for many. Having a space to share experiences in a setting of mutual understanding was reassuring, enjoyable, and gave rise to positive emotional responses. An especially valued element was that socialising with similar others facilitated a sense of normality, where attendees felt free and comfortable to be themselves. Similar to previous reports of group interventions, BISEP may foster social connection, help survivors to adjust to a 'new normal', and facilitate understanding, adjustment, and identity reconstruction (Couchman, McMahon, Kelly, & Ponsford, 2014; Lexell, Alkhed, & Olsson, 2013). Interacting with other survivors has been shown to be a source of friendship that is

more understanding, accepting, and without judgement, and can help fight social isolation after ABI (Salas Casassus, Rowlands, Pimm, & Flanagan, 2018). In a similar regard, Salas and colleagues (2020) developed a model of long-term social rehabilitation, where relatedness, normality, and a sense of belonging are key therapeutic ingredients. These studies, together with the findings from Chapter Four, suggest that providing an opportunity to socialise can provide a restorative experience of social connection in a managed way. Group interventions should, therefore, be considered an essential element of the long-term rehabilitation pathway.

In addition to perceived value and therapeutic experiences, the findings from this thesis (Chapter Five) provide evidence for the first time that group processes are also important for measurable *outcome* in a group intervention for ABI. The present thesis explored two processes as predictors of improvement: therapeutic alliance and 'group attraction'. Notably, despite moderate evidence that the alliance may be an influencing factor within neurorehabilitation (Stagg, Douglas, & Iacono, 2019, for a review), such *individual* therapeutic processes were not found to be positive predictors of improvement in BISEP. The findings suggest that positive feelings towards group members, and feelings of unity and acceptance, can be a vehicle for positive change. Specifically, within the context of BISEP, a strong sense of 'group attraction' was predictive of greater improvement in depression and more effective reappraisals. This is consistent with evidence from group interventions in the field of psychotherapy (Burlingame, McClendon, &Yang, 2018, for meta-analysis; Crowe & Grenyer, 2008), and suggests that fostering group connection may lead to therapeutic gains.

A possible explanation for this powerful effect of shared experience, and 'group attraction', may be related to Self-Determination Theory, and the Basic Psychological Needs sub-theory (Deci & Ryan, 2012; Ryan, 1995; Ryan & Deci, 2000a; 2000b). According to this,

people have core psychological basic needs, for relatedness, autonomy, and competence. When all three needs are met, an individual will experience greater well-being, intrinsic motivation, and flourishing (Ryan & Deci, 2000b).

It is well-reported that after an ABI an individual may experience social isolation, friendship and relationship breakdown, difficulty making new friends, and decreased social and recreational activities (Hoofien, Gilboa, Vakil, & Donovick, 2001; Salas et al., 2018; Sander & Struchen, 2011), thus their needs for relatedness may be thwarted. Socialising with people who do not have a brain injury can be uncomfortable for survivors, and it has been reported that they feel "not normal" in comparison (Salas et al., 2018, p.9). Together with fewer opportunities to feel competent, a sense of achievement (Häggström & Lund, 2008), and autonomy to behave as they want in the 'outside world' (Salas et al., 2018), survivors' self-determined needs may not have been met.

BISEP may have provided participants with a relational space to meet these needs, thus fostering well-being, motivation to implement the strategies, and improve their self-management skills (Ryan, Huta, & Deci, 2008). For instance, one of the stand-out themes from the qualitative interviews (Chapter Four) was the value of connecting with people who could understand their experiences, at a level that people without a brain injury cannot (*"we can all relate"*), thus meeting their need for relatedness. Providing a space of mutual understanding also allowed for a sense of normality, where the *group* defined what was normal, and participants felt free to interact without the pressure to "*act normal*". This may have contributed to their needs for autonomy. Finally, some of the survivors expressed the value of being able to *help* others in the group, feel that they were contributing to something bigger than themselves, and a sense of achievement related to their shared success at planning the end-of-programme party. These experiences may have contributed to their competence

needs. As a consequence, this may have had beneficial effects in the observed improvement scores. This idea is currently hypothetical, but is supported by the observation that many BISEP attendees built a community which out-lasted the intervention (e.g. stayed in touch, became friends, joined community groups, and created Social Media groups), to potentially continue satisfying their psychological needs. This theory may well provide a promising framework to understand motivation, and the role of social support, in ABI rehabilitation (Kusec, Velikonja, DeMatteo, & Harris, 2019).

These findings have a number of implications for neuropsychological rehabilitation services. Due to the powerful therapeutic effect of shared experience, which clinicians can only *facilitate* and not directly provide, it would be beneficial for services to incorporate group programmes within their care pathway. This is especially true for long-term rehabilitation, where less emphasis has been placed, because patients' socio-emotional difficulties persist in the chronic phase. Promoting a sense of group cohesion was an underlying principle that was built into BISEP, and similar interventions may do well to incorporate such a philosophy. The findings suggest that a facilitator's role should also include actively promoting a sense of connection, and that individual therapeutic alliance may be less important in a group context. Due to the relevance of social connection and support, more attention should be placed on community groups (e.g. Headway, Stroke Association), with research conducted to identify their therapeutic function and 'ingredients'.

Finally, the 2020 Covid-19 global pandemic has put a spotlight on *online* neuropsychological services or tele-neuropsychology (Bunnage, Evans, Wright, Thomas et al., British Psychological Society, 2020; Marra, Hamlet, Bauer, & Bowers, 2020), and have brought many new considerations into question. For example, providing neuropsychological rehabilitation safely to new and existing patients, and reducing the risk of virus transmission.

Services may need to adapt to these changes over the long-term, and plan for treating Covid-19 patient referrals who have cognitive impairment and psychological distress (Murphy, Wade, Bunnage, Doyle et al., British Psychological Society, 2020), or who had Covid-19-related strokes (Benger, Williams, Siddiqui, & Sztriha, 2020; Divani, Andalib, Napoli, Lattanzi, et al., 2020). Due to the value of group work in neuropsychological rehabilitation, careful consideration needs to be made to ensure that the social element is not neglected in online approaches.

7.1.5 Clinical Advice for Services and Facilitators

Throughout the individual chapters and Discussion, 15 recommendations for clinical practice have been offered, at a service level and for individual clinicians. These will not be repeated here, instead this section will focus mostly on recommendations specifically for group *facilitators* based on the findings from Chapter Six. Additionally, this section will re-iterate some of the overarching clinical suggestions of the thesis.

Suggestions Specifically for Group Facilitators

Group interventions are, by their nature, dynamic and can be unpredictable. Notably, groups of people with ABI bring additional challenges, such as difficulties associated with engagement (Brett, Sykes, & Pires-Yfantouda, 2017). Cognitive and emotional factors can also be barriers for clinicians during rehabilitation activities, and developing a strong therapeutic relationship (Judd & Wilson, 2005; Stagg et al., 2019). Such difficulties may also be a challenge in terms of group processes and connecting with their peers. The findings from Chapter Six provided the first insight into the impact of demographic, cognitive, and emotional factors on a number of processes underlying group-based treatment (therapeutic alliance, engagement, and 'group attraction'). A greater understanding of potential facilitating and impeding factors can inform a facilitator's approach to running a group programme, and encouraging individuals appropriately.

Chapter Six identified several factors which might influence the therapeutic processes which unfold in the group environment. Notably, depression symptoms may be a barrier to developing a strong bond between facilitator and patient, a finding which has been reported previously (Evans, Sheree, Nakase-Richardson, Mani, et al., 2008; Judd & Wilson, 2005). A novel finding from Chapter Six was that high depression symptoms appeared to also impact the *group* dynamic, and negatively influenced an individual's sense of unity with their group members. This may be related to difficulties with social functioning (Gainotti, 1993), cognitive phenomena such as automatic negative thoughts, or avoidance of the relational elements of group activities (Riley, Brennan, & Powell, 2004). As regards *engagement* with the group programme, lower levels of education, poorer working and episodic memory, and higher delayed memory recall, were risk factors for poorer engagement. Though some of these findings are consistent with research from other rehabilitation settings (e.g. Ramanathan-Elion, McWhorter, Wegener, & Bechtold, 2016; Skidmore, Whyte, Holm, Becker, et al., 2010), Chapter Six provides the first insight into these issues within a low intensity *group* intervention setting.

The implications of these novel findings are that group facilitators can now make evidence-based decisions regarding their approaches in running a programme, so that all attendees have an opportunity to benefit from the processes which unfold. A group facilitator should be especially mindful of actively encouraging individuals with higher rates of depression to bond with their peers. This could be done through support and scaffolding, to bring such individuals into group discussions and activities, and help them to move past maladaptive ways of coping (e.g. avoidance). In addition, facilitators need to be mindful of how depression can influence the individual therapeutic relationship, and encourage participation with the three dimensions of the therapeutic alliance (as discussed in Chapter 6).

