

# **Bangor University**

DOCTOR OF PHILOSOPHY

In the heat of the moment: An emotion regulation approach for managing anger after brain injury

Witten, Jade

Award date: 2023

Awarding institution: Bangor University

Link to publication

#### **General rights**

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

· Users may download and print one copy of any publication from the public portal for the purpose of private study or research.

You may not further distribute the material or use it for any profit-making activity or commercial gain
You may freely distribute the URL identifying the publication in the public portal ?

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.



# PRIFYSGOL BANGOR UNIVERSITY

# In the heat of the moment: An emotion regulation approach for managing anger after brain injury

Jade Abigail Witten

Bangor University, United Kingdom September 2023

Thesis submitted to the School of Human and Behavioural Sciences in partial fulfilment of the requirements for the degree of Doctor of Philosophy

### Declaration

I hereby declare that this thesis is the results of my own investigations, except where otherwise stated. All other sources are acknowledged by bibliographic references. This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree unless, as agreed by the University, for approved dual awards. I confirm that I am submitting this work with the agreement of my Supervisors.

Yr wyf drwy hyn yn datgan mai canlyniad fy ymchwil fy hun yw'r thesis hwn, ac eithrio lle nodir yn wahanol. Caiff ffynonellau eraill eu cydnabod gan droednodiadau yn rhoi cyfeiriadau eglur. Nid yw sylwedd y gwaith hwn wedi cael ei dderbyn o'r blaen ar gyfer unrhyw radd, ac nid yw'n cael ei gyflwyno ar yr un pryd mewn ymgeisiaeth am unrhyw radd oni bai ei fod, fel y cytunwyd gan y Brifysgol, am gymwysterau deuol cymeradwy. Rwy'n cadarnhau fy mod yn cyflwyno'r gwaith hwn gyda chytundeb fy Ngoruchwyliwr (Goruchwylwyr). "Hard work and perseverance is the cornerstone to achieve great things."

To my Uncle Lancie, in loving memory.

### Acknowledgements

This has been, hands down, the hardest journey I have ever undertaken – one I could not have walked alone. There are several people (and animals!) to whom I owe my sincerest gratitude. Each of you provided a step on my climb up what I thought would be an insurmountable mountain.

Firstly, to my supervisors, Professor Oliver Turnbull and Dr Rudi Coetzer. Thank you for your invaluable supervision and guidance. It has been an honour and a privilege to work with some of the greatest minds in the field. You have shown me that I can achieve anything I set my mind to, if I am willing to step outside my comfort zone, challenge my limitations, and believe in myself. I would also like to thank the chair of my PhD committee, Dr David Carey, for keeping me on track and always having my best interests at heart.

To my extraordinarily thoughtful, kind, and patient husband. Gary, you are 'yster!' Through thick and thin you have been my constant, my solace, my fixer, and my cheerleader. In the most desolate of moments, you reminded me of who I am and how far I have come, never failing to make me feel loved, supported, and empowered. To you I am eternally indebted, and this milestone is every bit mine as it is yours.

To my family. Mom and Dad, my unwavering pillars of love, courage, support, wisdom, and strength. Thank you for always being there for me, for putting my needs so selflessly above yours, for protecting me, and for fighting for me. Dane, my brother and best friend, thank you for believing in me. Our unique bond has been a comforting, reliable, and abundant source of motivation, love, encouragement, and strength. To my Uncles Don, Garth, and my late Uncle Lance and their respective families. Your unconditional and genuine love, as well as unfaltering support has dispelled all thoughts of doubt and frailty about my ability and strength. To my grandparents, Ma and Pa, thank you for instilling in me the value of education, and for raising a family who has been devoted to me on this journey. I would also

like to thank my in-laws, the Shaw family, for their boundless enthusiasm and support. Mrs Shaw, your endless kindness has made me feel cared for, nurtured, and loved. Natalie, Cheryl, Debbi, and Tracey, thank you for welcoming me with open arms into your sisterhood, and for always checking on me and finding ways to make my journey easier. And then, to my faithful hounds, Oakley and Nala. Thank you for being so loving and loveable, and for bringing me unequivocal joy in a way that no human has been able to.

To my friends who have made me feel part of the Bangor community. Ionela (my Janela), you are truly a one-of-a-kind friend. Your level of support has been unmatched, and there is absolutely no way that I would be where I am today without you. Ioana, you are a fiercely loyal friend, and your continued success constantly motivates me. Eva, your empathic, sensitive, and genuinely kind soul has both grounded and inspired me. And Julia, I'm grateful for your readily available insights and encouragement that I could rely on.

To the staff at Headway UK, the Active Care Group, and Global Brain Injury Awareness (GBIA). Thank you for the time and effort you invested in supporting my research, and for connecting me with the kind and compassionate individuals who were my participants. To Emma Truss, my research assistant, thank you for your commitment, hard work, and dedication to our research. And then to the Oppenheimer Memorial Trust, the British Psychological Society, and Bangor University, thank you for helping to fund my research and providing me with this opportunity to pursue my ambitions.

Finally, to my participants. It has been an incredibly enriching, rewarding, and fulfilling experience working with you. Thank you for opening up to me during a time when the world was shutting down, and for sharing your remarkable stories of adversity, strength, and resilience. You have given so much meaning to my work, and I will continue to do what I can to make even the smallest difference in the lives of others.

# **Table of Contents**

Thesis	s Summary	9
1.	Chapter One: Introduction	
	1.1 Background	
	1.1.1 What is Anger?	14
	1.1.2 Why is Uncontrollable Anger Important?	16
	1.2 Emotion Elicitation	
	1.2.1 Externally Generated Approaches	
	1.2.2 Internally Generated Approaches	
	1.2.3 Using AIPs in Clinical Populations	
	1.3 Emotion Regulation	
	1.3.1 Psychological Interventions for Post-ABI Anger	
	1.3.2 The Brain Basis of ER and Unregulated Anger	
	1.4 Telehealth and Emotions	
	1.4.1 Web-Based Tools	
	1.4.2 VC Platforms and Telerehabilitation	
	1.5 Thesis Aims	
	1.5.1 Personalise the Narrative	
	1.5.2 An ER-Based Approach	
	1.5.3 Zero-in on Anger	
	1.5.4 Telerehabilitation and Discrete Emotions	
	1.5.5 Simple and Personal	
	1.6 Thesis Overview	
2.	Chapter Two: Rage at strangers: Anger elicitation and regulation as a fund	ction of
	relationship type	
	2.1 Abstract	
	2.2 Introduction	
	2.3 Method	57
	2.4 Data Management and Statistical Analyses	
	2.5 Results	64
	2.6 Discussion	
3.	Chapter Three: Shades of rage: Applying the process model of emotion reg	gulation to
	managing anger after brain injury	78
	3.1 Abstract	79

	3.2 Introduction	
	3.2.1 Psychological interventions for Aggression	
	3.2.2 The Process Model of ER	
	3.3 Discussion	
	3.3.1 Number of Strategies	
	3.3.2 Strategy Type	
	3.3.3 Patient Agency and Choice	
	3.3.4 Data Analysis	
	3.3.5 Telemedicine	
	3.3.6 Conclusion	
4.	Chapter Four: Talk and Chalk: An emotion regulation intervention for	anger after
	acquired brain injury	
	4.1 Abstract	
	4.2 Introduction	
	4.3 Method	
	4.4 Data Management and Statistical Analyses	
	4.5 Results	
	4.6 Discussion	
5.	Chapter Five: Discussion	
	5.1 Summary and Implications	
	5.1.1 Relationship Categories Elicit Varying Levels of Anger	
	5.1.2 Reappraisal and Distraction Reduce Anger	
	5.1.3 Reducing Post-ABI Anger	
	5.1.4 Online Interventions are a Promising Alternative	
	5.1.5 Factors That May Enhance Efficacy	
	5.1.6 Suggestions for Scalability	
	5.2 Limitations and Suggestions for Future Research	
	5.2.2 Study Design	
	5.2.2 Self-Report Measures	
	5.2.3 Collateral Information	
	5.2.4 Participant Characteristics	
	5.2.5 Heterogeneous Clinical Descriptors	
	5.3 Conclusion	
Refer	ences	
Apper	ndices	

# List of Tables

<b>Table 1.1</b> Techniques from the Process Model of Emotion Regulation	. 29
Table 2.1 Six items measuring attentional deployment use	60
Table 2.2 Descriptive summary of the PANAS-XS emotion subscales	63
Table 2.3 Technique effectiveness in the ASR relationship categories	67
<b>Table 2.4</b> Predicting distraction performance for the Stranger ASR	69
<b>Table 4.1</b> Demographic and injury characteristics of the current sample	103
Table 4.2 Descriptive statistics for the sample's emotional and cognitive	
functioning	113
<b>Table 4.3</b> Descriptive statistics for anger outcome measures at three timepoints	115
<b>Table 4.4</b> Relationship between participant characteristics and intervention gains	117

# List of Figures

Figure 1.1 Schematic of the thesis structure, objectives, and components	6
Figure 2.1 PANAS-XS emotion subscale scores across the five relationship	
categories	5
Figure 2.2 PANAS-XS anger subscale mean differences by technique across the five	
relationship categories	8
Figure 4.1 Study overview	0
Figure 4.2 Recruitment overview	1
Figure 4.3 Meeting content	7
Figure 4.4 Example of a main trial for the <i>Family</i> relationship category10	8
Figure 4.5 Talk and Chalk intervention process	9

#### **Thesis Summary**

The ability to manage our emotions plays a vital role in interpersonal relationships. For survivors of acquired brain injury (ABI), impairments in emotion regulation (ER) are the most influential contributor to uncontrollable anger, where targeted interventions are needed. Existing interventions have their merits, however there are still gaps relating to their design and delivery. In addition, considering the impact of unmanaged anger on family members and loved ones, the design of emotion elicitation tools would benefit from the application of different categories of relationship. This thesis aimed to address these gaps through two primary objectives.

The first objective was to establish a personally relevant tool that could effectively *elicit* anger, using five relationship categories (Family, Partner, Friend, Stranger, Abstract). This was investigated in the first empirical study (Chapter Two) with 52 neurologically healthy adults. In this repeated measures design, participants took part in a single experimental session of 90-minutes, that was administered one-to-one over a videoconferencing (VC) platform. During the session, they completed a series of anger elicitation and regulation tasks, several measures of cognitive ability, and questionnaires on attachment styles and the use of ER techniques. The main finding was that most relationship categories selectively elicited anger, with some categories (i.e., Stranger) eliciting especially high levels.

The second objective was to establish whether two ER techniques (i.e., reappraisal and distraction) could effectively *reduce* anger. This was first investigated in Chapter Two, in the same empirical study described above. The main finding was that both techniques reduced anger intensity across all relationship categories. However, distraction was particularly effective for strangers, especially for those who use this technique in daily life,

have a certain attachment style, and are older in age. Notably, cognitive abilities were not influential.

Given these promising findings, a theoretical article considered some of the design principals for developing an ER-based intervention for post-ABI anger (Chapter Three). This review focused on key issues such as the number and type of strategies, patient choice, and mode of delivery.

These design principles informed the second empirical study (Chapter Four), which implemented reappraisal and distraction in an ER-based intervention with 24 survivors of ABI. In this pre-post intervention design, participants took part in five 60-minute individually administered sessions, over a VC platform, for a period of approximately four months. In addition to the baseline, post-treatment, and three-month follow-up assessments on anger and mood, session content included anger awareness, cognitive functioning, and ER strategy use. The intervention session focused on a series of anger elicitation and regulation tasks (viz. Chapter Two), where the participant applied reappraisal (Talk) and distraction (Chalk) to personal stories of past-anger-inducing events. The main findings demonstrated short-term improvements in the experience, control, and expression of anger, which were maintained at follow-up. Furthermore, intervention gains were associated with readiness to change, anxiety, and the use of a homework diary, whereas cognitive abilities were not related.

The empirical work of this thesis has clinical implications for post-ABI anger and advances the field of emotion rehabilitation in several notable ways. This brief, feasible and initially efficacious ER-based intervention presents a promising alternative to existing approaches, allowing clinicians to tailor its content to their patients' strengths and weaknesses. In addition, its virtual delivery facilitates increased accessibility, catering to otherwise excluded populations for reasons such as physical location, disability, and time

constraints. These implications may contribute to personally relevant, meaningful, and longlasting changes in the lives of survivors of ABI and their loved ones.

# 1. Chapter One

"[After the injury] I could just get angry for like what I think is not a good reason. I kind of went overboard with things...I wasn't happy with the way I conducted myself when I was feeling angry or frustrated."

~ Talk and Chalk Study Participant [Post-intervention interview, Winter 2022]

# **1. Introduction**

This chapter provides a review of the literature that contextualizes the research problem of unmanaged anger after an acquired brain injury (ABI). Topics include how this can affect survivors of ABI and their loved ones, how to elicit and regulate emotions like anger experimentally, and how telehealth can contribute to rehabilitation approaches.

# **1.1 Background**

Emotions have an enormously influential impact on our day-to-day functioning. They govern decisions such as whether we get out of bed in the mornings, how we behave at social events, or the way we dress (Barquet & Balam, 2015; Holroyd, 1978; Judd et al., 1996). They also provide a medium for which we can relate to one another, such as sadness when we lose a loved one, or joy when we have achieved a challenging milestone. Furthermore, our ability to manage these emotions plays a vital role in social interactions with others, with the power to make or break personal relationships with family, friends, and loved ones (Gross, 2002; Lopes et al., 2005).

Negative emotions such as anger, which is the focus of this review, are particularly impactful. This is because it can have devasting effects on both a personal and interpersonal level, such as in response to an adverse social situation like a relational conflict, which involves physical or psychological harm to oneself or others (Ekman & Cordaro, 2011; Gross, 2002; Lemay et al., 2012; Shahsavarani & Noohi, 2015; Webster et al., 2022). For example, unmanaged anger has been associated with intimate partner violence (see Norlander & Eckhardt, 2005 for a review), which can result in a range of poor health outcomes (see Bichard et al., 2022 for a review). Effectively managing a powerful emotion like anger therefore presents a noteworthy issue, that, if unaddressed, may have severe social, personal and health ramifications. To fully understand its impact, an explanation of anger is necessary.

### **1.1.1 What is Anger?**

A universal definition of anger remains an unresolved issue in the field (Alderman et al., 2013; Shahsavarani & Noohi, 2015). However, there appears to be a consensus on the notion that anger may be triggered by frustration which arises from obstacles impeding a person's goals (see Blair, 2012; Shahsavarani & Noohi, 2015 for reviews). Thus, Dollard and colleagues' (1939) widely used frustration-aggression hypothesis, which suggests that anger arises when a goal is unachieved, provides a unifying explanation. In addition, although there is an ongoing debate regarding the number and names of the basic emotions, all theories agree that anger is one of them (see Tracy & Randles, 2011 for a review).

There has been an increasing agreement in the field that there are universal basic and discrete emotions (see Tracy & Randles, 2011 for a review).<sup>1</sup> Furthermore, it is generally agreed that an emotion is a temporary state with accompanying subjective, expressive (i.e., facial expressions), and physiological (i.e., autonomic) characteristics (Ekman, 1992). Much research has focused on basic emotions, which the field defines as pre-programmed evolutionary responses, with an increasing consensus that they originate from subcortical brain regions (Panksepp & Watt, 2011; Turnbull & Salas, 2021). It has also been proposed that basic emotions developed as tools to adapt to and cope with important life situations

<sup>1</sup>Basic emotions serve as the foundation for *higher* levels of emotion (Panksepp & Watt, 2011), like the moral emotions of shame and guilt (see Haidt, 2003 for an explanation). These are socially constructed and require higher order cognitive processes like self-evaluation (Manstead et al., 1989; Sznycer, 2019; Tracy & Robins, 2004). On the other hand, physiological states such as hunger, thirst, or even disgust should *not* be confused as a basic emotion. Such states are a level below that of basic emotions and belong to their own sensory or homeostatic category of *bodily* affect (Panksepp, 2007).

(e.g., achievements viz. joy, frustrations viz. anger, death viz. sadness), and that each serves as a guide towards the best possible direction to achieve our desired goals (Ekman, 1992; Ekman & Cordaro, 2011).<sup>2</sup> In addition, after several decades of debate, it is increasingly understood that basic emotions are discrete, in that each is distinguishable from the other in notable ways (Darwin, 1872, 1998; Ekman, 1992; Ekman & Cordaro, 2011; Panksepp, 1998; Panksepp, 2005a, 2005b; Panksepp & Watt, 2011).<sup>3</sup>

Thus, as a basic and discrete emotion, it is typically understood that anger has three specific components: subjective feelings, facial expressions, and physiological responses (Carver & Harmon-Jones, 2009; Ekman, 1992; Harmon-Jones et al., 2017). Subjective feelings are often verbally labelled according to arousal levels and are experienced on a continuum with varying intensities (Ekman, 1992; Ekman & Cordaro, 2011; Shahsavarani & Noohi, 2015). Thus, low levels of anger may be labelled as annoyance or frustration whereas high levels may be labelled as fury or rage (Alia-Klein et al., 2020; Eatough & Smith, 2006;

<sup>3</sup>Panksepp and Watt (2011) acknowledge that despite their evolutionary basis, basic emotions may be *further* shaped by experiences. Discrete emotions may have arisen, for example, from social constructs of how humans should invariably react to mutually-experienced situations (Parkinson, 1996). As such, they may be influenced by social learning, and are continuously adapted throughout the lifespan according to factors such as attitudes towards emotional experiences or coping mechanisms for emotional triggers (Ekman & Cordaro, 2011).

<sup>&</sup>lt;sup>2</sup>In addition to the presented approach on basic emotions, there are other various competing approaches (e.g., see Sreeja & Mahalakshmi, 2017 for a discussion). This includes theories that explain basic emotions as social constructs (e.g., Barrett, 2012), or as primarily alike and only distinguishable according to high or low dimensions of pleasantness and arousal (e.g., Barrett & Russell, 1999; Russell, 1978).

Shahsavarani & Noohi, 2015)<sup>4</sup>. Facial expressions are characterised by furrowed brows, tension in the lips and jaws, flared nostrils, and displayed teeth (Ekman et al., 1972; Song et al., 2021; Vrana & Rollock, 2002). Finally, physiological responses include increased heart rate, blood pressure, and skin conductance (Fernández et al., 2012; Lobbestael et al., 2008; Marci et al., 2007; Shahsavarani & Noohi, 2015; Sharman & Dingle, 2015; Vrana & Rollock, 2002). Thus, early awareness of these subjective, expressive, and physiological markers of anger may serve as a warning sign for when this emotion might lead to an outburst.

# 1.1.2 Why is Uncontrollable Anger Important?

Uncontrollable anger is a prominent and significant issue in both clinical and nonclinical populations. For example, in a neurologically normal community, its prevalence can range from 8% to 33% (Leonard et al., 2002; Okuda et al., 2015). In clinical populations, such as survivors of acquired brain injury (ABI), unmanaged anger can have a prevalence rate of up to 57% (Ramos-Perdigués et al., 2015; Pouwels et al., 2019). Notably, post-ABI anger has been identified by family members and spouses as the single most problematic symptom of their survivors' injuries (Choi-Kwon & Kim, 2022; Saban et al., 2016).

The World Health Organisation (WHO; 1996) defines an ABI as any temporary or permanent injury to the brain that is sustained after birth and unrelated to a degenerative or genetic condition. These neurological conditions have been identified as one of the leading causes of death and disability globally (Institute for Health Metrics and Evaluation [IHME], 2018). Two common causes of an ABI are a traumatic brain injury (TBI), affecting approximately 69 million individuals globally each year, and a cerebrovascular accident

<sup>&</sup>lt;sup>4</sup>Self-report measures of anger, such as the most widely used State-Trait Anger Expression Inventory-2 (Spielberger, 1999), or the Aggression Questionnaire (Bryant & Smith, 2001; Buss & Perry, 1992) capture these subjective descriptions of anger.

(CVA), one of the top 10 leading causes of global deaths (Dewan et al., 2018; IHME, 2018). Other causes include tumours, infections, and hypoxic/anoxic events (e.g., Chan et al., 2013). Notably, prevalence rates for aggression were the highest in survivors of TBIs (Pouwels et al., 2019). Thus, not only are ABIs common, survivors of ABI also commonly experience dramatic emotional changes, especially in relation to anger (Ferro & Santos, 2020; Pouwels et al., 2019; Salas et al., 2018).

Importantly, the WHO (1996)'s definition also states that the injury may result in varying degrees of functional or psychosocial impairment, as well as depression and anxiety (see Arene & Hidler, 2009; Juengst et al., 2017; Mallya et al., 2015; McInnes et al., 2017; Meyer et al., 2014; Morton & Wehman, 1995; Scholten et al., 2016 for reviews). Of these challenges, it is arguably impairments in emotion regulation (ER): the ability to adapt and manage emotional experiences and expressions (Gross, 1998a, 2002), that are the most debilitating (Ferro & Santos, 2020; Winter et al., 2018). This is because, in addition to environmental and genetic factors, poor ER following ABI is the most influential contributor to uncontrollable anger, negatively impacting survivors and their loved ones (Bechara, 2004; Choi-Kwon & Kim, 2022).

Impact of post-ABI anger on survivors. Uncontrollable anger has an adverse effect on the survivor's quality of life. Verbal manifestations of anger are more frequent than physical manifestations (Pouwels et al., 2019), with survivors of ABI reporting that lifestyle changes like functional impairments due to neurological deficits, or cognitive impairments like language difficulties, were particular sources of frustration (see Choi-Kwon & Kim, 2022 for a review). Furthermore, survivors also identified specific individuals, namely family members and work colleagues, or issues, such as adverse economic circumstances, as sources of anger. However, spontaneous outbursts in the absence of a specific cause or individual/issue were not uncommon (Choi-Kwon & Kim, 2022). In addition, post-ABI anger

has been significantly associated with anxiety and depression (Baguley et al., 2006; Caplan et al., 2017; Gould, 2019; Roy et al., 2017; Tateno et al., 2003), suggesting its influential role in emotional wellbeing. Importantly, it also has a significant impact on personal relationships with loved ones (Ponsford et al., 2014).

Impact of post-ABI anger on loved ones. Family members and spouses describe a dramatic change in their previously loving relationships and report a particular fear of their survivors' anger (Gould, 2019; Saban et al., 2015; Yasmin & Riley, 2022). As such, they are usually the targeted recipients of anger outbursts, noting that their survivors are less tolerable due to their impulsivity, hostility, irritability, and sometimes physical aggression over inconsequential matters (Alderman et al., 2013; Choi-Kwon & Kim, 2022; Saban et al., 2015). Thus, uncontrollable anger is an influential contributor to caregiver burden, which, compared to other health conditions, is especially high for those looking after survivors of ABI (Choi-Kwon & Kim, 2022; Harding et al., 2015). In the absence of effective long-term pharmacological treatments for anger after ABI, to support survivors and their loved ones, targeted interventions for anger modulation are much needed. To measure the efficacy of interventions scientifically, it is important to have tools that can reliably elicit anger in a controlled research setting.

# **1.2 Emotion Elicitation**

In an ideal situation, researchers would be able to capture data on emotional events as they occur. However, as this typically is not possible, the next best solution is to create an environment where emotions can be induced and therefore studied in relation to their experiences, reactions, expressions, and control. Thus, Affect Induction Procedures (AIPs)<sup>5</sup>,

<sup>&</sup>lt;sup>5</sup>It is important to note the difference between several key terms. According to the most recent and comprehensive meta-analysis on AIPs, Joseph and colleagues (2020) define

or tools that manipulate affect in a research setting, have been a well-investigated topic over the last several decades, with the creation of various methods (Gerrards-Hesse et al., 1994; Joseph et al., 2020; Martin, 1990; Nummenmaa & Niemi, 2004; Westermann et al., 1996)<sup>6</sup>. Notably, some of these tools have been favoured due to their ability to maximize experimental control, whereas others have been valued more recently due to their ability to generate the greatest magnitude of emotions. These tools are typically categorised into externally and internally generated approaches (Gerrards-Hesse et al., 1994; Salas et al., 2012).

# **1.2.1 Externally Generated Approaches**

These AIPs use *externally generated* stimuli from outside sources that are not provided by, or personally relevant to, the individual (Gerrards-Hesse et al., 1994; Salas et al., 2012). Two widely used types are pictures and film clips (see Fernández-Aguilar et al., 2019; Ferrer et al., 2015; Lench et al., 2011, for reviews). The most used set of pictures is the International Affective Picture System (IAPS; Lang et al., 2008), which contains a database of colour

emotions as *short-term* states produced by a stimulus, moods as *longer-term* states that are *unrelated* to a stimulus and affect as a categorization for emotion *and* mood. Thus, AIPs can produce *both* short- and long-term states of emotion and mood, respectively. <sup>6</sup>On a historical note, one of the earlier tools was the Velten self-referential statements (Velten, 1968). Participants read each of these statements, and then tried to feel the targeted depressive or elated state. Despite its extensive use, methodological concerns such as experimental manipulation and demand characteristics were thought to have negatively impacted this method's effectiveness (see Kenealy, 1986; Larsen & Sinnett, 1991 for reviews). photographs depicting various emotion evoking, real-world scenes. Each picture has accompanying normative data on its valence, from pleasant to unpleasant, and arousal, from calm to excited, which is rated on a 9-point Likert scale. With regards to film clips, excerpts from several movies have been selected according to the desired target emotion (see Hewig et al., 2005 for a review). In relation to anger, these excerpts contain scenes of police brutality or violence, from films such as Gandhi, Witness, Cry Freedom, and My Bodyguard. After viewing each picture or film clip, participants are usually asked to rate the intensity of their emotions using a self-report measure.

**Strengths and limitations.** External AIPs have demonstrated an ability to elicit discrete emotions in neurologically healthy individuals (Gross & Levenson, 1995; Fernández et al., 2012; Mikels et al., 2005; Salas et al., 2012) and those with ABI (McDonald et al., 2010; Rowlands et al., 2021; Salas Riquelme et al., 2015). Furthermore, they have been a popular choice due to their methodological strengths, such as standardisation and experimental control (Ferrer et al., 2015). Nonetheless, the diverse types differ in their effectiveness (Ferrer et al., 2015; Uhrig et al., 2016), in addition to having several limitations regarding their standardisation, cultural sensitivity, and effectiveness for eliciting anger.

*Standardisation.* First, although the standardisation of external AIPs is a strength, it is also a limitation, as it varies across experimental studies in three notable ways. For one, different stimuli, such as films, have been chosen to elicit the same target emotion (e.g., anger is elicited through four different films; Hewig et al., 2005). Relatedly, the content and therefore themes of these clips differ (e.g., harassment or bullying). Furthermore, these clips vary in their duration, ranging between 32 and 236 seconds. Notably, these three variations are relevant to studies using pictures, too. Thus, while *individual* experiments follow standardised procedures (e.g., every participant receives the same stimulus, such as viewing

the same film clip or picture), these procedures differ *across* experiments (Siedlecka et al., 2019). As such, the influence of potential confounding variables cannot be ignored.

*Cultural sensitivity.* A second limitation of external AIPs is that they may not be culturally sensitive. In other words, there are cultural differences in emotion elicitation, such that individuals from North America produce the strongest emotional responses, compared to those from Asia or Central and South America (Joseph et al., 2020). Therefore, external stimuli may need to be adapted and validated for use in the intended population (Huang et al., 2015; Soares et al., 2015).

*Anger elicitation*. Although, on average, AIPs effectively elicit both positive (e.g., happiness, cheerfulness) and negative (e.g., anger, sadness) emotions, the *degree* of each tool's effectiveness varies according to the *type* of elicited emotion (see Joseph et al., 2020 for effect sizes of AIPs by target emotion). Thus, a third and most relevant limitation is the ability of external AIPs to elicit *anger*. This limitation was recognized by Mikels and colleagues (2005) and proposed to be an issue because anger is particularly difficult to elicit using artificial or *personally irrelevant* methods (Joseph et al., 2020; Lobbestael et al., 2008, 2009; Rowlands et al., 2021; Salas et al., 2012). As such, the participant is essentially a bystander of someone else's emotion-evoking material, therefore they themselves may not necessarily be experiencing the target emotion (Lobbestael et al., 2009). Relatedly, the elicitation of anger, compared to other discrete emotions, may require a higher level of engagement than, for example, merely passively viewing unmeaningful static pictures (Lobbestael et al., 2009; Mikels et al., 2005). Thus, internally generated AIPs have gained popularity in the last two decades, as they may induce more authentic and powerful emotions due to their personal salience.

### **1.2.2 Internally Generated Approaches**

These AIPs use *internally generated* stimuli from the individual themself, therefore they are personally relevant (Gerrards-Hesse et al., 1994; Salas et al., 2012). The most widely used internal AIP is autobiographical recall, whereby the individual discusses a personal event or situation where they felt the target emotion (Joseph et al., 2020; Mosak & Dreikurs, 1973). The suggested mechanism behind this method is that ruminating on a real event makes it feel as if the event happened recently, regardless of when it occurred, or its affective intensity (Siedlecka et al., 2015). Thus, the act of recalling a past event reignites the originally induced affect, resulting in a relived experience.

The Affective Story Recall (ASR; Turnbull et al., 2005) has demonstrated an ability to elicit discrete emotions in neurologically healthy individuals or survivors of ABI (Rowlands et al., 2020, 2021; Salas et al., 2012; Salas Riquelme et al., 2015). During this task, participants verbally recall, in as much detail as possible, a personal event or situation from their past where they felt the target emotion. After recalling the event, they usually rate the intensity of their emotions with a self-report measure. As autobiographical recall appears to be the most effective when participants are aware of the task's intent (Joseph et al., 2020), instructions for the ASR specifies which emotion it is designed to elicit.

**Strengths and limitations.** Internal AIPs such as autobiographical recall have demonstrated an ability to elicit discrete emotions in neurologically healthy individuals (Jallais & Gilet, 2010; Mills & D'Mello, 2014; Salas et al., 2012) and those with ABI (Rowlands et al., 2020, 2021; Salas Riquelme et al., 2015). These AIPs are advantageous due to the personal salience of the emotional content, which may produce more powerful emotional intensities and stronger physiological responses. In addition, such AIPs arguably produce more authentic emotional experiences due to their real-world relevance (Aboulafia-Brakha et al., 2016; Foster & Webster, 2001; Jallais & Gilet, 2010; Lobbestael et al., 2008,

2009; Marci et al., 2007; Rowlands et al., 2021; Salas et al., 2012; Salas Riquelme et al., 2015; Waldstein et al., 2000). Furthermore, the finding that autobiographical recall has been identified as the most effective method for inducing anger specifically (see Joseph et al., 2020 for a review), confirms that the induction of this emotion requires personally salient stimuli. Nonetheless, these methods are most limited by their susceptibility to demand effects (Jallais & Gilet, 2010; Joseph et al., 2020; Siedlecka et al., 2019).

*Demand effects.* These occur when the participant is aware of the AIP's aim, and therefore pretends to be in the targeted affective state to conform to experimental demands (Westermann et al., 1996). Thus, they may not *truly* experience the desired affect. This is especially an issue when the participant receives an overt instruction, such that the AIP is designed to elicit *anger*, and they should therefore enter an angry state. However, a merit of this instruction is that it assists participants in *genuinely* feeling the targeted affect, as they can fully focus on this experience without the distraction of intruding thoughts regarding its purpose (Westermann et al., 1996).

Importantly, this merit provides an explanation as to why personal AIPs may produce more powerful emotional and physiological responses. In addition, it may also explain why findings on the influence of demand effects on these AIPs are mixed, especially as there is limited evidence supporting the notion that participants are interested in deciphering experimental aims (Berkowitz & Troccoli, 1986; Cook & Campbell, 1979). Nonetheless, researchers should choose their AIP based on the desired target emotion (Joseph et al., 2020; Siedlecka et al., 2019). Therefore, it is at their discretion to decide whether demand effects pose a sincere threat to their chosen AIP's validity<sup>7</sup>. Thus, as empirical evidence supports the

<sup>&</sup>lt;sup>7</sup>Westermann and colleagues (1996) suggest two ways to determine this. Firstly, to investigate whether the autobiographical recall task elicits levels of other non-targeted

notion that autobiographical recall is the most effective AIP for anger (Joseph et al., 2020), it seems like the appropriate approach for inducing this emotion.