Finally, to promote engagement in those with cognitive difficulties, facilitators may encourage note-taking and provide information in short, understandable 'chunks'. As highlighted in Chapter Four, making group programmes enjoyable and experiential was valued by participants, and further emphasising these elements may encourage engagement in people from lower educational backgrounds.

The role of the facilitator is much more than delivering content. Facilitators must simultaneously be aware of each individual's potential difficulties, and work to promote activity and participation at the individual and group level. An experienced facilitator, or clinician, may be aware of these issues from practice. The findings from this thesis, however, provide concrete evidence of how these variables can impact the important processes in a group intervention. This knowledge can inform facilitators, especially those who have less experience running groups. Additionally, it can inform evidence-based approaches which can be discussed in clinical supervision, to mentor the growth of early-career professionals (Stucky, Bush, & Donders, 2010).

Service-level Suggestions

Service-level and general clinical suggestions have been discussed previously, however some pertinent and cross-cutting implications across chapters deserve to be reiterated. Firstly, the participants in this thesis reported ongoing, long-term difficulties and were, on average, seven years post-injury (range 9 months – 32 years, median = 4 years). This emphasises the need for the neurorehabilitation field to address the asymmetry in emphasis on post-acute phases of recovery, and ensure appropriate evidence-based interventions for the long-term outpatient care pathway, as discussed in the Introduction. Secondly, previous work at the qualitative level (Couchman et al., 2014; Patterson et al., 2016), and Chapters Four and Five of this thesis, suggest multiple benefits in providing

patients with *group*-based interventions, and opportunities to interact with other survivors. Thirdly, the findings suggest that promoting adaptive ER and positivity is a promising approach for neuropsychological rehabilitation. Finally, BISEP appears to be an efficacious and easy-to-implement intervention, that can be embedded within a community outpatient service. The intervention handouts are free to access, has a Welsh language counterpart, and a facilitator version with guidance is also freely available. Future research is, however, needed to further clarify its effectiveness with an RCT approach, and a detailed manual developed to train facilitators.

It is important to note, however, that there may be some difficulty and challenges in implementing such suggestions. For example, conducting research in community settings generates logistical difficulties, and researchers may spend considerable time travelling to participants at their homes, where there are important health and safety considerations. Many community services are often under-resourced, especially in rural settings such as North Wales. In recognition of this, the seven Welsh Health Boards received £890,000 as part of the Neurological Conditions Delivery Plan (Wales) to develop community neurorehabilitation services in 2018. This means that conducting research may not be an imminent priority for lower-resourced and new services. However, developing collaboration with Universities, such as the partnership between Bangor University and the North Wales Brain Injury Service, may be a promising way to increase research capacity.

Implementing group interventions can also be challenging for services and staff. Such programmes can have high attrition rates (20-47% for psychological therapies, Swift & Greenberg, 2012), there is substantial administrative work, and there are few free 'ready to implement' evidence-based resources that are suitable for staff who are part-way through training (who often facilitate group interventions in clinical practice). Finally, clinicians

should seek to work from robust frameworks, such as the Process Model, to promote adaptive ER. However, neuropsychological rehabilitation has many theoretical models, and clinicians may choose to incorporate various approaches with the Process Model (e.g. clinical models such as Acceptance and Commitment therapy, or Behavioural Activation, which overlap with Process Model ER strategies).

7.1.6 A Reflection of Implementing and Facilitating
Facilitator Reflections

Important lessons have been learned about the practicalities of running and evaluating BISEP, from reflections of its facilitation. As advised by NWBIS clinicians prior to programme implementation, the experience of running the groups can be challenging. Specifically, it was sometimes difficult to achieve the goals of each session, and maintain programme fidelity, whilst allowing time for informal discussions and relational processes to take place. A detailed manual would need to take into consideration a degree of flexibility for the informal discussions and group activities, and suggest ideas, or a framework, for facilitators to manage these elements.

Facilitating group sessions is also cognitively demanding, as there is a need to keep several things in mind at one time, such as attendees' shared experiences, the content, and the time. Running groups is a dynamic process, which requires a degree of flexibility, and some relevant clinical experience with survivors of ABI. However, BISEP was designed to be implementable by a staff member who is part-way through training, such as a Trainee or Assistant Psychologist, and through facilitating the sessions, this is deemed appropriate. Finally, evaluating a group intervention is challenging (Kennedy, & Turkstra, 2006), and valuable lessons were learned regarding study design and bias reduction.

Service Reflections

The Head of Service at NWBIS provided reflections on the implementation of BISEP and service-level benefits for their clinical approach. They noted that BISEP had very high acceptance by patients in the service, and several spontaneously reported about the programme's value during routine outpatient follow-up appointments. The intervention also had high ecological validity, as patients that were reviewed post-BISEP spontaneously reported making use of the rehabilitation strategies they were taught during the intervention. For example, the traffic light system, the memory box by the door, and 'Three Good Things'. NWBIS staff also contributed to the delivery of BISEP, which has resulted in high in-service acceptance of the programme. For this reason, BISEP will continue to be delivered to patients of NWBIS (post-coronavirus crisis). Upon its resumption, there will likely be further opportunities to evaluate its effectiveness, either via research or clinical audit. Introducing BISEP to NWBIS has left a cost-effective, ecologically valid, theoretically valid technology for delivering group-based psycho-education programmes, within a publicly-funded long-term brain injury rehabilitation service.

7.1.7 Limitations

The work reported in this thesis has provided an important foundation for continued research to addresses emotional difficulty after ABI, using a robust theoretical framework, and the implementation and evaluation of a neuropsychological intervention with ER at its core. Addressing the substantial gaps in the literature (as discussed in the Introduction) was an ambitious goal, and as one may expect, limitations are therefore present.

The first limitation is the potential for bias in the evaluation of BISEP (Chapters Four and Five) (Sterne, Hernán, Reeves, Savović, et al., 2016). This is especially notable because the same person evaluated and facilitated the programme. Participants may, therefore, have

reserved criticism or exaggerated the benefits of BISEP in the qualitative evaluation. In addition, it was not possible for assessments to be done 'blind' in the quantitative evaluation, groups were not randomly allocated, and there was no clinical trials registration or unit involvement. A range of measures were made to reduce this potential for bias. For example, an assessment protocol was followed, and task instructions and scoring remained consistent. Unfortunately, a 'blind' research assistant was outside the constraints of the study.

Another limitation of the work is regarding the unequal sample in the quantitative evaluation of BISEP (Chapter Five), which limited the statistical approaches available (Field & Wilcox, 2017). To mitigate against this, *robust* statistical techniques were used. As must inevitably be the case in studies based on clinical samples drawn from a single service, the groups were recruited from a limited participant pool and within the time constraints of the PhD, and therefore were not matched on all criteria. The difference in depression and anxiety at baseline made the results difficult to interpret. It is acknowledged that potentially a 'mean difference' approach may have been better to investigate *initial* efficacy (as opposed to seeking statistical significance and effect sizes), and that equal and matched groups would have been beneficial. It may have also been more informative to follow standardised reporting guidelines, such as CONSORT (Dijkers, 2015; van Heugten, Wolters, Gregório, & Wade, 2012). This would allow for better evaluation of the intervention in the context of existing evidence, and allow the field to progress in a direction where the evidence-base is strong, replicable, and reporting is more transparent (van Heugten et al., 2012).

A potential criticism is that the samples used were highly variable, in terms of participants' time since injury, type and location of ABI, and education levels. This limits inferences about the effect of lesion location, and whether findings are consistent across injury characteristics and demographics. However, investigating neuroanatomical correlates

were not one of the aims of the thesis. This body of work took a *functional* perspective, and was interested in cognitive mechanisms independent of injury site (Chapters Two and Three). The high variability in the sample is also reflective of the patient population, and strengthens the generalisability of the findings to the patients seen in real-world long-term rehabilitation settings. The high variability is also a *strength* of the intervention evaluation, and investigation of underlying processes (Chapters Four, Five, and Six). This is because it is representative of the target population, and as recommended by the American Academy of Neurology, applied the same inclusion and exclusion criteria as the would be set for running the group intervention in the setting as part of normal clinical practice (Kennedy & Turkstra, 2006).