*Subjectivity.* A second limitation of internal AIPs pertains to their subjective nature. Compared to external AIPs, which use objective stimuli (i.e., pictures, film clips), internal AIPs like autobiographical recall use individualised stimuli (i.e., personal stories) which are highly variable from person-to-person. This is arguably the greatest strength of these AIPs, as it supports the elicitation of genuine and powerful affective states (Aboulafia-Brakha et al., 2016; Foster & Webster, 2001; Jallais & Gilet, 2010; Lobbestael et al., 2008, 2009; Marci et al., 2007; Rowlands et al., 2021; Salas et al., 2012; Salas Riquelme et al., 2015; Waldstein et al., 2000). However, it is also a limitation, as this element of subjectivity does not lend itself towards standardisation. Nonetheless, as discussed previously, individual experiments using external AIPs for anger may follow standardised procedures, however these often differ across experiments in terms of the type, content, and duration of the stimuli (Hewig et al., 2005; Siedlecka et al., 2019). A similar argument can therefore be made for internal AIPs, in that every participant receives standardised instructions for the task, however the task itself may generate different types, contents and durations of stories.

# **1.2.3 Using AIPs in Clinical Populations**

Another relevant topic is whether AIPs are effective in clinical populations. Importantly, Joseph and colleagues' (2020) suggest that both positive and negative AIPs are *as* effective in clinical as they are in non-clinical populations. That is, individuals with clinical diagnoses are

affective states that were not declared by the researcher. And secondly, to consider including objective outcome measures, such as physiological responses, which are not as easily faked and therefore potentially impervious to demand effects.

*not* more emotionally responsive than their non-clinical counterparts. However, they do appear to be in a more negative affective state prior to commencing an AIP. Nonetheless, considering that these individuals have benefited from improved mood following AIPs, these tools are both effective and recommended for emotional rehabilitation in clinical populations.

# **1.3 Emotion Regulation**

The last few decades have seen an increasing understanding of how we regulate our emotions, especially after brain injury (Salas et al., 2019). Thus, the issue of managing post-ABI anger has been addressed using a range of pharmacological and non-pharmacological, or psychological, interventions (see Alderman, 2003; Alderman et al., 2013 for reviews). Despite their potential efficacy, pharmacological interventions present mixed evidence, in addition to resulting in adverse health effects for some of their users (see Alderman, 2003; Alderman et al., 2013; Hicks et al., 2019; Williamson et al., 2019 for reviews).<sup>8</sup> Thus, psychological interventions may provide a safer and effective alternative for managing post-ABI anger.

# 1.3.1 Psychological Interventions for Post-ABI Anger

Post-ABI anger has been addressed by various psychological approaches, such as cognitive behavioural therapy (CBT), applied behavior analysis, and comprehensive-holistic rehabilitation programs (see Alderman, 2003, Alderman et al., 2013; Byrne & Coetzer, 2016;

<sup>&</sup>lt;sup>8</sup>For example, Hicks and colleagues (2019) reviewed a range of medications (e.g., neurostimulants, beta-blockers) and, despite their mixed findings (like Williamson et al., 2019), recommended that amantadine (used to treat symptoms of Parkinson's disease) was the most appropriate. Nonetheless, the use of this medication in one individual may have led to a seizure.

Cattelani et al., 2010; Iruthayarajah et al., 2018 for reviews). Of these, CBT is the most widely used approach for the treatment of anger (see Lee & DiGiuseppe, 2018 for a review). However, these interventions vary greatly in terms of treatment duration, intensity, and frequency, with some needing major content modifications as well as longer periods of application (Alderman et al., 2013; Cattelani et al., 2010; Witten et al., 2022). In addition, CBT concepts can be challenging for survivors of ABI to grasp, as they may require a level of abstract, metacognitive ability that depends on executive functions (Ciurli et al., 2010; Moritz et al., 2022; Sassaroli et al., 2014). This approach is also suggested to be less beneficial for survivors of ABI when they are attempting to process their significant injury-related lifestyle changes and losses (Kangas & McDonald, 2011), which may be further compounded by issues of social isolation or loneliness (Byrne et al., 2022; Salas et al., 2018).

Furthermore, CBT-based studies for post-ABI anger do not always include follow-up data, and those which do demonstrate inconclusive findings regarding the maintenance of intervention gains over time (Byrne & Coetzer, 2016; Cattelani et al., 2010; Iruthayarajah et al., 2018; Witten et al., 2022). In addition, individual versus group administration poses a further challenge, with the latter requiring stringent inclusion criteria that limits the generalisability of their efficacy (Alderman et al., 2013). Although group settings are cost-effective in terms of resource allocation, and provide shared social support, they are not conducive to individual differences in ABI-related impairments of cognition, insight, and self-awareness (Alderman et al., 2003; Alderman et al., 2013).<sup>9</sup> But perhaps the most

<sup>&</sup>lt;sup>9</sup>It may also be argued that the same variance of cognitive impairment would exist whether individuals are seen one-to-one or as a group. The point here is that in a group with varying levels of impairment, the same content that is tailored for someone with moderate levels may not be understandable by those with more severe levels. This could therefore compromise the

pertinent limitation of existing CBT-based studies relates to how their theoretical components contribute to the intervention's design and implementation.

An ER-based approach. Existing approaches for post-ABI anger arguably neglect the significant contribution of impaired *ER* as the primary mechanism of uncontrollable anger (Salas et al., 2019; Witten et al., 2022). Although some of these approaches may include an ER component, these are usually just one of *several* different taught skills (e.g., Aboulafia-Brakha et al., 2013; Aboulafia-Brakha & Ptak, 2016; Medd & Tate, 2000). Therefore, there is an opportunity to design and implement interventions that focus on improving ER specifically, through the application of such strategies to day-to-day emotion-evoking situations.

The field of ER has grown substantially over the last several decades, with suggestions of various models and theoretical perspectives to explain ER-related processes (see Hofmann, 2014; Koole, 2009; Larsen, 2000; Salas et al., 2019; Tull & Aldao, 2015 for reviews). These frameworks can be conceptualised into two separate categories pertaining to ER and its techniques (see Grecucci et al., 2020 for a review and comparison of these categories).

The first category relates to *experiential* techniques, where emotions are regulated by *experiencing* them (Grecucci et al., 2020; Vandekerckhove et al., 2012). The emphasis is therefore on emotional *expression* (instead of control), by concentrating on its accompanying physiological sensations and creating an awareness of the emotional state. One example of a model that falls under this category is the Experiential-Dynamic Emotion Regulation (EDER) Model (Frederickson et al., 2018). This model suggests that ER is influenced by the ongoing

intervention's efficacy. On the other hand, in a one-to-one setting, the interventionist can modify the content accordingly, without impacting other participants.

process of experiencing the emotion, instead of voluntarily avoiding or suppressing it through a regulatory technique. In other words, actively engaging in this process will result in healthy emotion-related behaviours, including effective regulation.

The second category relates to regulating emotions through the *deployment* of cognitive techniques (Grecucci et al., 2020). The emphasis is therefore on emotional *control* (instead of expression). As such, emotion dysregulation may arise if ER techniques are *not* used in emotion-evoking situations to, for example, avoid the emotional response (Grecucci et al., 2020). One example of a model that falls under this category is the Process Model of ER (Gross, 1998a, 2014; Gross & Thompson, 2007). This model is the most extensively used in ER research with neurotypical populations (see Webb et al., 2012 for a review) and survivors of ABI (Rowlands et al., 2020, 2021; Salas et al., 2014, 2016). It aims to directly improve ER through the choice of multiple techniques that can be selected according to the survivor's injury-related circumstances (Salas et al., 2019; Witten et al., 2022).

The Process Model proposes five classes of regulatory techniques for emotion management: situation modification, situation selection, attentional deployment, cognitive change, and response modulation. These techniques can be categorised as antecedentfocused: manipulating an emotional reaction *before* it occurs, or response-focused: manipulating an emotional reaction *after* it occurs (John & Gross, 2004; Mauss et al., 2007). Although this section will focus on reappraisal (i.e., Talk) and distraction (i.e., Chalk), the remaining techniques and their applicability for post-ABI anger are discussed in Chapter Three (Witten et al., 2022) and considered by Salas and colleagues (2019) in relation to changes in ER after brain injury. See Table 1.1 for a description and example of each ER technique.

Techniques	Description	<b>Example: Driving in Traffic (Anger)</b>	
Antecedent-focused			
Situation modification	Making environmental adaptions in response to an unfolding situation as it occurs or soon after, according to the favoured or unfavoured emotional response (Gross, 2014; Gross & Jazaieri, 2014; Salas et al., 2019).	Turning the radio on while in the car, to listen to calming music as the traffic gets heavier.	
Situation selection	Making an advanced decision about which future situations to avoid or embrace, according to the favoured or unfavoured emotional response (Gross, 2014; Gross & Jazaieri, 2014). Particularly useful for those who have difficulties with regulating their emotions in the moment (Webb et al., 2018).	Choosing not to drive during peak times, because this has previously resulted in aggressive outbursts.	
Attentional deployment Distraction	Redirecting attention away from an aversion, or towards something neutral or pleasant, according to the favoured or unfavoured emotional response (Gross, 1998b, 2014; Gross & Jazaieri, 2014).	Redirecting attention away from the traffic and focusing on a memory of a recent beach holiday.	
Cognitive change Reappraisal	Altering thoughts about a situation according to it's favoured or unfavoured emotional response, by positively reframing the perception or meaning of a negative situation (Gross, 2013, 2014; Gross & Jazaieri, 2014; Gross & Thompson, 2007; McRae et al., 2012; Turnbull & Salas, 2021).	Reframing the situation as providing an opportunity to reflect on the day's events.	
Response-focused			
Response modulation Suppression	Inhibiting or hiding an emotional response to a situation that has already occurred (Gross, 2014; Gross & Jazaieri, 2014; Gross & Levenson, 1997).	Maintaining a neutral facial expression during the experience of anger.	

Table 1.1 Techniques from the Process Model of Emotion Regulation (Gross, 1998a, 2014; Gross & Thompson, 2007).

*Reappraisal.* Of the Process Model's ER techniques, reappraisal is the most widely investigated, and shows the most promise for emotion management in neurologically healthy individuals and those with ABI.<sup>10</sup> For example, Webb and colleagues' (2012) meta-analysis demonstrated that in neurologically healthy samples, reappraisal was the most effective for reducing negative emotions (e.g., by preventing angry responses; Beames et al., 2019), followed by response modulation (c.f., Beames et al., 2019; Kalokerinos et al., 2015) and attentional deployment, respectively. In relation to anger, reappraisal also appears to be more effective than response modulation for regulating the experience and expression of this emotion (Szasz et al., 2011).

A similar pattern of findings in studies with survivors of ABI demonstrated that reappraisal reduced negative emotions, including anger (Aboulafia-Brakha et al., 2016; Rowlands et al., 2020, 2021). Given this strategy's effectiveness, it is no surprise that the merits of reappraisal have been recognized *beyond* emotion management interventions for this clinical population. For instance, survivors of ABI who participated in an intervention for wellbeing, reported the use of positive reframing as a coping mechanism, by, for example, reappraising an anxiety-inducing situation as an opportunity for challenge (Tulip et al., 2020). The impact of this strategy therefore extends across multiple facets of post-ABI rehabilitation.

Nevertheless, there is also evidence to suggest that reappraisal does not always downregulate negative affect (e.g., Brockman et al., 2017). Furthermore, despite the common use of reappraisal amongst neurologically healthy individuals, this strategy is

<sup>&</sup>lt;sup>10</sup>Although reappraisal and response modulation are the only ER techniques that have been investigated in this clinical population (e.g., Rowlands et al., 2020, 2021; Salas et al., 2014, 2016).

suggested to rely on cognitive control abilities that may be affected after an ABI (Dunning et al., 2016; Nezlek & Kuppens, 2008; Salas et al., 2019; Strauss et al., 2016; Turnbull & Salas, 2021).<sup>11</sup> In particular, working memory, verbal fluency and inhibition have been identified as cognitive domains that are associated with the implementation of this strategy in survivors of ABI, such that poorer performance was associated with a longer time taken to produce a first reappraisal, and/or a fewer number of reappraisals produced (Rowlands et al., 2020, 2021; Salas et al., 2013, 2014). On the other hand (and regardless of age), distraction is preferred by individuals who have less cognitive control, suggesting that this technique may necessitate fewer cognitive resources, potentially providing an alternative for survivors of ABI (Scheibe et al., 2015; Shafir et al., 2022).

*Distraction.* Distraction appears to be another effective ER strategy in neurotypical populations. However, compared to reappraisal, it is less-well investigated (Webb et al., 2012). Interestingly, Webb and colleagues (2012) demonstrated that within attentional deployment, distraction was more effective than concentration, or focusing on positive affect-eliciting tasks (Gross, 1998b). Furthermore, the authors distinguished between two types of distraction that had variable effects.

The passive type provides the individual with a task that is unrelated to the evoked emotion, and demonstrated small effects (Webb et al., 2012). For example,

<sup>&</sup>lt;sup>11</sup>Indeed, it is suggested that all techniques deriving from the Process Model require cognitive resources for their implementation and/or effectiveness (see Salas et al., 2019; Turnbull & Salas, 2021 for further details). Nonetheless, in terms of their use by survivors of ABI, it is arguably *which* of these techniques might require the *least* amount of cognitive effort.

participants imagined and wrote a description of their university campus (see Denson et al., 2012). On the other hand, the active type assigns responsibility to the individual for generating their own distractive thought that is unrelated to the evoked emotion, and demonstrated small to medium effects (Webb et al., 2012). For example, participants focused on neutral thoughts, like shapes or day-to-day tasks (Shafir et al., 2015).<sup>12</sup> Nonetheless, few studies have investigated active distraction, especially with regards to asking individuals to generate something positive (Webb et al., 2012). Furthermore, existing Process Model-based interventions for survivors of ABI have not included distraction (e.g., Rowlands et al., 2020, 2021).

*Reappraisal versus distraction.* Both reappraisal and distraction appear to reduce negative affect, including anger, in neurologically healthy individuals (Denson et al., 2012; Dhaka & Kashyap, 2017; Fabiansson et al., 2012; McRae et al., 2010; Strauss et al., 2016). Furthermore, these two techniques are better implemented by older compared to younger adults (Lohani & Isaacowitz, 2014). However, findings on their comparative efficacy are mixed: in some cases, reappraisal produced larger reductions (McRae et al., 2010) especially in older adults (Lohani & Isaacowitz, 2014), whereas in others, distraction did (Denson et al., 2012). Notably, most of these studies used pictures from the IAPS (Lang et al., 2008) which elicited *general* negative affect (i.e., McRae et al., 2010; Strauss et al., 2016), with fewer studies focusing on the elicitation of *anger*, specifically (Denson et al., 2012). In addition to their efficacies, there is a growing body of literature on ER strategy choice (or preference) by neurologically healthy individuals, which appears to be influenced by factors of emotional intensity

<sup>&</sup>lt;sup>12</sup>Notably, this study used emotion-inducing pictures of fear, sadness, and disgust which were measured by electrophysiological and behavioural outcomes (Shafir et al., 2015).

and situation frequency (both related to the techniques' mechanisms), and less conclusively, age.