A final note is that the quantitative BISEP evaluation (Chapter Five) may have benefitted from additional measures, capturing various dimensions of ER. For instance, behavioural manifestations (e.g. – Cattran, Oddy, & Wood, 2011; Gratz & Roemer, 2004), family perspectives, and well-being or life satisfaction scales. A measure which captures the use of a wider range of ER strategies (as opposed to reappraisal alone), would be beneficial in future investigations. Additionally, BISEP addressed several aspects of ABI that were investigated using qualitative methods alone. Future investigation may benefit from investigating the impact of BISEP across several areas of functioning (e.g. with the European Brain Injury Questionnaire; Sopena, Dewar, Nannery, & Teasdale, 2007; Teasdale, Christensen, Willmes, Deloche, et al., 1997).

7.1.8 Future Directions

Each chapter has made suggestions for future research based on their findings. However, this section will highlight new avenues for enquiry, based on the main ideas and concepts of the *overall* thesis, and will not repeat all the suggestions from the individual

articles. These suggestions are grouped into three categories: 1) further evaluation of BISEP; 2) social rehabilitation in the long-term care pathway; and 3) emotion regulation and ABI.

1. *Further Evaluation of BISEP*

A clear avenue for further investigation, as previously mentioned, is a cluster randomised control trial of BISEP (ideally with an active control group), with several measures, capturing emotions and ER, well-being, and social and cognitive functioning. This would allow for investigation of the effectiveness of BISEP across several socio-emotional and functional/cognitive dimensions, and simultaneously allow for the development of a research network, with collaboration between higher education institutions and community services across Health Boards. Such an ambitious project would be subject to funding, a research team, and successful roll out across clinical settings, including the community neurorehabilitation services of the seven Health Boards in Wales. Future research may also benefit from investigating the cost-effectiveness of the programme, or including a cost-description. Economic evaluations, including direct clinical costs and wider societal costs, are being increasingly reported (Stolwyk, Gooden, Kim, & Cadilhac, 2019, for a review). This is an important aspect to consider when evaluating the effectiveness of treatment programmes, and especially for guiding allocation of resources, and government and funding agencies (Stolwyk et al., 2019).

2. *Social rehabilitation in the long-term care pathway*

This thesis highlighted the therapeutic value of group interaction as part of a formal programme, in developing a sense of identity and 'belongingness' (Salas et al., 2020). In this regard, *social* rehabilitation, and relating to similar others, may have a key role in addressing issues surrounding long-term self-discrepancy (e.g. 'I am different to who I was'). A promising and relatively unexplored avenue of future research is the role of community peer-

support groups (e.g. Headway, Stroke Association) in regaining a sense of normality, fostering 'belongingness' and adjustment, and promoting well-being. Research in this area is, indeed, in need of development. One study of note, however, demonstrates the role of Headway in providing social support and enhancing quality of life (Glover, 2003). A more detailed understanding of the perceived function and key 'therapeutic ingredients' of these peer-support groups would better inform a model of long-term social rehabilitation (Salas et al., 2020), and may become a more formal and evidence-based step in the rehabilitation pathway.

3. *Emotion Regulation and Brain Injury*

The Process Model provides a robust framework to understand ER difficulties after ABI (Gross, 2013). The evidence-base for reappraisal after brain injury is now growing (Rowlands et al., 2019; Salas et al., 2019), however more work needs to be done to bring together the two separate fields of ER and Neuropsychology. For instance, there is a need to develop and validate a questionnaire which measures the use of all five of the strategies of the Process Model, in neurologically healthy individuals and people with ABI. Such a tool does not currently exist, and is necessary to evaluate ER processes, and their contribution to psychological health, further.

The majority of research in the ER field has focused on frequency (typical use of ER in daily life), or the 'implementation stage' (Implementing an ER strategy once one has been selected) (McRae & Gross, 2020). However, emotion dysregulation also consists of being unable to identify a *need* to regulate one's emotions (the 'identification stage'), selecting the most appropriate strategy (the 'selection stage'), and monitoring its success. Little is known about these aspects of the ER process, and future work would benefit from investigating these stages in an ecologically valid way. For example, this could be done experimentally with

daily diary methodology (English, Lee, John, & Gross, 2017), or ecological momentary assessments (Colombo, Fernández-Álvarez, Suso-Ribera, Cipresso, et al., 2020). One exciting area of research which aims to improve *monitoring* is the use of biofeedback (Kim, Zemon, Lehrer, McCraty, et al., 2019). A further understanding of these elements of ER failure would provide additional information for neurorehabilitation professionals.

The participant accounts in Chapter Four especially noted the value and effectiveness of *situational* strategies (situation selection and situation modification) for managing emotional difficulties in their every-day lives. No study to date has explicitly investigated these ER strategies in people with ABI, despite the acknowledgement that engaging in positive activity can be beneficial for mood and recovery (Downing, Hicks, Braaf, Myles, et al., 2020; Lyon, Fisher, & Gracey, 2020). Evidence suggests that situation selection may be especially beneficial for those who are not competent at other ER strategies, or are higher in emotional reactivity (Webb et al., 2018). A promising line of enquiry, therefore, would be to investigate situation selection and modification in people with ABI, and their underlying cognitive mechanisms (Salas et al., 2019). In this regard, the study of people with marked and restricted cognitive impairment may provide useful insights. A final avenue worthy of mention is the study of situation selection to promote participation in activities that give rise to meaning and purpose. Future research may benefit from exploring the impact of situation selection on engagement in meaningful activity, its relationship to well-being, and interventions to promote this further.

7.1.9 Conclusion

This thesis began by identifying five 'gaps' that deserve to be acknowledged in the neuropsychological rehabilitation literature, and proceeded to address these areas through a 'family' of inter-connected studies. This process identified a potential mechanism by which

one aspect of ER may be impaired after brain injury (i.e. reappraisal). In line with an 'emotional turn' within neuropsychology, the current body of work also successfully developed an implementable programme for participants on the long-term care pathway. The programme had ER at its core, and was valued by participants. Despite the *emotional* focus of the thesis, it was the *social* element which strongly emerged from the data. More specifically, the therapeutic effect of socialising and relating to other ABI survivors was the most valuable element of BISEP for many, and may also drive measurable change. Finally, group facilitators can now identify those who may need additional support, so that all may access the potential benefits of BISEP and other group programmes.

This thesis is an example of how the Process Model perspective may be used in neuropsychological research and intervention development, and may promote the adoption of such an approach in future studies. A well-established theoretical framework, such as the Process Model, may increase the empirical understanding of ER mechanisms across the wider field of ABI, by enabling the comparison of findings across studies. In addition, this work demonstrates a method of increasing research capacity in neurorehabilitation settings that are often neglected within the wider literature: under-resourced, long-term community services. Continued collaborative research between such clinical settings as NWBIS and Higher Education institutions would build upon the theoretical and clinical evidence-base of the wider field. Finally, the thesis identified how a focus on feelings and optimism, and providing a social space, can have beneficial effects in patients' lives, and their adjustment process. As previously mentioned, if patients' lives are saved, we owe it to them to make their saved life worth living (Wilson, 2013, p.275). The intervention evaluation has set a stable base to improve patients' emotional lives with BISEP. Importantly, the process of designing and implementing the intervention also highlighted ways that it could be improved, and directions for future investigation.

We shall not cease from exploration
And the end of all our exploring
Will be to arrive where we started
And know the place for the first time.
Through the unknown, remembered gate
When the last of earth left to discover
Is that which was the beginning

T.S Eliot

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Appendices

Content

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Appendix A - Affective Story Recall Reappraisal task instructions
(Personal reappraisal task) (Chapters Two and Three)

Introduction. The task was introduced as follows "Sometimes people try to make themselves feel better by looking on the bright side of things. You will see an emotion word on the screen, it will be either sad, scared, angry, or neutral. When you see each word, try to recall an event in your life that caused you to feel that emotion. Try to be very detailed about the way you *feel*. Following this, you will rate how intensely you feel that emotion *now,* upon describing the event, on a 0 to 10 scale, with 10 being most intense. The next step is to think of as *many* positive sides of that situation as you can, as *quickly* as you can. After thinking of the positive sides, rate how you feel again on the same 0 to 10 scale".

As the "neutral" condition involves the *up*-regulation of emotion from neutral to happy, this was explained in more detail: "With *sad, scared*, and *angry,* low scores on the scale mean less intensely and high scores mean more intense. However, with *neutral,* the more neutral it is, the lower the score, and high scores mean happy. Do you understand the difference?" Before we start we have time to practice".

Practice. Patients were then trained on the task using an "angry", and then a "neutral" practice condition, with examples of two stories: Having an argument for the "angry" condition, and watching television for the "neutral" condition. Following this, participants were shown the 0-10 scale, and the description of the scale was repeated again. They were then required to think of reappraisals when prompted by the written cue "Think of the positive sides. Try to be quick", before examples of possible reappraisals were provided. For the "neutral" condition the example reappraisals were "I was watching television with family, which I am lucky to have and spend time with" and "It was nice to have an evening to relax". The example reappraisals for the "angry" condition were: "We don't argue that often" and "Because of this we've talked about ways we can communicate better in future". The emotion intensity scale was shown and explained again. If the participant did not understand the task, the practice procedure was repeated, until the participant was satisfied that they understood what was required during the task.