In terms of emotional intensity, reappraisal is preferred for *low* levels of negative emotion, as it enables individuals to *engage* with the situation and process their immediate emotional reactions (Scheibe et al., 2015; Shafir et al., 2015; Sheppes et al., 2011; Van Bockstaele et al., 2020). Notably, this strategy is suggested to no longer be effective for high levels of emotional intensity (Sheppes et al., 2011). Although the impact of reappraisal is not always immediately clear, this technique supports the long-term adaptive processing of negative emotions like anger (Denson et al., 2012; Scheibe et al., 2015; Sheppes et al., 2011). On the other hand, distraction is preferred for *high* levels of negative emotion, as it offers immediate short-term emotional relief by enabling individuals to *disengage* from the situation early on, preventing the processing of emotions before they become intense (Feldman & Freitas, 2021; Martins et al., 2018; Scheibe et al., 2015; Shafir et al., 2015; Sheppes et al., 2011; Van Bockstaele et al., 2020).<sup>13</sup>

In terms of situation frequency, reappraisal may be more beneficial for *recurring* confrontational situations, such as with a disliked colleague, due to its emphasis on cognitively resolving (or reframing) these situations (Denson et al., 2012). On the other

<sup>13</sup>Shafir and colleagues (2015) note that to confirm that reappraisal and distraction were distinctly different (i.e., that their respective tasks involved *engagement* with or *disengagement* from the emotional stimuli), their participants were not permitted to give reappraisals that were associated with reality modifications. For example, if they reframed a scenario in a photograph as being fake, reappraisal's mechanism would be disengagement.

hand, distraction may be more beneficial for *once-off* situations, such as not returning to a specific shop where there was a disagreement with the teller, due to this strategy's ability to provide temporary but immediate emotional respite (Denson et al., 2012). This may especially be the case for future high-intensity, once-off, negative situations that have not yet occurred (Feldman & Freitas, 2021).<sup>14</sup>

In terms of age, the findings are less conclusive. One line of research suggests that older compared to younger adults preferred distraction over reappraisal for regulating negative emotions, regardless of their intensity (Scheibe et al., 2015).<sup>15</sup> This suggestion is in keeping with the finding that older adults do appear to use more attentional deployment techniques (and more efficiently; Wirth & Kunzmann, 2018) to reduce the intensity of negative emotions (see Allen & Windsor, 2019 for a review), which has been associated with better overall affective wellbeing amongst these individuals (Scheibe et al., 2015).<sup>16</sup> Notably, there were no age-related differences for the use of cognitive change techniques like reappraisal (Allen & Windsor, 2019). However, another line of research suggests that there is no difference in technique preferences for negative emotions by age (Martins et al., 2018). Nonetheless, older

<sup>&</sup>lt;sup>14</sup>Interestingly, recent emotional experiences may also influence technique choice for future situations (Feldman & Freitas, 2021).

<sup>&</sup>lt;sup>15</sup>Scheibe and colleagues (2015) measured general negative affect through the IAPS. <sup>16</sup>Interestingly, better ER (and therefore affective wellbeing) in older adults is suggested to reflect their increased ability to manage their emotional responses, by optimising their chosen ER technique, or inhibiting unwarranted emotional reactions (Orgeta, 2009; Urry & Gross, 2010).

adults do appear to use less cognitively demanding techniques (Allen & Windsor, 2019).

# 1.3.2 The Brain Basis of ER and Unregulated Anger

Over the last several decades, the field's increasing understanding of emotions and their management has also encouraged the development of research regarding the neural bases of these regulatory systems. While genetic and environmental factors play a role in ER, this ability also depends on the normal functioning of specific brain regions (Canli et al., 2009; Etkin et al., 2015; Wang & Saudino, 2013). Hence, this topic has been widely investigated in neuroimaging research with neurologically healthy individuals, which suggests that ER systems are largely cortical (see Etkin et al., 2015; Turnbull et al., 2021 for reviews). Namely, these systems involve the frontal lobes (i.e., dorsolateral, ventrolateral, and ventromedial prefrontal cortices [PFCs]), presupplementary and supplementary motor areas, parietal cortex, dorsal and ventral anterior cingulate cortices, and the insula (Etkin et al., 2015; Turnbull & Salas, 2021).

Of particular interest, though, is the emerging notion that *each* regulatory strategy may have its *own* set of differential affective networks (Turnbull & Salas, 2021). Such networks involve connections between areas of the PFC, which are associated with cognitive control, and limbic regions, which are associated with modulating affective responses (McRae et al., 2010; Turnbull & Salas, 2021). For example, in a neuroimaging study comparing reappraisal and distraction, both were associated with increased activity in PFC and cingulate regions, and decreased amygdala activity (McRae et al., 2010).<sup>17</sup> However, compared to distraction, and

<sup>&</sup>lt;sup>17</sup>See Buhle and colleagues (2014) for a meta-analysis of neuroimaging studies on reappraisal. For example, their findings demonstrated activation in the dorsolateral,
consistent with reappraisal's definition, this strategy was associated with larger increases in areas related to processing the meaning of affective stimuli (i.e., anterior temporal cortex and medial PFC). When compared to reappraisal, distraction was associated with larger increases in activity in the parietal cortex and PFCs, and larger decreases in amygdala activity (Kanske et al., 2011; McRae et al., 2010). Thus, it appears that each ER technique engages similar and different brain structures (see Etkin et al., 2015 for a neuroimaging review of the neural substrates of ER, or Dörfel et al., 2014; Goldin et al., 2008 for further information on individual strategies).

Furthermore, given the important role of various frontal regions in emotion management, it comes as no surprise that individuals who have sustained injuries to these areas from an ABI would be especially susceptible to difficulties with anger regulation (Blair, 2012; Salas et al., 2019). Specifically, in keeping with the cortical basis of ER (Etkin et al., 2015; Turnbull et al., 2021), and supported by both neuroimaging and lesion studies (which provide a valuable avenue for investigating and understanding brain-behaviour relationships; Feinstein, 2013), injury to the ventromedial and (lateral) orbitofrontal cortices and their relevant networks has been selectively associated with unregulated anger (and no other negative emotion), due to this circuit's role in inhibiting such automatic emotional responses (Choi-Kwon & Kim, 2022; Dougherty et al., 2020; Potegal, 2012; Starkstein & Robinson, 1991). Simply put, the cortex's inhibitory role on the amygdala is disrupted (Starkstein & Robinson, 1991).

ventrolateral, and dorsomedial PFCs, as well as posterior parietal and temporal regions, in addition to decreased activation of the amygdala bilaterally.

It therefore appears that survivors of ABI who have sustained frontal lobe injuries may be particularly susceptible to anger dysregulation.

### **1.4 Telehealth and Emotions**

Telehealth (also known as telemedicine), refers to the real-time administration of a variety of healthcare services, including research-related psychological interventions, through various internet-based information and communication technologies (VandenBos & Williams, 2000). Prior to the COVID-19 pandemic, telehealth was recognised as a potentially acceptable, feasible, and effective approach for clinical service delivery (see Banbury et al., 2018; Barnett et al., 2021 for reviews). However, when mandatory restrictions limited in-person interactions during the pandemic, telehealth services were essential to continue conducting research and delivering healthcare (Doraiswamy et al., 2020; Dores et al., 2020; Hlatshwako et al., 2021; Mendes-Santos et al., 2020; Witteveen et al., 2022).

Importantly, this approach is favoured for providing a more affordable and timeefficient alternative that increases patient access to healthcare, especially in rural areas (Banbury et al., 2018; Carrillo de Albornoz et al., 2022; Jadhakhan et al., 2022). Telehealth is also favoured for its scalability, by, for example, being able to cater to individuals with reduced mobility, or to those who are socially isolated (Banbury et al., 2018; Jadhakhan et al., 2022). Nonetheless, the drawback to this approach is also wellknown, particularly in relation to its technical requirements (e.g., stable internet connection, digital literacy) and, consequentially, accessibility barriers (Jadhakhan et al., 2022). Of the various telehealth modalities, web-based tools and videoconferencing (VC) platforms are the most widely investigated (Chen et al., 2015; Ferrer et al., 2015; Jadhakhan et al., 2022).

#### 1.4.1 Web-Based Tools

Web-based AIPs, without a face-to-face element, consist of tools that are comprised of software (e.g., Qualtrics, Survey Monkey, PsyToolkit, Gorilla) that researchers can use to design and conduct independently administered experiments (Ferrer et al., 2015). Thus, these tools have a unique self-help component, with an additional advantage of not requiring the presence or oversight of the researcher during data collection (Jadhakhan et al., 2022).

These tools have been used in online experiments of affect induction (e.g., Marcusson-Clavertz et al., 2019), and can effectively induce general negative and positive affective states, and most discrete emotions, including anger (Ferrer et al., 2015).<sup>18</sup> Furthermore, web-based AIPs for negative emotions like anger were *almost* as effective as in-person/laboratory-administered AIPs. In addition, except for film clips, all web-based AIPs were able to induce their targeted affective states without simultaneously inducing non-targeted states (Ferrer et al., 2015). In relation to ER, although the number of studies in this field are modest, they do appear to improve ER in individuals with mental health conditions (see Jadhakhan et al., 2022 for a review), as well as in individuals from non-clinical populations (e.g., Flujas-Contreras et al., 2021; Stappenbeck et al., 2021).

<sup>18</sup>Overall, web-based AIPs did not effectively elicit happiness (Ferrer et al., 2015). This may be because positive emotions are not as easily elicited as negative emotions if participants are already in a positive mood at baseline, if they are not, for example, required to physically be in, or travel to, the laboratory (Göritz, 2007; Göritz & Moser, 2006). Although web-based tools are a potentially effective and comparable alternative to in-person approaches, further research is necessary to support a more robust finding, given the limited number of (CBT-based) studies and their various methodological limitations, such as small sample sizes (Jadhakhan et al., 2022). Furthermore, without the presence of, and oversight from, a researcher (or interventionist), there is clearly a lack of experimental control (Ferrer et al., 2015). Thus, it is difficult to confirm the reliability of the data if the researcher (or interventionist) cannot ensure that the participant is fully engaged in the task, or free of environmental distractions, such as other people or noise (Ferrer et al., 2015). In addition, at least for emotion elicitation, web-based AIPs are still comparably less effective than those administered in an in-person/laboratory setting (Ferrer et al., 2015). It may therefore be useful to explore other types of online modalities that may more reliably and effectively elicit affective states like anger.

# 1.4.2 VC Platforms and Telerehabilitation

Telerehabilitation is the administration of rehabilitation services through internet-based information and communication technologies (Brennan et al., 2011). These use VC platforms, which provide a virtual space for live visual and audio communications between users (Sabri & Prasada, 1985). Although these platforms have not, to date, been used to elicit discrete emotions like anger, of the various telehealth modalities, they are suggested to be as effective as in-person approaches (Banbury et al., 2018; Barnett et al., 2021). This may be because, compared to self-help web-based tools, VC environments could produce similar in-person facets of cohesion and connection (Banbury et al., 2018) through its face-to-face component. In addition, this component enables the interventionist to maintain a certain level of control, by managing the participant's understanding, effort, and attention (Ferrer et al., 2015).

Before the pandemic, the small but growing ABI telerehabilitation field recognised the merits of VC platforms (see Chen et al., 2015 for a review), including for the delivery of ER-based interventions. Furthermore, the administration of self-report measures to survivors of TBI via VC was suggested to be as effective and reliable as those administered in-person (Rietdijk et al., 2017). However, during the pandemic, VC platforms were a particularly favourable and promising alternative for the delivery of psychological interventions that required a face-to-face component (e.g., see Bryant et al., 2022 for an example of a successful mental health intervention). For example, in relation to survivors of ABI, Wilkie and colleagues (2021) conducted a series of wellbeing interventions that were partly administered over Zoom. PowerPoint presentations were used to guide participants during the intervention sessions, which covered topics such as irritability, changes in behaviour, and the effect on participants' families. In addition to facilitating ER improvements, participants were able to engage through this platform, and highlighted the benefit of easier access to rehabilitation resources, compared to the difficulties experienced with obtaining in-person appointments.

**ER-based interventions for ABI.** Only two studies have investigated the feasibility and effectiveness of a VC-administered group-based intervention for ER after brain injury. The first feasibility study, with a group of survivors of TBI, demonstrated high attendance rates across sessions (over 90%), successful completion of questionnaires online and acquisition of taught skills, and high treatment satisfaction (Tsaousides et al., 2014). In support of its effectiveness, their follow-up study demonstrated preliminary evidence of significant reductions in ER difficulties after the intervention, which continued to decrease until follow-up (Tsaousides et al., 2017). The authors suggest that such findings are particularly noteworthy, as they may be an

indicator of continued application and use of intervention skills after treatment has ceased, with implications for its real-world applicability.

Several advantages have been reported by survivors of TBI who participated in the above studies (Tsaousides et al., 2014, 2017). Firstly, similar to Wilkie and colleagues (2021), participants reported that this mode of delivery provided a means to receive treatment for people who would not usually have access to TBI specialists because, for example, of their physical location. Secondly, even for those who were living near the physical facilities, this mode of delivery was more convenient as they could take part from home, therefore circumventing any travel and transportation requirements. Thirdly, for some, the virtual setting was less distracting than in-person and associated with less fatigue.

Comparatively minor and short-term disadvantages were also reported (Tsaousides et al., 2014, 2017). For one, some participants initially found the virtual environment and interactions uncomfortable. However, this discomfort appeared to dissipate as the sessions progressed, with some participants requesting an early start to the session so they could have an informal chat with each other, as they would have done by arriving early to an in-person meeting. Secondly, like web-based tools (e.g., Jadhakhan et al., 2022), some participants reported technical difficulties, although these did not appear to interfere with their engagement.

# 1.5 Thesis Aims

This review has highlighted several notable gaps in the literature, which, if addressed, could contribute to authentic, meaningful, and long-lasting changes in the lives of survivors of ABI and their loved ones. This thesis aims to address these gaps, which can be categorized according to five key areas.

#### **1.5.1** Personalise the Narrative

Autobiographical recall tools have been identified as the most effective AIP for anger (Joseph et al., 2020). Importantly, family and spousal relationships are especially affected by uncontrollable anger (Choi-Kwon & Kim, 2022). However, no studies have applied different *categories of relationship* to these tools and investigated whether they produce varying levels of emotional intensity. Addressing this crucial question may further our understanding of the nature of anger in personal relationships. Chapter Two addresses how five anger-targeted categories of relationship (Beames et al., 2019; Choi-Kwon & Kim, 2022; Saban et al., 2016) produce varying intensities of anger.

# 1.5.2 An ER-Based Approach

The Process Model of ER (Gross, 1998a, 2014; Gross & Thompson, 2007) has informed a range of studies in neurotypical populations (Webb et al., 2012), but only a handful in populations with ABI (Rowlands et al., 2020, 2021; Salas et al., 2013, 2016). Most of the anger management or ER interventions for survivors of ABI are based on CBT (Byrne & Coetzer, 2016; Iruthayarajah et al., 2018; Tsaousides et al., 2014, 2017), and none on a *theoretical model of ER*. While CBT has its merits, it also has several practical challenges which can complicate an intervention's implementation and the interpretation of findings (Alderman et al., 2013; Cattelani et al., 2010; Iruthayarajah et al., 2018; Witten et al., 2022). CBT also has multiple components and does not focus on the substantial contribution of impaired ER as the principal mechanism of uncontrollable anger (Salas et al., 2019; Witten et al., 2022). This is a notable limitation, considering that the theoretically motivated and well-established ER-based approach offers the opportunity to design targeted interventions. Chapters Two and Four address how two ER techniques from the Process Model (i.e., reappraisal and distraction) can decrease anger.

#### 1.5.3 Zero-in on Anger

The few studies on ER techniques in ABI have focused on *multiple* discrete emotions (Rowlands et al., 2020, 2021; Salas et al., 2013, 2016). Although, in some studies, anger is one of these (Rowlands et al., 2020, 2021), this emotion has not been the *sole* focus of targeted regulation. This is an important limitation, as the poor management of anger is related to other symptoms of mental health (Baguley et al., 2006; Caplan et al., 2017; Gould, 2019; Roy et al., 2017; Tateno et al., 2003), in addition to being singled out by relatives and partners as the most significant consequence of their survivors' brain injury (Choi-Kwon & Kim, 2022; Saban et al., 2016). Focusing specifically on the most challenging emotion of anger could improve the emotional wellbeing of both survivors and their loved ones. Chapter Four addresses the preliminary efficacy of an ER-based intervention to reduce post-ABI anger.

# **1.5.4 Telerehabilitation for Discrete Emotions**

Telerehabilitation is a growing field and was particularly important for continuing research and clinical service delivery during the COVID-19 pandemic (Chen et al., 2015; Doraiswamy et al., 2020; Dores et al., 2020; Wilkie et al., 2021). The few studies that have used a VC platform to deliver an ER intervention to survivors of TBI have aimed to improve ER *in general* (Tsaousides et al., 2014, 2017). A VC-delivered ER intervention for *discrete emotions* such as anger has yet to be investigated. This line of enquiry is particularly promising, as these types of interventions are both feasible and effective (Tsaousides et al., 2014, 2017). Furthermore, survivors of ABI have reported that VC has several advantages over in-person approaches, especially in relation to increased accessibility to specialised treatment (Tsaousides et al., 2014, 2017; Wilkie et al., 2021). Furthermore, it would advance this small niche in the telerehabilitation field, especially considering that existing interventions for post-ABI anger have been

delivered in-person (Byrne & Coetzer, 2016; Iruthayarajah et al., 2018). Chapter Four addresses the delivery of an ER-based intervention for post-ABI anger over Zoom.