Testing. Participants were informed that they have a maximum of three minutes to describe their stories (as per Salas et al., 2015), but they could use more time if needed. Their responses to the reappraising cue ("Think of the positive sides. Try to be quick") were timed and audio-recorded. These recordings are later transcribed *verbatim*. If participants struggled to think of stories, they were prompted with generic stories, for example "Some people would say they were *sad* when they lost a pet or family member", "Some people would say they were *angry* when they came across someone being rude or disrespectful", "Some would say they were *scared* when they feared for their or their family's safety or well-being", "Some would say they were *neutral* when going for a walk". Previous

work using an ASR task, however, shows that brain-injured patients are able to recall emotional events (Salas et al., 2015, Turnbull et al., 2005). In line with this, all patients were able to recall stories, though some required additional prompting during the "neutral" condition, which consisted of asking the participant what they did on the days leading up to the testing session.

Appendix B - International Affective Picture System reappraisal task instructions
(Impersonal reappraisal task) (Chapter Three)

Introduction. The task was introduced as follows "Sometimes people try to make themselves feel better by looking on the bright side of things. You will see a series of pictures on the screen. Spend a little bit of time looking at the picture. You will then rate how intense your emotional response to the picture on a 0 to 10 scale, with 10 being most intense. The next step is to think of as *many* positive sides of what you are seeing as you can, as *quickly* as you can. After thinking of the positive sides, rate how you feel again on the same 0 to 10 scale".

As pictures which result in lower emotional intensity ratings can be up-regulated into positive this was explained in more detail: "Low scores on the scale mean less intensely and high scores mean more intense. However, if your emotional response to an image is low, you can up-regulate to positive. That is, you can think of higher numbers on the scale to mean that you feel more positive about it. Do you understand the difference?" Before we start we have time to practice".

Practice. Patients were then trained on the task using two IAPS pictures. Following this, participants were shown the 0-10 scale, and the description of the scale was repeated again. They were then required to think of reappraisals when prompted by the written cue "Think of the positive sides. Try to be quick", before examples of possible reappraisals were provided. For Set A, one of the practice pictures was 'Truck' which included a vehicle stuck in mud with people pushing it, and example reappraisals are 'People are helping each other' and 'they will get out without damage'. The emotion intensity scale was shown and explained again. If the participant did not understand the task, the practice procedure was repeated, until the participant was satisfied that they understood what was required during the task.

Testing. Participants engaged with each picture for as long as they felt necessary to grasp its content. Their responses to the reappraising cue ("Think of the positive sides. Try to be quick") were timed and audio-recorded. These recordings were later transcribed *verbatim*. If participants struggled to think of reappraisals after two minutes, they were prompted as per Salas et al., 2013 (e.g. 'Could you please try to think of the positive sides of this?').

Appendix C - International Affective Picture System image details (Chapter Three)

Set A – Mean Valence = 3.10 (*SD* = 0.84), Mean Arousal = 5.25 (*SD* = 0.75)

Practice: 2683 WAR
Practice: 9041 SCARED CHILD
2745 SHOPLIFTING
2053 BABY
2141 GRIEVING FEMALE
5971 TORNADO
2480 ELDERLY MAN
9530 BOYS
9622 JET
9920 CAR ACCIDENT

Set B - Mean Valence = 3.00 (*SD* = 0.80), Mean Arousal = 4.91 (*SD* = 0.85)

Practice: 9495 FIRE
Practice: 2900 CRYING BOY
9220 CEMETERY
2751 DRUNK DRIVING
9404 SOLDIERS
9341 POLLUTION
9611 PLANE CRASH
9921 FIRE
9471 BURNT BUILDING
2520 ELDERLY MAN

Set C - Mean Valence = 2.70 (*SD* = 0.70), Mean Arousal = 5.45 (*SD* = 0.77)

Practice: 9435 ACCIDENT
Practice: 9280 SMOKE
9910 CAR ACCIDENT
2205 HOSPITAL
3181 BATTERED FEMALE
3220 HOSPITAL
9621 SHIP
8485 FIRE
6838 POLICE
2752 ALCOHOLIC

Set D - Mean Valence = 3.00 (*SD* = 0.61), Mean Arousal = 5.35 (*SD* = 0.69)

Practice: 2272 LONELY BOY

Practice: 9250 WAR VICTIM

6834 POLICE

9230 OIL FIRE

9520 KIDS

9470 RUINS

2661 BABY

9911 CAR ACCIDENT

2455 SAD GIRLS

2750 BUM

Set E - Mean Valence = 2.80 (*SD* = 0.70), Mean Arousal = 5.68 (*SD* = 0.60)

9913 TRUCK
9046 FAMILY
2691 RIOT
3350 INFANT
9342 POLLUTION
9911 CAR ACCIDENT
6836 POLICE
3230 DYING MAN
9050 PLANE CRASH
5972 TORNADO

Appendix D - Examples of reappraisals (Chapter Three)

ABI patient 1

Personal (ASRR) Task (*Story Recall: Scared when they were unable to provide for family following brain injury***)**

Reappraisals*: Positive sides, like my wife says, I have recovered, I've come back from dire consequences. I suppose, I've recovered from something I don't understand, got back on the bike, and got back to work. I've had the great help of [Psychologist's name] at the service. My friends have been amazing and my family, and the love shown to me by people [**Exhales loudly. Eyes tear up**], I swear to god, one of the things that helped me recover is looking back at messages and the love shown to me and my situation [**voice breaks from emotion**]. And you can have bad times in your life when you think the world is against you, but you learn through adversity that they are not, and that is a great feeling, you think my god, there's some good people out there and that is truly great. Faith in humanity definitely. I feel good now.*

Impersonal (IAPS) Task (*Sick Baby picture***)**

Reappraisals*: Oh god… oh god I feel that…makes me feel really… just hope that there's a positive outcome… it's an odd picture…. Is it a new born baby…or is it? It's odd…There's nothing else positive.*

ABI patient 2

Personal (ASRR) Task (*Story Recall: Sad when family dog was sick***)**

Reappraisals*: We actually managed to go to RSPCA vets who helped, and they were cheaper. We definitely got a better vet, who gave her a really good check over and the right medication. The pill was cheaper than the one at the normal vets, and we left feeling like we hadn't been ripped off. We gave them extra money as a good will gesture because, they are a charity and needed the money, and I felt pretty good having done that.*

Impersonal (IAPS) task (*Sick man picture***)**

Reappraisals*: I don't know enough information about it…The guy seems pretty ill. I don't know whether he is… I don't know if he is going to survive or pass away, so I don't know. It's not a very pleasant picture.*

ABI patient 3

Personal (ASRR) Task (*Story Recall: Neutral when going Kayaking)*

Reappraisals: The positive sides is the company I have when I go, the people who are out on the water with me, from all sorts of backgrounds, young and old, fantastic company. When I'm out there I forget about everything that's going on in my life outside the kayaking. The surrounding is fantastic, the views form the lake is stunning. It enhances my life really, it's superb, one of the best things I've ever done was getting in to it. And of course, it keeps me fit. The emotions take over, it gives me things to talk about, and it's all I think about, comparing this week's views with the previous week. Now I can't really measure how much more positive I feel, it consumes me.

Impersonal (IAPS) task (*Lonely man picture)*

Reappraisals: I don't really have any personal attachment to the picture…if I did it would be different…but I can empathise with this chap looking out the window. Nothing much in the house, suggests poverty to me…the positive is that he has a view out of his window, and maybe he is waiting for someone to come and visit…that's it really.

HC participant

Personal (ASRR) Task (*Story Recall: Having to take family dog for euthanasia)*

Reappraisals: Positive side is just how lucky I am to have had her in my life and all the love and fun she brought. I have the happy memories to cheer me up when I'm sad about it. And I guess…knowing that I did the right thing by her, and that she is now out of her pain, makes me feel better. All the family were there with her at the time giving her treats, so she was as comfortable as she could have been. And she had a great life with us."

Impersonal (IAPS) task (*Boys picture)*

Reappraisals: Oh… Well, the kids have each other. They are probably just playing in the dirt, having fun, being kids. They don't look like they are malnourished or anything like that.

Appendix E - Interview Protocol (Chapter Four)

Semi-Structured Interview Protocol

The interviewee used the following questions and additional memory prompts to explore group members' experience of BISEP. Scaffolding was used when necessary to assist patients in developing a narrative and expressing their ideas.

- What are your thoughts on BISEP?
    - Content - Session by session reminder prompts
    - Group format
    - 'Three Good Things' activity
    - Party
- What did you value most?
- Are there any aspects that could be improved?
- Has the programme helped you understand how to manage your emotions better? In what way?
    - 'Before', 'During', and 'After' strategies
    - 'Three Good Things' activity
- Have you used things from the sessions in your day to day life?
    - Recap of main ideas/strategies from each session
- Do you have any additional comments?

Appendix F - Detailed description of the Brain Injury Solutions & Emotions Programme
(BISEP) (Chapter Four and Five)

       The content of BISEP is theoretically-driven, and based on recent research in affective neuroscience (Tracy & Randles, 2011, for a review), and from the field of ER (Gross, 2013; Salas Gross, & Turnbull, 2019), and Positive Psychology (Andrewes, Walker, & O'Neill, 2014; Seligman, 2002; Seligman, Steen, Park, & Peterson, 2005). BISEP has been influenced by principles often reported as being important for individual and group rehabilitation, such as practical tips and compensation methods (Bertisch, Rath, Langenbahn, Sherr, & Diller, 2011; Wilson, 2000; Wilson, 2002), the newly developed field of Positive Psychology and its focus on an optimistic outlook (Seligman et al., 2005), and holistic principles which focuses upon emotion, awareness, and cognitive consequences as a whole.

       The programme has been built upon seven underlying principles, in accordance with the way neurorehabilitation is, and should continue, to move: Encourage a *positive outlook*, focus on *persevered abilities*, suggest *practical solutions* for common problems, increase *awareness of emotion*, suggest *strategies for emotion regulation*, attendees to take an *active role*, and to encourage a sense of *group cohesion*. BISEP consists of (1) an introductory session, and (2) a session on basic anatomy and mechanisms of injury. This is followed by (3) a session on emotional changes, and (4) emotion regulation. Sessions with an emotion focus are given as early as practically possible, as they are the main focus of the intervention. The next session, (5) problem solving, then follows logically from ER, and is considered a major goal of rehabilitation (Ben-Yishay & Prigatano, 1990). One of the most regularly reported consequences, (6) memory, then follows, which can be managed with practical compensation strategies (Wilson, 2000). Lastly, (7) fatigue is discussed, which is a barrier to all the preceding themes. The programme ends with a party, which the attendees organise throughout each week as a way to develop skills and encourage group cohesion and engagement. The party involves food and drink, certificates, a speaker, and an additional activity or topic of attendees' choosing.

Encourage a positive outlook

       An important component of BISEP is to emphasise emotional adjustment in a manner that promotes a positive outlook. To address this, BISEP has been influenced by the field of PP (Seligman, Steen, Park, & Peterson, 2005). This field emphasizes how positive health is much more than the absence of disability or illness (Ryff & Singer, 1998), and is concerned with optimising positive emotions and well-being (Seligman & Csikszentmihalyi, 2014). To achieve this, BISEP includes the 'Three Good Things' PP micro-intervention (Seligman et al., 2005), from session 1 to programme completion. This involves writing down three things that go well each day with a short causal

explanation. Attendees keep a 'Three Good Things' daily diary throughout the programme, and share one good thing with the rest of the group at the beginning of each session.

Focus on persevered abilities

A greater focus on *preserved* abilities is an underlying factor facilitating rehabilitation, and allows for functional gains and the development of compensation methods based on an individual's strengths. Indeed, awareness of preserved abilities is associated with more positive functional gains (Ownsworth & Clare, 2006). It is seen as an important factor for greater motivation to participate in the rehabilitation process, and utilise compensation strategies (Fleming & Strong, 1995). Increased positivity towards their *abilities,* as opposed to weaknesses, may promote positive perceptions of functions and expectations of rehabilitation (Bertisch, Rath, Long, Ashman & Rashid, 2014). During session two, attendees are encouraged to think of what they *can* do, to achieve their goals. For example, if the goal of memory is to remember, and you can remember by using diaries, you've achieved your goal.

Suggest practical solutions for common problems

BISEP is function and solution based. Each session includes suggestions of simple psychological and physical tools, and compensation strategies, to help manage problems. For instance, the 'Memory' session includes multiple examples of simple compensation aids (e.g. diaries) and how changing the environment (e.g. placing often misplaced items in a box by the front door) can facilitate memory. The use of compensation strategies is in line with the philosophy of holistic rehabilitation. By encouraging attendees to use strategies independently, it increases their internal locus of control, so that can act to change their life for the better (Svendsen & Teasdale, 2006).

Increase awareness of emotion

BISEP aims to increase understanding and awareness of physiological, cognitive and phenomenological aspects of the basic emotions (happiness, sadness, anger, fear) (Panksepp, 2004), as they arise at low levels. Attendees are introduced to a traffic light activity, where 'recognising the orange light before it turns red' is a metaphor for being aware of emotions as they arise at low levels where they are easier to manage. Such awareness is encouraged through education, experiential activities, and case studies. For example, as a group, attendees take part in an activity where they describe the experiential and phenomenological feelings and behaviours they experience when they are sad, angry, afraid, or happy. Increasing awareness of emotion is a fundamental step to provide an opportunity to regulate emotions, and has been shown to be effective in patients with ABI (Neumann, Malec, & Hammond, 2017).

Strategies for emotion regulation

Patients with brain injury are vulnerable to emotion dysregulation, therefore, there is an important clinical need to provide strategies to help patients manage their feelings. BISEP includes simplified Emotion Regulation (ER) strategies that are based upon the Process Model (Gross, 2013).

These are conceptualised as ones to use 'before' (situation selection), 'during' (situation modification, attentional deployment), and 'after' (cognitive change) an emotional event. At each time point, attendees are encouraged to think 'S.O.S' which stands for 'Stop.Orange.Solutions'. When faced with difficult emotions, the first step is to 'Stop', think things through and identify the problem. 'Orange' refers to 'recognising the orange light before it turns red', or to be aware of emotional changes, and finally 'Solutions' refers to finding solutions to the situation, as discussed in BISEP. For example, 'before' strategies to help with emotional difficulty whilst shopping includes choosing to go to a quieter shop at a quieter time of day. Attendees learn how to apply these strategies in real world situations and for personal events, through tasks, case-studies and group discussions. Attendees are encouraged to practice these strategies throughout BISEP, and they are threaded throughout the remaining sessions.

Taking an active role

Group attendees take an active role in this programme. There are many opportunities to share their ideas and experiences, and group discussion is encouraged. Attendees have a sense of ownership to how the programme runs, as they organise an event to celebrate programme completion. Such a sense of ownership and person-centeredness creates a more positive rehabilitation experience (Wain, Kneebone, & Billings, 2008). A greater active role is associated with greater motivation for rehabilitation (Maclean, Pound, Wolfe, & Rudd, 2000). Attendees may also set up a network, such as a 'Whatsapp' group or share contact details, which will help them plan the event, but also provide a platform where they can discuss other things related to their injury should they wish to, and to stay in touch following the programme.

Group Cohesion and support

The importance of *any* group intervention is not only what can be learned from the facilitator, but the learning one can achieve through the experience of sharing with *other* people who are in a similar situation (Couchman, McMahon, Kelly, & Ponsford, 2014). A sense of group support is, therefore, encouraged throughout the sessions, and through the planning of the graduation-type event. The social element of group interventions have strong therapeutic effects and are valued by patients (Couchman et al., 2014; Patterson, Fleming, & Doig, 2016). Many people experience a loss of social roles and identity after a brain injury (Villa, Causer, & Riley, 2020). BISEP provides an opportunity to relate to people with similar difficulties, which can facilitate a sense of social normality. Social isolation is a profound change after injury, but relating to other people who have also had a brain injury can help fight the isolation (Salas, Casassus, Rowlands, & Pimm, 2016).

BISEP's seven sessions

Session one – Introduction

The aims of this session are to introduce the group and the programme. This session begins with the facilitators and group members introducing themselves, including their hobbies and interests.

Following this, the aims and structure of the programme are discussed. Facilitators follow the handout, which have group discussion prompts, such as confidentiality, turn-taking in conversation, and support and respect. The session describes the 'Three Good Things' intervention, why it is effective, and some ideas to help (e.g. meeting people, new experiences, a successful routine, learning something new). Facilitators give attendees a notebook that is small and a convenient size to carry around, so they can make a note of their 'Three Good Things'. The role of compensation strategies is discussed, as this is a large component of BISEP and are helpful in neurorehabilitation. Facilitators encourage group discussion about their subjective experiences of progress and compensatory techniques. The graduation-type event at the end is then introduced and explained, and group members and facilitators begin to allocate roles and plan the party. Survivors of brain injury perceive that they are restricted in many aspects of participation (Cardol, de Jong, van den Bos, Beelem, *et al.*, 2002), the party planning gives them an opportunity to plan and contribute to a social event. Finally, the session ends with a short unstructured group discussion, with some ideas at the end of the handout (E.g. How does it feel to meet other people who might be in a similar situation? How does the thought of planning an event make you feel?). There is a 15 minute break approximately half-way in every session.