# **1.5.5 Simple and Personal**

Existing interventions for post-ABI anger have *multiple* sessions that are often administered in a *group* setting (Byrne & Coetzer, 2016; Iruthayarajah et al., 2018). While some studies report high attendance rates, there have been difficulties with recruitment and attrition (Iruthayarajah et al., 2018). Furthermore, although group interventions are commonly and effectively deployed, this form of delivery can result in non-generalisable findings due to strict inclusion criteria, or issues of participants in a group who have varying levels of cognitive impairment (Alderman et al., 2003; Alderman et al., 2013). Addressing this gap would extend treatment services to survivors of ABI who have time constraints (e.g., those who are employed), or who would feel more comfortable in a one-to-one setting. Chapter Four addresses the preliminary efficacy of an individually administered intervention that contains a single session on ER.

### **1.6 Thesis Overview**

The core components of this thesis are comprised of two empirical chapters and one theoretical chapter. Although presented as separate and individual articles, they are all connected. At the time of submitting this thesis, all three articles were either published (Witten et al., 2022, 2023) or accepted for publication (Witten et al., in press) in peer-reviewed journals. Taken together, these chapters attempt to address the two primary objectives of this thesis.

The first objective is to establish a personally relevant tool that can effectively and powerfully elicit anger. This was investigated in the first empirical study with a group of neurologically healthy adults (Chapter Two). Once elicited, the second primary

objective is to establish whether two ER techniques can effectively reduce anger. This was initially investigated in the first empirical study (Chapter Two), before using the techniques in the second empirical study with a group of survivors of ABI (Chapter Four). Before launching the second empirical study, a theoretical article highlighted some of the design principals to consider when developing an ER-based intervention for post-ABI anger (Chapter Three). The last chapter (Chapter Five: Discussion) synthesizes the findings across the two empirical chapters and suggests how these may be applied in clinical practice. It also offers suggestions for future work. See Figure 1.1 for a graphical overview of the thesis.





*Note*. ABI = acquired brain injury; ER = emotion regulation.

# 2. Chapter Two

"I always wore my heart on my sleeve, but after the brain injury, I struggled to control my outbursts. Due to the COVID pandemic, this tended to manifest at home and was taking its toll on my relationship with family members."

~ Talk and Chalk Study Participant [Email communication, Autumn 2021]

# 2. Rage at strangers: Anger elicitation and regulation as a function of relationship type<sup>19</sup>

# 2.1 Abstract

Anger can be the most socially debilitating of the basic emotions, and effective and simple techniques for its management are much needed. Autobiographical recall is a powerful method for emotion elicitation, with obvious clinical utility. However, the content of the material elicited, most notably the variable of relationship type, has not been systematically studied. The present study investigated the effectiveness of the Affective Story Recall task for anger elicitation, using five relationship categories; and the effectiveness of two emotion regulation (ER) techniques: reappraisal and distraction. 52 neurologically healthy adults completed a series of anger elicitation and regulation tasks, several measures of cognitive ability, and questionnaires on attachment styles and the use of ER techniques. Most relationship categories selectively elicited anger, with some categories eliciting especially high levels. Both reappraisal and distraction reduced anger intensity across all relationship categories. However, distraction was particularly effective for strangers. Distraction effectiveness was predicted by its use, attachment style, and age, but cognitive factors played no significant role. These findings have implications for rehabilitation, allowing clinicians to tailor interventions to patients' strengths and weaknesses.

<sup>&</sup>lt;sup>19</sup>The updated and final version of this chapter has been accepted for publication:
Witten, J. A., Truss, E., Coetzer, R., & Turnbull, O. H. (in press). Rage at strangers:
Anger elicitation and regulation as a function of relationship type. *American Journal of Psychology*.

#### **2.2 Introduction**

Managing negative emotions, such as anger, directly affects our relationships and interactions with the people we love or come in to contact with. This is particularly problematic in clinical populations, where aggressive outbursts can be a consequence of an acquired brain injury (ABI; Rao et al., 2009). Although unmanaged anger seems to be particularly detrimental to social relationships (e.g., Saban et al., 2015), there is little research directly investigating the effectiveness of *emotion regulation* (ER)-based techniques for anger after an ABI (Witten et al., 2022).

# **2.2.1 Eliciting Emotions Through Stories**

Personally salient stories are an authentic emotion elicitation method (see Siedlecka & Denson, 2019 for a review). They produce stronger physiological (Lobbestael et al., 2008) and emotional (Webb et al., 2012) responses compared to impersonal emotion elicitation methods (e.g., film clips, computer-based tasks, pictures), which do not generate the same intensity of emotions as these may have less ecological validity (Lobbestael et al., 2008; Rowlands et al., 2021; Salas et al., 2012). In other words, the personal nature of recalling past real-world experiences closely replicates everyday emotion-inducing situations (Cheung et al., 2015). Furthermore, impersonal methods such as pictures tend not to selectively (i.e., specifically) induce anger, suggesting that personal memories are more appropriate for evoking this emotion (Mikels et al., 2005; Siedlecka & Denson, 2019).

The Affective Story Recall (ASR; Turnbull et al., 2005) is an autobiographical method that effectively induces strong emotions in both neurologically healthy adults (e.g., Salas et al., 2012), and those with ABI (Rowlands et al., 2020, 2021). In a study comparing the effectiveness of the ASR and film clips to elicit four basic emotions, Salas and colleagues (2012) demonstrated that both methods selectively induced anger

(i.e., elicited anger the *most*, in comparison to joy, sadness, and fear).<sup>20</sup> In addition, there was no difference between the methods in terms of anger intensity (i.e., one method did not elicit higher levels of anger than the other), suggesting that both the ASR and film clips effectively elicited anger.

However, in a recent and comprehensive meta-analysis on affective induction procedures (AIPs), Joseph and colleagues (2020) suggest that autobiographical recall tasks are the most effective for eliciting *anger*. This finding supports the notion that the induction of anger requires personally salient stimuli, as personally irrelevant film clips could produce a situation where the individual is essentially a bystander of another's emotion-evoking material, therefore they themselves may not necessarily experience the target emotion (Joseph et al., 2020; Lobbestael et al., 2008; Mikels et al., 2005; Rowlands et al., 2021; Salas et al., 2012).

**Categories of stories.** The few studies that have investigated ER after ABI tend to compare *multiple* basic emotions (e.g., Rowlands et al., 2020, 2021). Examining a range of emotions is, indeed, a strength of previous work. However, it may also be considered a limitation, as this broad line of enquiry arguably de-emphasises the focus on more socially debilitating emotions like anger (Salas et al., 2018). Particularly, there has been no research in clinical *or* non-clinical populations, on the way in which anger differs across *relationship categories*, such as a stranger versus a romantic partner, or a family member versus a friend. This is surprising, given the links between interpersonal relationships and ER (see Lindsey, 2020; Marroquín, 2011 for reviews).

<sup>&</sup>lt;sup>20</sup>Indeed, selectivity is operationalised as only eliciting the target emotion (i.e., anger). However, this construct is *measured* by eliciting the target emotion at levels that are significantly higher than levels of the elicited non-target emotions (Salas et al., 2012).

There are several reasons for why relationship categories are important for ER. Firstly, individuals appear to make more of an effort to regulate their emotions in the presence of others, and to use specific strategies according to the closeness of the relationship (English et al., 2017).<sup>21</sup> Secondly, strategy choice is governed by an individual's perceived control over the situation and the goal of ER (Chen & Liao, 2021). In terms of situational control, this does not appear to influence ER when a parent is involved. In contrast, individuals perceive more situational control with romantic partners or spouses. In terms of the ER goal, when this is to maintain the relationship, certain strategies are preferred for situations with a romantic partner or parent (Chen & Liao, 2021). Thirdly, social support from close relationships, such as a romantic partner or friend, may contribute to healthier ER, by using less maladaptive and more adaptive strategies (Cheung et al., 2015; Marroquín, 2011; Marroquín & Nolen-Hoeksema, 2015).

Taken together, there is ample evidence to justify further research on how emotion elicitation and regulation may vary as a function of relationship type (Cheung et al., 2015; English et al., 2017, Lindsey et al., 2020; Marroquín, 2011). Relationship categories therefore offer the opportunity to determine *which* types of individuals elicit the *most* anger, and which of these situations are *most* susceptible to emotion management techniques. These findings have potential implications for clinical practice.

# 2.2.2 Emotion Regulation Techniques

The field of ER has grown substantially over the last three decades (Gross, 2013), with

<sup>&</sup>lt;sup>21</sup>For example, close relationships may be with individuals who are family or friends, whereas unclose relationships may be with individuals who are strangers or employers (English et al., 2017).

a particular line of research investigating the Process Model of ER (Gross, 1998b). This approach specifies five categories of techniques for emotion management (see Gross, 2013), and has provided a theoretical framework for research in both clinical (e.g., ABI; Rowlands et al., 2020, 2021) and non-clinical (see Webb et al., 2012 for a metaanalysis) populations.

One clear theme that has emerged is that a cognitive change technique such as reappraisal (i.e., positively reframing a situation; Gross, 1998b; Gross, 2002) effectively modulates emotions (Webb et al., 2012) when implemented successfully (Ford et al., 2017). Despite this technique's ability to reduce the intensity of *anger* in neurologically healthy individuals (e.g., Denson, 2015; Denson et al., 2012; Fabiansson et al., 2012; Mauss et al., 2007) and those with ABI (Rowlands et al., 2020), it appears to be cognitively taxing, and therefore less easily *implemented* in individuals with cognitive difficulties (Witten et al., 2022). For these individuals, techniques deriving from attentional deployment (i.e., redirecting attention away from a situation; Gross, 1998b), which appear to be less cognitively demanding, might be more appropriate.

The importance of directly comparing the effectiveness of at least two ER techniques for anger has been recognized in the non-clinical literature (e.g., see Beames et al., 2019 and Denson, 2015 for reviews). For example, reappraisal appears to reduce anger more effectively than techniques such as suppression (Szasz et al., 2011) or rumination (Fabiansson et al., 2012). In relation to reappraisal versus distraction (i.e., a type of attentional deployment technique that refers to thinking about memories unrelated to the situation; Gross, 1998b), *both* techniques decreased anger intensity (Denson et al., 2012; Offredi et al., 2016), with distraction doing so *more* effectively in some situations (Denson et al., 2012).

That is, reappraisal is favored for *repeated* anger-inducing situations such as those with a disliked colleague, as its engagement mechanism encourages individuals to cognitively resolve or reframe these situations (Denson et al., 2012). As a result, this technique holds *long-term* benefits by facilitating the adaptive processing of anger (Denson et al., 2012), especially if individuals will be facing a repeated confrontational situation (Tamir et al., 2008). On the other hand, distraction is favored for *one-time* anger-inducing situations such as not returning to the store where there was a confrontation with the cashier, as its disengagement mechanism supports the *short-term* but quick emotional relief of anger (Denson et al., 2012).

Considering these promising findings, and their potential benefits for clinical populations such as those with ABI, it is worthwhile expanding this line of research (Beames et al., 2019). Firstly, there are various methodological limitations that restrict the generalizability and robustness of the existing findings, such as a reliance on samples with university students (Denson, 2015), or the use of a single item to measure changes in anger intensity (Denson et al., 2012). Secondly, further research is needed into the comparative effectiveness of reappraisal with different *types* of distraction techniques, *first* in a non-clinical and *then* in a clinical sample.

# **2.2.3 Factors Influencing Emotion Regulation**

Attachment style. The way that an individual manages their emotions in their interpersonal relationships is influenced by the parent-child attachment relationship during childhood (Contreras & Kerns, 2000). It is therefore no surprise that adult attachment style is closely linked to ER, as well as psychological wellbeing and the quality of relationships with non-family members (Bigdeli et al., 2013; Brandão et al., 2020; Brenning & Braet, 2013; Contreras & Kerns, 2000; Karreman & Vingerhoets; 2012; Mikulincer & Shaver, 2019; Nielsen et al., 2017).

A secure attachment style has been associated with greater reappraisal use and resilience and therefore better wellbeing (Bigdeli et al., 2013; Burgkart et al., 2021; Karreman & Vingerhoets, 2012; Mikulincer & Shaver, 2016), particularly in close relationships with partners (Winterheld, 2016). On the other hand, an anxious or avoidant attachment style has been associated with anger dysregulation and less reappraisal but more suppression use (Brandão et al., 2023; Brenning & Braet, 2013; Vrtička et al., 2012), and therefore higher emotional intensity (Mikulincer & Shaver, 2019). Anxious and avoidant attachment styles and ER impact a partner's wellbeing, demonstrating the importance of accounting for the interpersonal nature of these elements in couple relationships (Brandão et al., 2020). Thus, some attachment styles (e.g., anxious) may sustain emotion dysregulation (Nielsen et al., 2017), but social support through interpersonal relationships may enhance wellbeing (Bigdeli et al., 2013).

Taken together, the relationship between adult attachment styles and specific ER strategies, especially in relation to (categories of) interpersonal relationships, is a worthy line of further exploration. Previous work has demonstrated links between ER techniques such as reappraisal and suppression, however the link between adult attachment style and distraction has not been investigated.

**Cognition.** Considering the present study's aim to support a formative clinical study on anger regulation, the review of the following specific cognitive domains is based on their association with reappraisal in survivors of ABI.

Firstly, working memory capacity has been associated with the execution of reappraisal in survivors of ABI (cf. Salas et al., 2014), such that an increase in this ability results in a decrease in the amount of time it takes to produce a first reappraisal; reappraisal *difficulty* (Rowlands et al., 2020, 2021), and an increase in the number of

reappraisals produced; reappraisal *productivity* (Rowlands et al., 2021). On the other hand, this domain was not associated with either aspect of reappraisal execution in neurologically healthy individuals (Rowlands et al., 2021). In terms of reappraisal effectiveness, working memory was not associated with this strategy's ability to downregulate negative emotions in survivors of ABI or neurologically healthy individuals (Rowlands et al., 2021). This finding is inconsistent with previous work in neurologically healthy individuals, which supports the modulatory function of working memory in the reduction of negative affect through reappraisal (Adamczyk et al., 2022; Hendricks & Buchanan, 2016; McRae et al., 2012).

Secondly, verbal fluency has been associated with reappraisal difficulty but not productivity (cf. Rowlands et al., 2020, 2021) in survivors of ABI (Salas et al., 2014). On the other hand, verbal fluency was not associated with either aspect of reappraisal execution in neurologically healthy individuals (Rowlands et al., 2021). In terms of reappraisal effectiveness, this domain was not a factor in survivors of ABI or neurologically healthy individuals (Rowlands et al., 2021).

And thirdly, inhibition has been associated with reappraisal difficulty but not productivity (cf. Rowlands et al., 2020) in survivors of ABI and neurologically healthy individuals (Salas et al., 2014; Rowlands et al., 2021). In terms of reappraisal effectiveness, inhibition was a factor in survivors of ABI but not neurologically healthy individuals, such that an increase in this ability would result in an increase in reappraisal's effectiveness (Rowlands et al., 2021). This finding for neurologically healthy individuals is consistent with previous work which suggests that inhibition is not associated with the reduction of negative affect through reappraisal (Hendricks & Buchanan, 2016; McRae et al., 2012).

Regarding attentional deployment, the influence of cognition on this category of techniques is less well known. One possibility is that a high working memory load facilitates the downregulation of negative affect through distraction (Adamczyk et al., 2022). Considering the evidence for reappraisal's reliance on working memory, verbal fluency, and inhibition, the field would benefit from a similar investigation involving distraction in neurologically healthy individuals or survivors of ABI. This may be especially important for survivors of ABI with impairment in these domains, as attentional deployment techniques could provide a less cognitively demanding alternative to reappraisal (Witten et al., 2022). In addition, considering the present study's novel focus on relationship categories, this line of enquiry may shed light on how working memory, verbal fluency and inhibition facilitate or impede ER in these situations.

# 2.2.4 Study Aims

Personal narratives are an ideal method to elicit emotions authentically, especially anger. However, the question of how such narratives can be adapted to elicit varying levels of emotional intensity through real-world anger-inducing events has yet to be explored. The present study is therefore the first to investigate how five categories of relationship (i.e., *family member*, *romantic partner*, *friend* or *colleague*, *stranger*, *abstract*) that are implicated in real-world situations of unmanaged anger (Beames et al., 2019; Choi-Kwon & Kim, 2022; Saban et al., 2016) and used in previous ER work (Chen & Liao, 2021; Cheung et al., 2015; English et al., 2013, 2017; Lindsey, 2020; Marroquín, 2011; Marroquín & Nolen-Hoeksema, 2015), produce varying intensities of this emotion.

The present study aimed to establish a personally relevant, powerful, and effective anger elicitation tool that can be used in a rehabilitative context for emotion

management. It also aimed to establish the effectiveness of two ER techniques for anger in this same context. Due to their novelty, before using the tool and techniques in a clinical population of survivors of ABI, we first investigated their effectiveness in a non-clinical population of neurologically healthy adults.

Regarding elicitation, the following hypotheses (based on Salas et al., 2012) were tested: (1) for each of the five relationship categories, there is a difference between the levels of elicited anger and the other three basic emotions of sadness, fear, and joy (i.e., each category *selectively* elicits anger); and (2) there is a difference between the levels of elicited anger and the type of relationship category (i.e., certain categories elicit higher anger *intensities*).

Regarding regulation, the following hypotheses were tested: for each relationship category, there is a difference between: (3) the levels of anger *before* and *after* deploying an ER technique (i.e., both reappraisal *and* distraction *effectively* reduce anger); and (4) the *amount* of reduced anger and reappraisal *versus* distraction (i.e., one technique reduces more anger than another; *comparability*).

# 2.3 Method

# 2.3.1 Participants

For the within-subjects comparisons, a power analysis suggested that a sample size of N = 32 was adequate to achieve a power of .90, given a medium effect size (Cohen's d = 0.60; Plonsky & Oswald, 2014) and an alpha of .05. For the between-subjects comparisons, a sample size of N = 46 was adequate to achieve a power of .90, given a large effect size (Cohen's d = 1.00; Plonsky & Oswald, 2014) and an alpha of .05.

Therefore, 52 adults were recruited through Bangor University's Psychology Student Participant Panel or the wider UK community. Participant eligibility was confirmed at the start of the experimental session by the Research Assistant (ET) via

self-report. All participants were fluent English-speakers (including Welsh-English bilinguals) between the ages of 18 and 60, with no major neurological or mental health conditions. 38 females and 14 males took part, between the ages of 19 and 52 (M = 29.79; SD = 8.89). Participants completed between 12 and 23 years of education (M = 17.13; SD = 2.66), and 44 (85%) of them were right-handed.

Ethical approval was granted by the Research Ethics and Governance Committee at Bangor University's School of Human and Behavioural Sciences (reference no. 2019-16654). Informed consent was obtained from all participants (see Appendix A for an example of the Participant Information Sheet and Consent Form). No monetary compensation was provided. However, Bangor University students were awarded research participation credits.

# 2.3.2 Materials

Anger elicitation. The ASR (Turnbull et al., 2005) is an autobiographical recall task that was used to elicit anger. Although its psychometric properties have not been investigated, this task has previously been used to elicit discrete emotions in both clinical and non-clinical populations (Rowlands et al., 2020, 2021; Salas et al., 2012). Participants had up to three minutes to verbally recall, in as much detail as possible, a personal event where someone or something from a specific relationship category made them feel angry. The five categories were chosen as they have been identified as relationship types that are affected by uncontrolled anger (Beames et al., 2019; Choi-Kwon & Kim, 2022; Saban et al., 2016), and have been used in previous ER work involving interpersonal relationships (Chen & Liao, 2021; Cheung et al., 2015; English et al., 2013, 2017; Lindsey, 2020; Marroquín, 2011; Marroquín & Nolen-Hoeksema, 2015).

**Emotion measurement.** The PANAS-XS (Salas et al., 2012), an abbreviated version of the Positive and Negative Affect Schedule – Expanded Form (PANAS-X; Watson & Clark, 1994), which was designed to capture emotional responses over several occasions in the same study, captured participants' affective states. The PANAS-X has demonstrated satisfactory validity and reliability, and is particularly sensitive to detecting affective changes in everyday life (Bagozzi, 1993; Haney et al., 2023; Watson & Clark, 1994).

The PANAS-XS is comprised of 12 items representing the four basic emotions and uses a 5-point Likert scale (from 1 [very slightly or not at all] to 5 [extremely]). Participants are instructed to "indicate the greatest amount of EACH emotion you experienced." *Joy* is represented by the items "happy", "joyful", and "energetic." *Sadness* is represented by the items "sad", "downhearted", and "alone." *Anger* is represented by the items "angry", "hostile", and "disgusted." And *fear* is represented by the items "scared", "frightened", and "shaky."

**Emotion regulation.** The Emotion Regulation Questionnaire (ERQ; Gross & John, 2003) captured participants' use of reappraisal and suppression ER techniques. This measure has demonstrated good reliability and validity (Preece et al., 2019, 2021), and is comprised of 10 items with a 7-point Likert scale (from 1 [strongly disagree] to 7 [strongly agree]. An example of a reappraisal item is "When I want to feel less *negative* emotion, I *change the way I'm thinking* about the situation." An example of a suppression item is "I control my emotions by *not expressing them*." Six additional questions were created by the authors to capture attentional deployment, through minor wording modifications to the six items representing reappraisal (see Table 2.1).

Attachment style. The State Adult Attachment Measure (SAAM; Gillath et al., 2009) captured participants' current feelings of attachment. This measure has

**Table 2.1** Six items measuring attentional deployment use.

- 1) When I want to feel more *positive* emotion (such as joy or amusement), I *think of something different.*
- 2) When I want to feel less *negative* emotion (such as sadness or anger), I *think of something different*.
- 3) When I'm faced with a stressful situation, I make myself *think of something different* to help me stay calm.
- 4) When I want to feel more *positive* emotion, I *think of something unrelated* to the situation.

5) I control my emotions by *thinking of something different* from the situation I'm in.

demonstrated satisfactory reliability and validity, and is comprised of 21 items representing anxious, avoidant, and secure, using a 7-point Likert scale (from 1 [disagree strongly] to 7 [agree strongly]). An example of an anxious item is "I want to share my feelings with someone." An example of an avoidant item is "If someone tried to get close to me, I would try to keep my distance." And an example of a secure item is "I feel like I have someone to rely on."

**Cognitive assessment.** A short battery of tests measured the cognitive domains of working memory, visual memory, verbal generativity, and inhibition. Working memory was measured using the Digit Span subtest from the Wechsler Adult Intelligence Scale - Fourth UK Edition (WAIS-IV UK; Wechsler, 2010). Visual memory was measured using the Benton Visual Retention Test (BVRT; Benton Sivan, 1991). Verbal generativity was measured using the Verbal Fluency Test from the Delis-Kaplan Executive Function System (DKEFS; Delis et al., 2001). And inhibition was measured using the Hayling Sentence Completion Test from the Hayling and Brixton Tests (Burgess & Shallice, 1997). All tests have demonstrated adequate psychometric properties (Benton Sivan, 1991; Burgess & Shallice, 1997; Delis et al., 2001; Wechsler, 2010).

<sup>6)</sup> When I want to feel less *negative* emotion, I *think of something unrelated* to the situation.

#### 2.3.3 Procedure

Participants attended an individual, 90-minute experimental session with ET on Microsoft Teams. Due to the virtual administration of the study, all responses were given verbally by participants and captured electronically by ET. Participants were asked to complete the session on a laptop or desktop computer. Instructions for the session were accompanied by a PowerPoint presentation, which ET presented through the 'share screen' option on Microsoft Teams.

The participants began by answering questions about their background and medical history. Next, they completed two questionnaires relating to their attachment style (i.e., SAAM) and ER (i.e., ERQ). For the main trials, the participants were instructed to "Try to recall an event in your life where [someone/thing from the relationship category] caused you to feel anger or rage. Try to be quick when thinking of the event, and very detailed about the way you *feel*" (i.e., ASR). Next, they deployed one of the two ER techniques, either by offering as many positive interpretations to each event as they could (i.e., reappraisal), or drawing a picture of a happy memory unrelated to the event (i.e., distraction).

Regarding reappraisal, Rowlands and colleagues' (2020, 2021) personal reappraisal task was used, where participants were instructed: "Sometimes people try to make themselves feel better by looking on the bright side of things. Think of as *many* positive sides of the situation as you can, as *quickly* as you can." Regarding distraction, this novel task was created by the authors. However, its instructions were based on *active* paradigms where the participant is responsible for generating their *own* distractive thought that is unrelated to the induced emotion (see Webb et al., 2012), such as envisioning everyday activities (Shafir et al., 2015). They were therefore instructed: "I would like you to draw a picture of a time when you felt happy. The quality of your

drawing does not matter. However, I would like you to draw something that is *not* related to the event you just recalled. Please tell me out loud what you are drawing while you are drawing it."

Before and after deploying the ER technique, the participants completed a selfreport measure (i.e., PANAS-XS) where they rated how much of each emotion they felt (1) while recalling the event; and (2) after reframing the event/drawing a happy memory. This block of tasks (i.e., ASR + ER) was repeated five times in relation to the five relationship categories. The administration of these categories, and the ER techniques, were counter-balanced to avoid order effects (see Appendix B for the counterbalance design). Each block was separated by the administration of a cognitive test. The last block was a positive mood induction task, where the participants recalled a neutral event (i.e., an ordinary moment in their typical day), and offered as many positive perspectives on this event as they could (i.e., reappraisal).

#### 2.4 Data Management and Statistical Analyses

All statistical analyses were conducted using SPSS. The threshold for statistical significance was set at  $\alpha = .05$ , unless indicated otherwise.

#### 2.4.1 Selectivity

Following Salas and colleagues' (2012) procedure, selectivity was measured by first calculating average scores for the four basic emotion subscales of the PANAS-XS by ASR relationship category (see Table 2.2). For example, for each of the five relationship categories, the average score for *Joy* was calculated by summing the ratings for the items "happy", "joyful", and "energetic" and then dividing this total by three. Next, a series of one-way repeated-measures ANOVAs were conducted with these average scores, and Greenhouse-Geisser corrections were used for all categories. The

	PANAS-XS Subscale					
	M (SD)					
Category	Joy	Anger	Sadness	Fear		
Family	4.27 (1.88)	8.08 (3.43)	6.98 (3.30)	5.15 (2.71)		
Partner <sup>1</sup>	4.59 (2.31)	8.41 (3.01)	7.59 (3.56)	4.45 (2.18)		
Friend	4.67 (2.49)	7.87 (3.18)	6.37 (2.79)	4.00 (1.75)		
Stranger	4.94 (2.29)	9.56 (3.59)	5.56 (2.24)	5.60 (3.14)		
Abstract	5.06 (2.47)	7.06 (2.89)	6.02 (2.91)	4.88 (3.14)		

**Table 2.2** Descriptive summary of the PANAS-XS emotion subscales (N = 52)

*Note*. PANAS-XS = Shortened version of the Positive and Negative Affect Schedule (Salas et al., 2012).

<sup>1</sup>For this category, data were not available for one participant as they chose not to recall this story for personal reasons (n = 51).

differences between the intensity of anger and the other three basic emotions were compared with a simple contrast, using anger as the reference.

# 2.4.2 Intensity

Following Salas and colleagues' (2012) procedure, the average scores derived above for the anger subscale of each of the relationship categories were used in a one-way repeated-measures ANOVA. The assumption of sphericity was upheld, and a repeated contrast for the differences between anger intensity across the relationship categories was conducted.

# 2.4.3 Effectiveness and Comparability

To determine each technique's effectiveness, a series of paired sample *t*-tests were conducted to compare the average PANAS-XS anger subscale scores for each category, before and after deployment of an ER technique. To investigate the comparable effectiveness, a series of independent sample *t*-tests were conducted on the mean difference scores for reappraisal versus distraction for each category. Corrected values were used when equal variances were not assumed (this applied only to Abstract).

#### **2.4.4 Predictors of Emotion Regulation Performance**

A set of secondary analyses were conducted to determine whether certain variables contributed to better ER. These variables were the raw scores of age, attachment type (anxious, avoidant, secure; SAAM), everyday ER use (reappraisal, suppression<sup>22</sup>, attentional deployment; ERQ), working memory (digits backwards; WAIS-IV UK), visual memory (Administration A; BVRT), verbal fluency (letter fluency; DKEFS), and inhibition (completion time, number of errors; Hayling Sentence Completion Test).

A series of bivariate correlations confirmed that none of the predictor variables were highly correlated (i.e., above .80). Next, a series of forced entry multiple linear regression models for each relationship category explored the influence of the predictor variables on the outcome variable of ER performance (measured by the mean difference scores on the PANAS-XS anger subscale).

# 2.5 Results

The present study investigated four hypotheses in relation to the elicitation (i.e., *selectivity, intensity*) and modulation (*effectiveness, comparability*) of anger.

#### 2.5.1 Anger Elicitation by Relationship Categories

**Selectivity.** Before using anger-themed stories, it is important to demonstrate that they can selectively induce the target emotion (i.e., see Salas et al., 2012). Figure 2.1 illustrates that all five ASR relationship categories elicited anger at rates higher than the other three basic emotions, and in some cases (e.g., Stranger), at magnitudes above

<sup>&</sup>lt;sup>22</sup>Suppression was not an ER technique of interest to the present study. However, the authors still thought it was worth including in the secondary analyses, should it be a significant predictor of performance.



Figure 2.1 PANAS-XS emotion subscale scores across the five relationship categories.

50% higher.

Participants described, for example, stories of family members who were not supportive, or school friendships that faded at university. Stories involving a partner also elicited high levels of sadness, in addition to anger. For example, one participant described a story where they were angry at their partner for changing their holiday plans, but also sad as this meant they would not be seeing their family.

A series of one-way repeated-measures ANOVAs demonstrated that the intensity of anger elicited by the Family [ $F(2.28, 116.46) = 25.97, p < .001, \eta 2 = 0.34$ ], Friend [ $F(2.38, 121.54) = 27.32, p < .001, \eta 2 = 0.35$ ], Stranger [ $F(2.53, 128.95) = 31.75, p < .001, \eta 2 = 0.38$ ] and Abstract [ $F(2.52, 128.35) = 8.24, p < .001, \eta 2 = 0.14$ ] categories were significantly higher than the intensity of sadness, fear and joy (all with large effect sizes). However, for the Partner category, the intensity of anger elicited was significantly higher than fear and joy, but not sadness [ $F(2.14, 107.22) = 31.95, p < .001, \eta 2 = 0.39$  (large effect size)].

**Intensity.** In addition to determining which categories selectively induced anger, it is also important to investigate which elicited the *highest* (or most *intense*) levels of the target emotion (i.e., see Salas et al., 2012). Figure 2.1 illustrates that Stranger elicited the most anger, followed by Partner, Family, Friend, and Abstract.

The Stranger category elicited the highest intensity of anger (M = 9.56; SD = 3.59), with stories about, for example, shoppers who did not respect social distancing during the early stages of the COVID-19 pandemic. In comparison, Abstract elicited the lowest intensity (M = 7.06; SD = 2.89), with stories about, for example, laptops that are slow or have poor battery life.

A one-way repeated-measures ANOVA demonstrated that anger intensity was significantly affected by the type of relationship  $[F(4, 200) = 6.55, p < .001, \eta 2 = 0.12]$  (medium effect size)]. In particular, the Stranger category induced significantly higher levels of anger compared to Friend  $[F(1, 50) = 9.82, p < .05, \eta 2 = 0.16]$  and Abstract  $[F(1, 50) = 26.99, p < .001, \eta 2 = 0.35]$ , but not Partner or Family (with large effect sizes).

# 2.5.2 Anger Regulation by Relationship Categories

**Effectiveness.** The ability of each ER technique to reduce anger (i.e., *effectiveness*) can be established from the difference between pre- and post-ER anger subscale scores on the PANAS-XS. Table 2.3 demonstrates that both reappraisal and distraction significantly reduced anger in all five categories.

Regarding reappraisal, a series of paired sample *t*-tests demonstrates that these reductions ranged from Stranger [t(26) = 7.51, p < .001] to Abstract [t(24) = 6.90, p < .001] with large effect sizes. For example, one participant described a situation where a dog walker did not pick up their pet's waste, and then reappraised it as them not having a bag at the time and returning later to dispose of it.