Session two – What is Brain Injury?

At the beginning of each session, facilitators go over a short recap of the main points from the previous session. The 'Three Good Things' sharing activity then takes place (approximately 10 minutes depending on size of group), where facilitators and each attendee share one of their 'Good Things' with the group. This session aims are introduced, which are as follows: to help attendees develop an understanding of the basic functional anatomy of the brain, the mechanisms and sequelae of different types of injury, and to discuss the common consequences more generally. Facilitators discuss brain injury as a hidden disability, and promote group discussion about this point. Attendees are encouraged to think about how they can be active in helping others to understand, for example, through the use of a Headway card. The handout then guides the facilitators and group members through the basic functional anatomy of the brain, including the cortex, white matter, and parts of the brain (e.g. brain stem, cerebellum, limbic system). Brain and skull models are used alongside this session, and group members are encouraged to hold them, to support learning experientially. In line with the positive ethos and underlying principles of BISEP, the session then covers function and achieving goals. It encourages attendees to think about the *goal* of potentially impaired capacities, and how they can still achieve these through focusing on preserved abilities. For example, 'A common consequence of brain injury is difficulty problem solving, but the goal is to find a solution. You don't need problem solving skills to think of solutions. You are allowed to ask for advice'.

The session then uses case-studies to help conceptualise different types of brain injury, their mechanisms, and their consequences. The hypothetical cases' difficulties and progress are discussed,

before facilitators encourage group discussion about which sessions they are looking forward to most (as opposed to which difficulties they experience most, in line with the positive ethos of BISEP). The session ends with more event planning, and informal group discussion with prompts if needed (E.g. What was the best idea we talked about today? Does understanding the brain help you to understand the effects of your injury?)

Session three – Emotional Changes

Once everyone has shared one 'Good Thing' with the group, the facilitators introduce the aims of this session (to develop understanding and awareness of different emotions, their intensities, and to introduce some ideas on emotion regulation). Different types of emotions are described, and attendees are encouraged to think of more. The idea of emotions having different levels of intensities is then introduced, and that the target is to find a *healthy level*. Next, the facilitators go through each basic emotion (sadness, anger, fear, happiness – wanting and liking), describing what causes these feelings and *how* they feel. An activity is carried out for each emotion, where group members must describe the feelings and behaviours they experience for each emotion (E.g. anger: jaw clenching, hand shaking, feeling loss of control). This is designed to help them develop awareness of the physiological and experiential aspects of affective states. For each emotion there is a tip on how to help, such as 'we can help by removing ourselves from the situation' (anger), 'by spending time with others' (sadness), 'by becoming de-sensitised' (fear), 'by exposing ourselves to something new, things we enjoy, meaningful and social activities' (happiness: wanting), and 'by focusing more on wanting not liking' (happiness: liking). The session then covers mood swings and the potential effects emotional difficulties can have on other people.

The first step in the emotion regulation process is introduced, and that is to develop the necessary awareness of emotions as they arise at low levels. This is introduced with a traffic light metaphor, which is 'recognising the orange light before it turns red'. To further assist group members in developing awareness of some of the phenomenological aspects of basic emotions, facilitators guide them through a group activity. Here there are a number of short case vignettes, and the group must identify which emotion is being described. The facilitators then go through a more comprehensive case-study, of the emotional effects of Jane's injury on her life and her family. Attendees must first identify the emotion categories in the case story, before offering suggestions to help them cope. As per every session, this one ends with event planning and informal discussion with prompts if needed (E.g. 'has the session taught you anything about your emotions?').

Session 4 – Emotion Regulation

Following the recap of the previous session, and the sharing of one 'Good Thing', the aims are introduced. This includes learning about ways to manage emotions, and how these strategies can be used in day to day life. To begin, facilitators introduce the idea that managing emotions happen in different ways and at different times (before, during, and after), and they must recognise the 'orange

light' for each. These time points are addressed separately, are first described, and followed by a concrete example that group members work through together.

The main idea described in the 'before' category is that people do not have to wait until they are in a situation to manage how they feel, there are steps they can take beforehand by looking ahead to future scenarios and finding solutions to *potential* difficulties. If attendees have an upcoming situation that might cause them emotional difficulties, or they feel that they could engage more in situations that might give rise to desirable emotions, they are encouraged to think S.O.S (Stop.Orange.Solutions). Firstly, to stop and think things through (stop), to be aware of emotions (orange light), to think of solutions that might help (solutions), and to reflect. Some examples of solutions are provided, before the group work through a concrete example, involving being anxious about doing the shopping, using the S.O.S mantra. The same procedure is followed for 'during', where the main idea is about practical steps to change a situation or focusing our attention elsewhere, and 'after' which involves changing how we think about something to change how we feel about a situation which has passed. These map on to four of the emotion regulation strategies in the 'Process Model' (Gross, 2013), including situation selection ('before'), situation modification and attentional deployment ('during'), and cognitive change or reappraisal ('after').

The facilitators then discuss how other people can help us manage emotions, by external emotion regulation which is helpful for people with brain injury. Group attendees take part in an activity, where they work through an S.O.S example together, for one of their problems (back-up of 'feeling low and alone in the house' in cases where nobody volunteers a problem). The session ends with discussion and activity about potential emotional problems that may occur at the event, and how these could be resolved. For example, what 'before' suggestions can be made for someone who feels nervous before coming, and what 'during' suggestions can be made if someone feels overwhelmed during the party. Lastly, there is informal discussion about the session content, with some prompting ideas.

Session five – Problem Solving

The aims of this session are to introduce executive functions, to help attendees develop an understanding of problem solving, and provide a framework and general advice to help. These are introduced following the usual recap of the previous session which includes an S.O.S activity, and the sharing of the 'Good Things'. Executive functions are important to cover in BISEP as they underpin the planning and execution of purposeful behaviour, and thus can lead to substantial difficulties in daily functioning. The session begins by introducing some of the roles of executive functions, and describing some specific executive capacities (E.g. working memory, inhibition, monitoring). Facilitators then encourage group discussion about experienced changes in these domains. To assist patients in the understanding of executive functions, BISEP uses the Stuss (2011) model of frontal lobe functioning. Although this model describes the functions of the frontal lobe surfaces, it provides

a means of explaining the four domains of executive functions in a way that can be relatively easily understood by patients. This has been influenced by the approach used at the Oliver Zangwill Centre, UK, (Winegardner, 2016) who also introduce executive functions by simplifying the Stuss model (2011). In BISEP, we executive processes are described as being important for four broad reasons: Doing (energization), thinking (executive cognition), understanding (metacognition), and managing feelings (emotional and behavioural self-regulation). Following this, there is a group discussion about people's strengths and what they could work on, in the context of these four categories.

The session then focuses more specifically on *problem solving*, a capacity described by Ben-Yishay and Prigatano (1999) as one that should be a major focus in neuropsychological rehabilitation. Similar to existing approaches to problem-solving interventions, BISEP uses a multi-step cycle to describe the problem solving process. This is in line with the work of Luria (1963) which describes the steps in the process as (1) recognising that a problem exists, (2) to identify and define the problem, (3) to think of potential solutions, (4) implementing solutions, and (5) evaluate the outcome. To simplify this, so that it is more easily remembered, BISEP includes (1) Pause, (2) Identify the problem, (3) Think of solutions, (4) Did it work?.

Each step is addressed in turn. The main ideas for (1) 'Pause' includes encouraging attendees not to act impulsively but to 'STOP', and think things through. For (2) 'Identify the problem', group members are encouraged to not only identify what the problem is but to try to think of it in terms of the *goal*. For example, if the problem is relationship breakdown then the goal is to improve the relationship. This was done to adhere to the positive element of BISEP, and goal-setting has been shown to enhance confidence, engagement, and motivation for neurorehabilitation (e.g. Rosewilliam, Roskell, & Pandyan, 2011). Attendees are encouraged to 'give your goal a chance', this involves a positive outlook on accepting that some goals might be hard to achieve. For example, if the goal is to improve the relationship breakdown then giving the goal a chance might mean accepting that it might take time, and it might be different to before, but it does not mean it can't be happy and successful relationship. The next step is to think of a 'half-way house', which involves breaking the goal down into smaller parts. Attendees are then encouraged to (3) 'Think of solutions'. Features of good solutions are described, and examples given. Members are encouraged to always have more than one potential solution. The last step in the process is to check (4) 'Did it work?'. Here, the main ideas are that set-backs and hurdles are inevitable, and it is important not to give up and to try other solutions. BISEP then includes an activity whereby the group use the format to try to solve one of their problems.