	Anger Subscale of the PANAS-XS		Paired Differences		Anger Subscale of the PANAS-XS		Paired Differences			
Category <sup>1</sup>	Pre-Reappraisal	Post-Reappraisal	Pre-Post	t	d	<b>Pre-Distraction</b>	Post-Distraction	Pre-Post	t	d
	M(SD)	M(SD)				M(SD)	M(SD)			
Family	8.50 (3.36)	4.88 (2.21)	3.62***	6.52	1.25	7.65 (3.51)	3.15 (0.78)	4.50***	6.85	1.74
Partner	8.42 (3.13)	4.08 (1.49)	4.35***	7.61	1.74	8.40 (2.94)	3.40 (1.12)	5.00***	8.53	2.21
Friend	8.04 (3.38)	4.84 (2.72)	3.20***	6.77	1.03	7.70 (3.04)	3.15 (0.36)	4.56***	7.91	2.07
Stranger	9.00 (3.63)	4.44 (2.28)	4.56***	7.51	1.48	10.16 (3.53)	3.20 (0.50)	6.96***	9.86	2.72
Abstract	6.52 (2.16)	3.64 (1.08)	2.88***	6.90	1.66	7.56 (3.40)	3.30 (1.54)	4.26***	6.61	1.59

**Table 2.3** Technique effectiveness in the ASR relationship categories (N = 52)

*Note*. ASR = Affective Story Recall (Turnbull et al., 2005); PANAS-XS = Shortened version of the Positive and Negative Affect Schedule (Salas et al., 2012).

\*p < .05. \*\*p < .01. \*\*\*p < .001.

<sup>1</sup>Sample sizes vary due to the counterbalanced categories. For Reappraisal, there were 26 participants for Family and Partner, 25 for Friend, 27 for Stranger, and 25 for Abstract. For Distraction, there were 26 participants for Family, 25 for Partner (data not available for one participant as they chose not to recall a Partner for personal reasons), 27 for Friend, 25 for Stranger, and 27 for Abstract.

Regarding distraction, a series of paired sample *t*-tests demonstrates that these reductions ranged from Stranger [t(24) = 9.86, p < .001] to Abstract [t(26) = 6.61, p < .001] with large effect sizes. For example, one participant described a situation where another driver pulled into their lane without warning, and then drew a picture of a funny telephone conversation with their friend.

**Comparability.** Regarding the effectiveness of reappraisal and distraction, both techniques reduced anger for all five relationship categories. Figure 2.2 illustrates that although distraction appears to reduce anger more than reappraisal (i.e., the *comparability* of one technique to the other), a series of paired sample *t*-tests demonstrates that this difference was only significant for Stranger [t(50) = -2.59, p < .05, Cohen's d = 0.71; medium effect size].

**Figure 2.2** PANAS-XS anger subscale mean differences by technique across the five relationship categories.



### 2.5.3 Predictors of Emotion Regulation Performance

A series of multiple linear regression models sought to determine whether certain sociodemographic, personal, and cognitive variables were related to better ER performance. Table 2.4 demonstrates that the only significant model was distraction for Stranger, which accounted for 84% of the variance,  $R^2 = .84$ , F(12, 10) = 4.31, p < .05 (large effect size).

	В	SE B	$\beta$	t			
(Constant)	9.79	6.57		1.49			
Age	0.24	0.10	0.58	2.57*			
Anxious attachment (SAAM)	-0.16	0.07	-0.42	-2.25*			
Avoidant attachment (SAAM)	0.37	0.11	0.81	3.43**			
Secure attachment (SAAM)	-0.11	0.13	-0.21	-0.90			
Reappraisal (ERQ)	-0.21	0.10	-0.35	-2.13			
Suppression (ERQ)	-0.28	0.15	-0.36	-1.81			
AD (ERQ)	0.31	0.09	0.59	3.47**			
Working memory (Digits Backwards)	0.13	0.32	0.07	0.41			
Visual attention (BVRT)	0.15	0.68	0.04	0.21			
Verbal fluency (Letter Fluency)	-0.13	0.07	-0.40	-1.87			
Inhibition: Completion time (Hayling Sentences)	-0.04	0.02	-0.39	-2.05			
Inhibition: Number of errors (Hayling Sentences)	-0.05	0.37	-0.03	-0.15			
<i>ote.</i> ASR = Affective Story Recall (Turnbull et al., 2005); BVRT = Benton Visual							

**Table 2.4** Predicting distraction performance for the Stranger ASR (N = 23)

*Note.* ASR = Affective Story Recall (Turnbull et al., 2005); BVRT = Benton Visua Retention Test (Benton Sivan, 1991).

ERQ = Emotion Regulation Questionnaire (Gross & John, 2003);

SAAM = State Adult Attachment Measure (Gillath et al., 2009).

p < .05. p < .01.

The significant predictors of distraction, in order, were: (1) the daily use of attentional deployment: one unit increase produced a 0.59 performance improvement; (2) avoidant attachment style: one unit increase produced a 0.81 performance improvement; (3) age: one unit increase produced a 0.58 performance improvement; and (4) anxious attachment style: one unit increase produced a 0.42 performance decrease.

# 2.5.4 Methodological Note

One concern with a repeated measures design is the possible influence of order effects.

Although the task conditions were counterbalanced, a series of investigations were conducted

(all with large effect sizes) to confirm that position did not influence anger elicitation or ER effectiveness for any of the relationship categories.

Regarding anger *elicitation*: Family F(9, 42) = 0.79, p = .63,  $\eta 2 = 0.14$ ; Partner F(9, 41) = 1.12, p = .37,  $\eta 2 = 0.20$ ; Friend F(9, 42) = 0.76, p = .65,  $\eta 2 = 0.14$ ; Stranger F(9, 42) = 1.13, p = .36,  $\eta 2 = 0.20$ ; Abstract F(9, 42) = 1.29, p = .27,  $\eta 2 = 0.22$ . Regarding ER *effectiveness*: Family F(9, 42) = 1.07, p = .40,  $\eta 2 = 0.19$ ; Partner F(9, 41) = 1.24, p = .29,  $\eta 2 = 0.22$ ; Friend F(9, 42) = 1.11, p = .37,  $\eta 2 = 0.19$ ; Stranger F(9, 42) = 1.29, p = .27,  $\eta 2 = 0.22$ ; Abstract F(9, 42) = 1.52, p = .17,  $\eta 2 = 0.25$ .

# **2.6 Discussion**

The present study confirmed the effectiveness of a novel anger elicitation tool and two ER techniques in a non-clinical group of neurologically healthy adults. It is the first to investigate how discrete categories of relationship type produce varying intensities of anger, with implications for the elicitation and management of this emotion. In addition, it adds to the existing anger modulation literature which directly compares the effectiveness of reappraisal and distraction in neurologically healthy individuals (e.g., see Beames et al., 2019 and Denson, 2015 for reviews), and elucidates previous findings on the link between ER and interpersonal relationships (see Lindsey, 2020; Marroquín, 2011 for reviews).

This study also addresses some of the existing literature's methodological limitations, by: (1) extending the generalisability of the findings beyond a homogeneous student sample (Denson, 2015) to a more representative sample of individuals living in the community; and (2) supporting more robust conclusions drawn from a measure with several items representing anger intensity (Denson et al., 2012). Consideration is given to the potential clinical relevance of the five principal findings.

### 2.6.1 Most Relationship Types Selectivity Induce Anger

The *selectivity* hypothesis predicted that there would be a significant difference between the levels of elicited anger and the other three basic emotions, for all five relationship categories. This hypothesis was largely confirmed: The Family, Friend, Stranger, and Abstract categories of the ASR elicited anger significantly more than any of the other three basic emotions. This finding is consistent with previous research which suggests that the ASR can selectively induce anger (Salas et al., 2012), and supports the endorsement of autobiographical recall tasks for the effective elicitation of this emotion due to their personal relevance (Joseph et al., 2020; Lobbestael et al., 2008; Mikels et al., 2005; Rowlands et al., 2021; Salas et al., 2012).

Partner stories also elicited higher levels of anger, but this effect was not significant as it elicited moderate levels of sadness, too. It is not uncommon for stories about anger to simultaneously elicit other negative emotions such as sadness (Salas et al., 2012) or fear (Lobbestael et al., 2008). However, it is interesting that the co-elicitation of anger was only observed for Partner stories. One explanation could be related to attachment style, as individuals with a more anxious style experienced more feelings of sadness when recalling an anger-inducing story about a partner. This finding is in keeping with previous research, which suggests that individuals with an anxious style reported high intensities of negative emotions, in comparison to those with a secure or avoidant style (Mikulincer & Shaver, 2019). Nonetheless, future research with the ASR that aims to selectively elicit anger, should consider using only four of the five relationship categories.

# 2.6.2 Anger Intensity Varies by Relationship Type

The *intensity* hypothesis predicted that there would be a significant difference between the levels of elicited anger and the type of relationship category. This hypothesis was confirmed: Notably, the Stranger category of the ASR elicited significantly higher levels of anger compared to Friend and Abstract, but not Partner and Family. One explanation for this
finding may be that anger is most powerfully elicited for strangers because they do not have the complex emotional history that applies to other relationship categories. Another possibility may be that executive control functions tempers anger responses towards loved ones because of greater personal investment in these relationships. It may also be that the Abstract category was interpretated in a range of different ways, making it the least powerful anger elicitor. Considering the previous finding that Partner also elicits high levels of sadness, future research that aims to elicit the highest intensities of anger selectively, should consider focusing on the Stranger and Family categories.

# 2.6.3 Both Techniques Reduce Anger Intensity

The *effectiveness* hypothesis predicted that there would be a significant difference between the levels of anger before and after deploying reappraisal or distraction, for each of the five relationship categories. This hypothesis was confirmed and produced a very clear finding: Both ER techniques lowered anger intensity across all relationship categories. This finding is in keeping with previous research that supports the effectiveness of reappraisal and distraction for anger modulation (Denson, 2015; Denson et al., 2012; Fabiansson et al., 2012; Mauss et al., 2007; Offredi et al., 2016; Rowlands et al., 2020; Szasz et al., 2011; Webb et al., 2012).

To better understand this result, it is of interest to explore the association between the daily use of attentional deployment and distraction effectiveness, a relationship which has not previously been investigated. Consistent with previous findings in relation to reappraisal (Rowlands et al., 2021), the data suggest that the more attentional deployment is used in daily life, the more it lowers anger intensity. Thus, both distraction and reappraisal are effective techniques for anger modulation, especially if regularly used.

#### 2.6.4 Distraction is More Powerful than Reappraisal

The *comparability* hypothesis predicted that there would be a significant difference between the amount of reduced anger and the type of deployed ER technique, for each of the five relationship categories. This hypothesis was partially confirmed: Distraction was more effective than reappraisal for the Stranger category, which is, of course, the most powerful anger elicitor. This finding is in keeping with previous research which suggests that distraction is more effective than reappraisal for anger modulation (Denson et al., 2012).

One explanation for this could be related to the *nature* of the event. That is, distraction might be more effective for immediate and short-term emotional relief after a *once-off* encounter with a stranger (Denson et al., 2012) that results in a strong emotional response (Sheppes et al., 2011). It may therefore be that this technique is better suited for relationship categories that elicit *powerful* emotions in *less-frequently* occurring interactions, a proposal that requires confirmation with an adequate sample size in future research.

# 2.6.5 Predictors of Emotion Regulation Effectiveness

To better understand the factors that influence ER technique effectiveness, it is of interest to investigate the most powerful predictors. For the Stranger category, the largest reductions in anger intensity were, in order of significance: regular use of attentional deployment, a more avoidant attachment style, and older age. On the other hand, having a more anxious attachment style reduced the effectiveness of distraction.

The present study is the first to investigate the relationship between adult attachment types and the magnitude of anger reduction gained through distraction. Particularly, findings suggest that in situations with a stranger, individuals with an avoidant attachment style benefit the *most* from distraction, whereas those with an anxious style benefit the least. The finding that attachment style was not related to reappraisal across any of the relationship categories is inconsistent with previous work (Bigdeli et al., 2013; Brandão et al., 2023;

Brenning & Braet, 2013; Burgkart et al., 2021; Karreman & Vingerhoets, 2012; Mikulincer & Shaver, 2019; Vrtička et al., 2012; Winterheld, 2016), and that which established a connection with couple relationships or relationships with non-family members (Brandão et al., 2020; Contreras & Kerns, 2000). Individuals, or their clinicians, may consider choosing an ER technique that would be most beneficial, based on their attachment styles.

Notably, older individuals benefited more from lowering anger through distraction compared to reappraisal (cf. Webb et al., 2012). It may be that attentional deployment techniques such as distraction (compared to reappraisal or other forms of cognitive change) are used *more* by older adults (see Allen and Windsor, 2019 for a review), and, as suggested previously, an increased use of these techniques is associated with better distraction effectiveness.

This is the first study to investigate how working memory, verbal fluency, and inhibition influences the effectiveness of distraction in neurologically healthy individuals. Notably, none of these cognitive abilities were significant for the *effectiveness* of reappraisal (consistent with Hendricks & Buchanan, 2016; McRae et al., 2012; Rowlands et al., 2021) or distraction (cf. Adamczyk et al., 2022). However, based on previous research (Rowlands et al., 2020, 2021; Salas et al., 2014), it may be worth exploring whether all three cognitive domains govern the *execution* of distraction in neurologically healthy individuals or survivors of ABI, and whether the *effectiveness* of distraction is governed by these same domains in survivors of ABI. These findings would be especially relevant for individuals who have impairments in working memory, verbal fluency, or inhibition, as attentional deployment techniques could provide a less cognitively taxing alternative to reappraisal (Witten et al., 2022).

#### **2.6.6 Clinical Implications**

The present study supports the use of the ASR for anger elicitation, and the implementation of reappraisal or distraction for anger regulation, in a group of neurologically healthy adults. These findings may have several practical implications for emotion rehabilitation after ABI.

Firstly, clinicians may want to discuss emotionally powerful situations with their patients that elicits authentic anger, to practice the application of ER techniques. The present study suggests that clinicians could define categories of relationship to elicit anger, depending on the personal circumstances of the patient. Notably, all five relationship categories elicited high levels of anger, though some might be more appropriate for timesensitive interventions (i.e., Stranger, Family).

Secondly, it is clearly of interest to see which of the two techniques might be more effective. For all five relationship categories, both reappraisal and distraction were effective, suggesting that either technique can be used clinically. This finding supports the opportunity for patients to *choose* a technique of their preference (Witten et al., 2022). However, during the selection process, patients may still wish to consider the following factors. Firstly, in terms of the *frequency* of the situation, there may be long-term benefits to using reappraisal in repeated confrontational situations, and short-term benefits to using distraction in one-time situations (Denson et al. 2012; Tamir et al., 2008). Secondly, patients may wish to consider the *relationship category* of the involved party, by using reappraisal or distraction with non-close individuals (English et al., 2017), but distraction especially for situations with a stranger. In close relationships with a parent or romantic partner, reappraisal may be preferred if the goal of ER is to maintain the relationship (Chen & Liao, 2021). As social support from close relationships like romantic partners or friends may contribute to healthier ER (Cheung et al., 2015; Marroquín, 2011; Marroquín & Nolen-Hoeksema, 2015), patients may wish to consider their loved ones in the selection process.

Thirdly, it is of interest to consider the influence of important predictors of outcome, especially when using distraction in situations with a stranger, to allow clinicians to tailor their interventions according to their patients' strengths and weaknesses. Daily attentional deployment use was the most powerful predictor; therefore, patients should be encouraged to use these techniques regularly. In addition, distraction was more effective for older individuals and for those with an avoidant attachment style. On the other hand, this technique was less effective for those with anxious styles. Lastly, the effectiveness of reappraisal or distraction across all relationship categories did not rely on working memory, verbal fluency, or inhibition. It would therefore seem that these cognitive abilities should neither facilitate nor impede the effectiveness of these two techniques for patients.

# 2.6.7 Limitations

Despite the practical contributions of the present study, there are some limitations. Firstly, although these findings stem from a neurologically healthy population, the effectiveness of the ASR and ER techniques are worth exploring in clinical populations such as those with ABI. Secondly, technique effectiveness was determined by a self-report measure (i.e., PANAS-XS), and responses may be susceptible to demand characteristics. However, previous research using these measures have produced similar effects in populations both with and without an ABI (Rowlands et al., 2020, 2021; Salas et al., 2012).