BISEP then includes a list of general advice to help with problem solving and executive functions more generally. This includes, for example, avoiding processing too much information at once, diaries and calendars to help plan and organise, and setting specific goals.. Following this, there is a group discussion about the people who help the attendees with problem solving. Group members

and facilitators then work through a case study, and work on an activity using the problem solving cycle. As per every session, it ends with more discussions and planning for the event, and informal group discussions.

Session six – Memory

Following a recap of session five, and the sharing of the 'Good Things', the aims of this session are introduced. These are to develop an understanding of memory changes after brain injury, and learn some strategies and compensation aids that can help. The facilitators describe types of memory, conceptualised as 'preserved strengths (long term memory)', and 'vulnerable skills (recent memory)'. For simplicity the specific and scientific name for the memory systems have been replaced with real-world examples. For example, 'preserved strengths (long term memory)' include 'existing skills, and meaning of words', as opposed to procedural memory or semantic memory, and 'vulnerable skills (recent memory)' include, for example, 'new personal memories' and 'remembering appointments', as opposed to episodic memory and prospective memory. This is followed by a group discussion about the types of things the attendees find difficult to remember, as well as things they find easier to remember to encourage them to focus on preserved strengths.

The session then goes on to distinguish the different processes that are important in order to remember things ('attention, storing, retrieving'). BISEP uses 'attention' as opposed to 'encoding' as it is a word more familiar to lay persons. A short description of each stage of the process is included, with a filing cabinet metaphor to help patients conceptualise the information. Each step in the process comes with a "we can help by…" which includes some pointers to help if that phase breaks down. For instance, "we can help by reducing distractions (attention)", "by making information meaningful", and "by using prompts". The majority of the session then focuses on various compensation strategies and environmental changes that can help.

The external strategies included in BISEP consist of (1) 'always in the same place' which is a memory box to keep often misplaced items around the house, (2) 'cork-board reminders' or noticeboards to keep a record of appointments etc., (3) 'nail it now' which is about doing things as they happen or making a note of something straight away whilst it is in their mind, (4) 'clever phones' which is about how built in functions on mobile phones can help (alarms, reminders, GPS, internet, camera, notes and memos), (5) 'Apparently', which include a list of Apps that can help with different aspects of memory, as well as signposting attendees to www.my-therappy.co.uk, which is an NHS website of tried and tested Apps by survivors of brain injury, (6) 'Lists', which encourages group members to keep lists, for example to-do lists, shopping lists etc., (7) 'Diary', to keep a record of schedules but also journals to reflect and remember the good things, (8) 'Tying things together' for often misplaced items (e.g. keys on a lanyard or a clip on a belt, use of bum-bags), and (9) 'Asking others' to help remind. The facilitators guide the attendees through each strategy, including their benefits, and potential problems and solutions. A group discussion is encouraged about each strategy

and whether the members use them already or plan to try them. One of the main ideas the facilitators communicate to members is that the strategies can complement each other and work together, and that using them can become good habits. Attendees then work through a case study, and work through an activity where they suggest strategies that can be used to help with the hypothetical case's difficulties. In the case study the person's memory difficulties have an effect on his emotions, and as a way to re-cap on emotion regulation strategies there in an activity where group members must suggest strategies to help manage their feelings. The session finishes with event planning and the usual informal discussion (e.g. 'what was the best idea we talked about today?')

Session seven – Fatigue

The last session is about managing fatigue. This was chosen because fatigue is a frequently reported symptom of ABI, and has an impact on people's quality of life and community participation (Ouellet & Morin, 2006). Additionally, it is a symptom reported by survivors as being poorly understood. Fatigue can also act as a barrier, and a contributing factor, to the preceding sessions. According to the 'coping hypothesis', fatigue is a response to a need for increased compensatory effort for impairment, in the face of diminished cognitive resources (Zomeren ; Cantor, Gordon, & Gumber, 2013; Ponsford et al., 2012). Due to the complexity of the interacting factors influencing fatigue, BISEP takes a compensatory and adaptive coping approach to managing fatigue.

The session begins in the usual format, with recap and 'good things' activity, before introducing the aims of developing an understanding of what fatigue is, its various manifestations, and ways in which it can be managed. Before going in to detail about fatigue, the facilitators describe how it overlaps with depression. This is to clarify how they interact and due to their similar symptomatology. Depression is briefly described and a group discussion encouraged ('Have you experienced these changes?'), before some solutions are suggested. The solutions are theoretically-driven and have a large evidence-base, and include prescribed medication, 'Get out' (Behavioural activation), and exercise, as based upon the National Institute of Clinical Excellence (NICE) guidelines.

Features of fatigue are then described and discussed, with a 'battery' analogy. Here attendees are encouraged to think about the various ways their 'batteries' are not optimal. For example, (1) not being able to find the 'battery' to begin with (i.e. no energy), (2) the 'battery' doesn't last (i.e. it's hard to sustain things), and (3) using up the 'battery' (i.e. it takes longer to recover). This was done to help group members understand and acknowledge fatigue as a symptom, and to reflect upon their own personal experience of fatigue and how it affects them. It also provides a framework to describe the appropriate solutions for each manifestation. The solution to each component is discussed in turn, and begins with setting a small, fairly enjoyable task to help 'warm up the batteries' if group members feel they have no energy to begin with. Secondly, if they feel that they cannot sustain activity, the suggested solutions include chunking and pacing. These processes are described in detail, along with

the '5 Ps' (priorate, plan, pace, play, practice). Lastly, if they feel that they push themselves too much and it takes long to recover, the suggested solutions are planning around the fatigue, use of external strategies to keep track of time spent doing activities (alarms), and developing an awareness of warning signs and to take a break when these are experienced. Facilitators encourage a group discussion about personal warning signs, or physiological and cognitive experiences when fatigued. Some general advice is then provided, for example, nutrition and hydration, asking for help if needed, sleep hygiene, and to take time over activities. There is then a case study activity, where group members must identify the three manifestations of fatigue and come up with solutions. The session ends with event planning and informal discussions.

Table 1. Table demonstrating which sessions the seven underlying principles of BISEP appear in

Principle	Session 1 Introduction	Session 2 What is Brain Injury?	Session 3 Emotion Changes	Session 4 Emotion Regulation	Session 5 Problem Solving	Session 6 Memory	Session 7 Fatigue
Encourage positive outlook	√	√	√	√	√	√	√
Focus on preserved abilities	√	√	√	√	√	√	√
Practical solutions for common problems			√	√	√	√	√
Awareness of emotion			√	√			
Strategies for emotion regulation			√	√	√	√	
Taking an active role	√	√	√	√	√	√	√
Encourage group cohesion	√	√	√	√	√	√	√

Appendix G - Ethical approval documentation

Study title:	Emotion Regulation and Brain Injury: An investigation into a group psycho-education intervention
REC reference:	17/WA/0257
IRAS project ID:	224613

This study was given a favourable ethical opinion by the Committee on 01 September 2017.

Research Ethics Committees are required to keep a favourable opinion under review in the light of progress reports and any developments in the study. You should submit a progress report for the study 12 months after the date on which the favourable opinion was given, and then annually thereafter. Our records indicate that a progress report is overdue. It would be appreciated if you could complete and submit the report by no later than one month from the date of this letter.

Guidance on progress reports and a copy of the standard Research Ethics Service progress report form is available from the Health Research Authority website:
http://www.hra.nhs.uk/resources/during-and-after-your-study/progress-and-safety-reporting/

The Health Research Authority website also provides guidance on declaring the end of the study: http://www.hra.nhs.uk/research-community/end-of-study-and-beyond/notifying-the-end-of-study/

If you fail to submit regular progress reports - which is a condition of the favourable ethical opinion - the REC may wish to consider suspending or terminating its opinion.

17/WA/0257 Please quote this number on all correspondence

Yours sincerely

Norbert Leon Ciumageanu
Ethics Service Administrative Assistant
Health Research Authority
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GIG CYMRU NHS WALES
Bwrdd Iechyd Prifysgol
Betsi Cadwaladr
University Health Board

Panel Arolygu Mewnol Y&D
R&D Internal Review Panel

Betsi Cadwaladr University Health Board
Ysbyty Gwynedd
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21st September 2017

Dear Miss Leanne Rowlands

Re: Confirmation that R&D governance checks are complete / R&D approval granted

Study Title	Emotion Regulation and Brain Injury: An investigation into a group psycho-education intervention
IRAS reference	224613
REC reference	17/WA/0257

Thank you for submitting your R&D application and supporting documents. The above research project was reviewed at the meeting of the BCUHB R&D Internal Review Panel

The Panel is satisfied with the scientific validity of the project, the risk assessment, the review of the NHS cost and resource implications and all other research management issues pertaining to the revised application. *A full list of documents included in the review is attached as an appendix.*

The R&D Office, on behalf of the Internal Review Panel, is pleased to confirm that all governance checks are now complete and to grant approval to proceed at Betsi Cadwaladr University Health Board sites as described in the application.

Appendix H - Example of consent form and information sheet

An example of English 1) consent form, and 2) invitation letter and information sheet, for the intervention group in the quantitative evaluation of BISEP is provided here. For consent forms, information sheets, and debrief sheets for other studies please see Google Drive: https://drive.google.com/drive/folders/1MwpKWGBWzkglBI6k8Mn2i3c3HvrlI8S3?usp=sharing

1) **Consent Form**

PARTICIPANT CONSENT FORM

Study Title: Emotion Regulation and Brain Injury

Participant Identification Number:
Date:
Version: 1

Names of Researchers: Ms Leanne Rowlands, Professor Oliver Turnbull, Dr Rudi Coetzer

Please initial the box

1. I confirm I have read and understood the information sheet dated .... For the above study and have had the opportunity to ask questions.

2. I understand that my participation is voluntary and that I am able to withdraw at any time, and that my care and legal rights will not be affected if I withdraw.

3. I understand that relevant information from my medical notes may be looked at by the Principal Investigator, Ms Leanne Rowlands. I give permission for this researcher to access any relevant records.

4. I understand that my information will be kept confidential, however I also understand that if there are any concerns regarding my well-being or safety the researcher will be obligated to report this to professionals in charge of my care at the North Wales Brain Injury Service.

5. I agree for the study to be audio recorded. I understand that the recording will be anonymised for data collection, and no direct quotes will be used.

6. I agree to take part in the above study.

Name of Participant _____ Date_____

Signature _____

Name of Researcher _____ Date _____

Signature of Researcher _____

Participant Identification Number:
Date:
Version: 1

Invitation Letter

We would like to invite you to take part in our research study. Our research will be looking at whether we can improve understanding of injury and emotion regulation through a new psycho-education programme: Brain Injury Solutions and Emotions Programme (BISEP).

You have been chosen because your clinician at the North Wales Brain Injury Service thinks that you would be able to complete all the tasks that are involved.

Attached to this invitation letter is an Information Sheet. This will give you more information about the research and what it involves. It is up to you whether you want to take part. If you decide that you do not want to, this will not affect any care you receive at the North Wales Brain Injury Service.

Please take the time to read the information sheet before deciding if you would like to take part. You may ask questions and speak to others about it if you would like. You can take up to 7 days to decide, and you may contact me as many times as you would like for more information. Once you have decided, please contact me to let me know. The contact details are on the information sheet attached to this letter. Thank you.

Kind Regards,

Leanne Rowlands

2) Invitation Letter and Information Sheet

Ysgol Seicoleg
Prifysgol Bangor

Adeilad Brigantia
Ffordd Penrallt
Bangor
Gwynedd
LL57 2 AS

School of Psychology
Bangor University

Brigantia Building
Penrallt Rd
Bangor
Gwynedd
LL57 2 AS

Information Sheet

Researchers: Ms Leanne Rowlands, Dr Rudi Coetzer, Pofessor Oliver Turnbull

1. Study Title

Emotion Regulation and Brain Injury: An investigation into a group psycho-education intervention.

2. What is the purpose of the study?

Many people who have acquired a brain injury experience changes in their capacity to control and regulate their emotions. The aim of this study is to see whether we can improve this capacity through an education-based group programme. We will also investigate the relationships between brain processes and emotion regulation. This will help us understand the various ways that a brain injury can impact upon emotional life.

3. Why have I been chosen?

You have been invited to take part in this study as you have had a brain injury, and you attend services at the North Wales Brain Injury Service. Staff at Bangor University and the North Wales Brain Injury Service think that you will be able to take part and complete all tasks involved. Additionally, they think the sessions might be of benefit to you.

4. Do I have to take part in the study?

No, it is your decision if you want to take part. If you do decide to take part you will be given this information pack to keep, and will be asked to sign a consent form. You will be able to withdraw from the study at any time, should you wish to. Your participation in this study will not affect the care that you will receive at the North Wales Brain Injury Service.

5. What does the study involve?

If you decide to take part, you will first need to attend an individual session where we will give you some questionnaires and some tasks to do. These will be about how you manage your emotions and also to test some brain processes. You will also be required to complete two emotion regulation tasks, involving looking at pictures and recalling emotional events that have happened to you.

Please allow roughly 2 hours for this session, as you may wish to take some breaks. The emotion regulation tasks will be voice-recorded; this is to help the researcher work with it later.

Once the study is over it will be deleted, and it will not be shared with anybody except the researchers at any point.

Approximately a week after this individual session you will be invited to partake in a 7-week group psycho-education programme. This may be immediately, or the following time it runs (approximately 7 weeks later).

The group sessions will be held at the North Wales Brain Injury Service. These will be held weekly, and will be 2 hours long with a break in the middle. Here we will discuss topics related to your brain injury. Every week will be a different topic, and will include topics such as the effects of injury on different parts of the brain, fatigue, emotional changes and memory. These group sessions will be informal and you will have the opportunity to discuss and share with others who may be in a similar position. You may also set up a network to help stay in touch with each other.

After the 7 weeks of psycho-education you will be asked to complete some emotion assessment again. You will be asked to complete the emotion questionnaires and tasks again at a 3-month interval.

6. What are the benefits of taking part?

Your clinician hopes that taking part in this study might be beneficial to your rehabilitation process, as you will learn some information that you might find will help you understand your injury and yourself. The results of this study will provide information on the topic of emotional problems after brain injury, and may help develop this programme for other patients.

7. What are the possible risks and disadvantages of taking part?

The risks involved with this study are much the same as other treatment at the North Wales Brain Injury Service. You will be asked to complete some tasks, it is possible that you will find this tiring, but don't worry you can take as many breaks as you want and you can stop at any time. You can also talk to your clinician at the North Wales Brain Injury Service.

8. Will my information be confidential?

All information about you will be kept completely confidential, and you will not be identified in any publication or report. Anything you disclose in the groups will not be shared with anyone outside of the North Wales Brain Injury Service and researchers involved in this project.

If we feel that your well-being is at risk, we will have to inform the professional in charge of your care, for example the consultant neuropsychologist. All data may be kept for approximately 5 years and then it will be deleted.

9. What happens after the study?

The conclusions will be shared with other professionals, and may be published in scientific journals and presented at conferences, in order to help other people with brain injury.

We will provide a feedback letter to you once the study is over. If you would like to know the results of the study you can request this at the end. In addition, our findings will contribute to an educational qualification, copies of which will be given to the Bangor University Library.

10. Who is organising and funding the research?

The research is funded in part by the North Wales Brain Injury Service and European Social Funds, through the Welsh Government, via the KESS 2 scheme at Bangor University. The research is also organised at Bangor University.

11. Has this study been reviewed?

Yes, the study has been reviewed by the Ethics Committee of the School of Psychology, Bangor University and the North Wales Research Ethics Committees.

12. Who do I contact for more information?

Ms Leanne Rowlands (Principal Investigator)
School of Psychology
Bangor University
Bangor
Gwynedd
LL57 2AS

Email: Leanne.rowlands@bangor.ac.uk
Tel: 07376854781

Please let Ms Leanne Rowlands know if you would like to take part in the study. You can also contact Dr Coetzer at the North Wales Brain Injury Service for any advice about your care.

Rudi Coetzer (Concultant Neuropsychologist)
North Wales Brain Injury Service
Hesketh Rd
Colwyn Bay
LL29 8AY

Email: rudi.coetzer@wales.nhs.uk
Tel: (01492) 807770

13. What if something goes wrong?

Any complaints or concerns regarding this study should be directed to either of these persons below:

Mr Huw Ellis
School Manager
School of Psychology
Brigantia Building
Penrallt Road
Bangor
Gwynedd
LL57 2AS
Email: huw.ellis@bangor.ac.uk
Tel: 01248 388339

Professor John Parkinson
Head of School
School of Psychology
Brigantia Building
Penrallt Road
Bangor
Gwynedd
LL57 2AS
Email: j.parkinson@bangor.ac.uk
Tel: 01248 388 340

Or you can contact the Concerns Team, Betsi Cadwaladr University Health Board:

The Concerns Team

Ysbyty Gwynedd

Bangor

Gwynedd

LL57 2PW

Email: ConcernsTeam.bcu@wales.nhs.uk

Tel: 01248 384 194