# 2.6.8 Conclusion

Emotion regulation is a substantial challenge for many disorders of mental health, and evidence suggesting simple, yet effective techniques are much needed, together with an idea of how other variables might influence performance. This is the first study to explore anger elicitation and regulation as a function of relationship type, investigating two easily implementable emotion regulation techniques. Both techniques are effective, though their

usefulness may differ depending on a range of factors, such as frequency of use, attachment style, and age. These findings are also a reminder that the ASR is an authentic method for emotion elicitation, providing a basic and reliable clinical tool.

# 3. Chapter Three

"Leaving the house is difficult. With additional physical restrictions, a huge amount of energy is expended into getting ready. Then, the stress for traveling...sitting in a waiting room. [With it being online] you don't have to make that much personal effort."

~ Talk and Chalk Study Participant [Post-intervention interview, Autumn 2021]

# **3.** Shades of rage: Applying the process model of emotion regulation to managing anger after brain injury<sup>23</sup>

# 3.1 Abstract

Uncontrollable anger is common following an acquired brain injury (ABI), with impaired emotion regulation (ER) being one of the main contributors. Existing psychological interventions appear moderately effective, though studies typically include limitations such as small sample sizes, issues of long-term efficacy, and standardization of content. While ER has been a popular research field, the study of ER for anger management after ABI is less well investigated, and contains few interventions based on the widely used Process Model of ER. This review surveys the efficacy of ER strategies in individuals with ABI, and proposes a novel research design for future interventions. Recommendations are made about: strategy number and type, shared decision-making, approaches to data analysis, and mode of delivery.

<sup>&</sup>lt;sup>23</sup>Witten, J. A., Coetzer, R., & Turnbull, O. H. (2022). Shades of rage: Applying the process model of emotion regulation to managing anger after brain injury. *Frontiers in Psychology*,

#### **3.2 Introduction**

It is estimated that 69 million individuals suffer from a Traumatic Brain Injury (TBI) globally each year (Dewan et al., 2018), making it one of the leading causes of death and disability worldwide<sup>24</sup> (Hyder et al., 2007). In addition to the well-known cognitive impairment, survivors of TBIs and other types of acquired brain injuries (ABI), such as cerebrovascular accidents, experience substantial difficulties with social functioning and employment<sup>25</sup>. These difficulties are further compounded by the presence of aggressive outbursts post-injury (Sabaz et al., 2014).

Uncontrollable anger is common following an ABI (Caplan et al., 2015; Khan et al., 2003; Neumann et al., 2017), with an estimated prevalence of up to 41% during the first five years post-injury (Baguley et al., 2006; Rao et al., 2009; Roy et al., 2017; Tateno et al., 2003). Family and loved ones are typically the recipients of uncontrollable expressions of anger, reporting sudden and unpredictable outbursts (Saban et al., 2015). Amongst environmental factors, such responses are likely due to impaired emotion regulation (ER; Aboulafia-Brakha et al., 2016; Arciniegas & Wortzel, 2014; Caplan et al., 2015; Salas et al.,

<sup>25</sup>These difficulties include problems with relationships and social interactions, decreased social contact, loss of old friendships or difficulty creating new ones, and unemployment or issues with returning to work (Benedictus et al., 2010; Ma et al., 2014; Grauwmeijer et al., 2012; Morton & Wehman, 1995; Ponsford et al., 2014; Ruet et al., 2018; Salas et al., 2018; Shames et al., 2007; Stocchetti & Zanier, 2016).

<sup>&</sup>lt;sup>24</sup>The Global Burden of Disease Study (2017) identified stroke and road injuries as two of the top ten leading causes of early death worldwide (Institute for Health Metrics and Evaluation, 2018).

2014; Winter et al., 2018): the ability to modify and control personal experiences and expressions of emotion (Gross, 1998b; Gross, 2002).

The majority of anger management interventions for individuals with ABI (see Byrne & Coetzer, 2016) or mental health disorders (see Ross et al., 2013), focus on *physical* manifestations of aggression. This focus excludes an individual's *subjective* experience of anger (i.e., emotional outbursts), with important implications for gender differences. An international survey demonstrated *equivalent* levels of anger for men and women, recognizing that women are less likely to transform subjective anger into acts of physical aggression (Özkarar-Gradwohl & Turnbull, 2021). This may explain why domestic abuse is a gendered crime, with implications for treatment eligibility.

# 3.2.1 Psychological Interventions for Aggression

Psychological interventions appear moderately effective (d = -0.46) in populations with ABI (see Byrne & Coetzer, 2016; Iruthayarajah et al., 2018) and mental health disorders (see Lee & DiGiuseppe, 2018; Ross et al., 2013). The majority of these interventions are based on cognitive behavioural therapy (CBT), which include several limitations.

Small sample size (e.g., single case studies; n = 1) is a common limitation (Alderman et al., 2013; Byrne & Coetzer, 2016; Iruthayarajah et al., 2018; Ross et al., 2013). Studies in populations with mental health disorders contain larger samples than those with ABI. Ross and colleagues (2013) reported samples ranging from three to 290, while Byrne and Coetzer (2016) and Iruthayarajah and colleagues (2018) reported ABI samples ranging from one to 52. While an adequate sample size is necessary for scientific rigor, the inherent nature of recruiting from clinical populations (and especially those with ABI), makes this a challenging limitation to overcome (e.g., see Armstrong et al., 2020).

The *long-term efficacy* of interventions is also under-investigated, partly because not all studies include follow-up assessments (Byrne & Coetzer, 2016; Iruthayarajah et al., 2018).

The majority of studies that *do* report follow-up data do *not* report therapeutic efficacy over time (Byrne & Coetzer, 2016; Ross et al., 2013), meaning that potential gains are not measured.

The *standardization of interventions* is another issue (e.g., Byrne & Coetzer, 2016; Ross et al., 2013). Ross and colleagues (2013) report differences in the CBT content across studies (i.e., standard CBT versus additional study-specific components), as well as differences in dosage or intensity (i.e., hours versus days), and modality (i.e., individual versus group), of treatments. Some interventions encourage participant involvement in the rehabilitation process (e.g., see McClain, 2005). Mode of administration varies across settings, with an increase in virtually administered services since the COVID-19 pandemic (Wosik et al., 2020). Lastly, Lee and DiGiuseppe (2018) report that interventions such as CBT may be more effective, however this field requires further research with non-CBT interventions.

# 3.2.2 The Process Model of ER

None of the studies included in previous reviews (Byrne & Coetzer, 2016; Iruthayarajah et al., 2018) used interventions based on a theoretically driven perspective, which relates to impaired ER as the likely mechanism of uncontrollable anger after ABI (Aboulafia-Brakha et al., 2016; Arciniegas & Wortzel, 2014; Caplan et al., 2015; Khan et al., 2003; Neumann et al., 2017; Salas et al., 2014; Winter et al., 2018). Although approaches such as CBT are widely used for anger management, they lack the focus on ER as the primary mechanism for moderating emotions (Salas et al., 2019). The Process Model of ER (Gross, 1998b; Gross, 2014) is the only model that has informed ER studies after ABI (Rowlands et al., 2020, 2021; Salas et al., 2013; Salas et al., 2014), suggesting five classes of ER strategies: cognitive change, attentional deployment, situation selection, situation modification, and response modulation.

This article has two aims. Firstly, to discuss the efficacy of each strategy in individuals with ABI and/or non-clinical samples. Secondly, to recommend an anger management intervention for individuals with ABI, that includes at least two ER strategies. To demonstrate the difference between strategies, we discuss each in relation to a practical example of "arguing with a partner."

**Reappraisal.** This strategy refers to altering the way an event is perceived (Gross, 2014). For example, after the argument, "we discussed practical ways of communicating better." Reappraisal is one form of cognitive change and is widely used to regulate discrete emotions in non-clinical samples (e.g., Nezlek & Kuppens, 2008) and individuals with ABI (e.g., Rowlands et al., 2020, 2021; Salas et al., 2013; Salas et al., 2014). A meta-analysis by Webb et al. (2012) investigated the efficacy of cognitive change, attentional deployment, and response modulation in non-clinical samples. They reported a small-to-medium effect ( $d_+ = 0.36$ ) for reappraising emotional reactions. In comparison to other strategies such as response modulation and attentional deployment, evidence suggests that reappraisal is more effective when regulating negative emotions (Kalokerinos et al., 2015; McRae et al., 2010; Webb et al., 2012), and is preferred over attentional deployment for lower levels of affect (Gross, 2013; Van Bockstaele et al., 2020).

The few studies investigating reappraisal in ABI suggest that this strategy relies on executive elements that are often impaired in individuals with ABI (Dunning et al., 2016; Livny et al., 2017; Rowlands et al., 2020; Salas et al., 2013; Salas et al., 2014). For example, working memory, verbal fluency, and inhibition affected how long it took individuals with an ABI to produce a reappraisal, and working memory also affected the number of reappraisals produced (Salas et al., 2014; Rowlands et al., 2020).

Thus, reappraisal is arguably more cognitively demanding than other ER strategies. However, findings suggest that once produced, they decrease the intensity of anger<sup>26</sup> for individuals with ABI, in the same way as they do for neurologically normal individuals (Rowlands et al., 2020). While reappraisal appears challenging for individuals with cognitive impairment (Salas et al., 2014; Rowlands et al., 2020), it may still be a useful strategy, depending on the *level* of impairment. For example, individuals with milder cognitive sequelae may be suitable candidates, a line of enquiry that is worth exploring. Reappraisal therefore appears to be a suitable ER strategy for individuals with ABI who have cognitive impairment, because it is a widely investigated strategy, and one of the few strategies investigated in ABI, that has also demonstrated effectiveness for regulating negative emotions such as anger. In addition, it would be particularly relevant to compare reappraisal to another strategy that is less cognitively taxing.

Attentional deployment. This strategy refers to moving attention away from emotion-evoking stimuli (Gross, 2014). For example, after the argument, "we chose to distract ourselves by watching a film." Webb et al.'s (2012) meta-analysis report no effect size for attentional deployment as a strategy for emotional reactions in non-clinical samples. However, they suggest that the effectiveness of attentional deployment depends on strategy *type*. Two examples of attentional deployment are *distraction* (focusing on memories unrelated to the target emotion) and *concentration* (focusing on a task that elicits positive affect; Gross, 1998a). Findings from Webb et al.'s (2012) meta-analysis suggest that concentration is ineffective for emotional reactions ( $d_+ = -0.26$ ), whereas distraction is ( $d_+ =$ 0.27).

<sup>&</sup>lt;sup>26</sup>As well as other negative emotions such as fear and sadness.

Although findings suggest that decreased cognitive control impedes the execution of attentional deployment in neurologically normal individuals (Lohani & Isaacowitz, 2014; Wirth & Kunzmann, 2018), studies have yet to investigate the influence of executive functions on this strategy's implementation and efficacy in ABI with cognitive impairment (Salas et al., 2019). Attentional deployment might be another suitable strategy. Firstly, compared to reappraisal, this strategy is *preferred* for regulating negative emotions in *older* adults (Scheibe et al., 2015). Secondly, distraction is preferred over reappraisal when regulating *high* levels of affect (Gross, 2013; Van Bockstaele et al., 2020). One explanation for this preference could be that these individuals find distraction less cognitively taxing. Overall, these findings, coupled with the fact that the majority of individuals who sustain an ABI *are* older adults (M = 47.8 years for TBI and M = 58.8 years for non-TBI; Colantonio et al., 2011), suggest that distraction is a strategy worth exploring.

**Situation selection.** This strategy refers to choosing which situations to embrace or avoid, depending on the desired emotional outcome (Gross, 2014). For example, "we chose to go shopping at quieter times, as shopping during busy times leads to arguments." Webb et al.'s (2012) meta-analysis does not include data for the effectiveness of situation selection, and this strategy has yet to be investigated in ABI. However, Webb et al. (2018) explored situation selection in two non-clinical samples, and propose two advantages: (1) it may be less cognitively demanding in comparison to other strategies; and (2) it does not require individuals to manage their emotions immediately. In terms of cognitive demand, Salas et al. (2019) suggest that situation selection may not be suitable for individuals with lesions to the ventromedial prefrontal cortex (vmPFC). It therefore seems inappropriate to include this strategy in a comparative anger regulation intervention for ABI, if individuals have sustained lesions to the vmPFC.

Situation modification. This strategy refers to adapting one's environment in accordance with a favorable emotional milieu (Gross, 2014). For example, "we agree on a grocery list before shopping, as shopping without one leads to arguments about what to buy." Webb et al.'s (2012) meta-analysis does not include situation modification, and this strategy has yet to be investigated in ABI. Van Bockstaele et al. (2020) explored situation modification in a non-clinical sample, by allowing participants to choose between modification, distraction or reappraisal. Their findings suggest that situation modification is effective for regulating high levels of negative affect. While Livingstone and Isaacowitz (2015) propose that situation modification is not cognitively demanding, Salas et al. (2019) suggest that it might not be effective for individuals with lesions to the dorsolateral prefrontal cortex or vmPFC. It therefore seems inappropriate to include situation modification as part of a comparative anger regulation intervention for ABI.

**Response modulation.** This strategy refers to changing an already elicited emotional response (Gross, 2014). For example, "we agree not to have the argument while we are shopping." Webb et al.'s (2012) meta-analysis report a small effect for using response modulation for emotional reactions. Suppression, a type of response modulation, refers to purposely inhibiting an emotional reaction (Gross & Levenson, 1997). This strategy is particularly effective for inhibiting emotional *expression*, in comparison to inhibiting *thoughts* related to the emotion-inducing event.

Only one study has investigated response modulation in ABI. Salas et al. (2016) found that individuals with lesions to the right PFC and insula struggled to purposely inhibit or intensify the relevant facial expressions associated with positive emotions during a response modulation task. In terms of cognitive demand, they suggest that inhibitory control is associated with effectively suppressing positive emotions. Since response modulation relies on the ability to control the motor expressions associated with emotions, this strategy may not

be effective for individuals with right frontal and insula lesions (Salas et al., 2019). Furthermore, evidence suggests that suppression is ineffective for regulating negative emotions (Kalokerinos et al., 2015). Taken together, it seems less optimal to include response modulation as part of a comparative anger regulation intervention for ABI.

#### **3.3 Discussion**

While ER has been a popular research field (Gross, 2013), the study of ER after ABI is less well investigated (Salas et al., 2019). This article makes some recommendations about subjective experiences of anger, in relation to strategy number and type, shared decision-making, approaches to data analysis, and mode of delivery.

#### 3.3.1 Number of Strategies

The majority of studies investigate a single strategy (see Webb et al., 2012), while only a minority directly compare two or more (e.g., Kalokerinos et al., 2015; Kanske et al., 2011; Livingstone & Isaacowitz, 2015; McRae et al., 2010; Scheibe et al., 2015; Van Bockstaele et al., 2020). While single-strategy studies are noteworthy, good clinical practice would be to directly compare the efficacy of more than one approach, especially since some strategies rely on cognitive abilities often affected after ABI (Rowlands et al., 2020; Salas et al., 2014). In terms of comparative efficacy, the debate remains as to whether approaches stemming from a particular class of strategy are equally effective, or whether approaches from one class may be more effective than another (Kanske et al., 2011; McRae et al., 2010; Strauss et al., 2016).

# 3.3.2 Strategy Type

Reappraisal is widely investigated, and the only strategy explored in ABI. Despite its cognitive demands, it has demonstrated evidence of regulating negative emotions by decreasing their intensity (e.g., Rowlands et al., 2020; Salas et al., 2013). Thus, it appears

sensible to include reappraisal as *one* of the investigated strategies. A strategy that is less cognitively taxing, such as distraction, would present a good comparison, especially for regulating high levels of affect in older adults (Gross, 2013; Scheibe et al., 2015; Van Bockstaele et al., 2020). It is likely that the same lesion sites implicated in situation selection and modification are also implicated in reappraisal and distraction. However, evidence supports the efficacy and preference of the latter two strategies, and encourages prioritizing the investigation of these first. Furthermore, experimental conditions for strategies such as situation selection and modification might be challenging for individuals with ABI and cognitive impairment, if they are required to independently maintain their concentration during a computer-based task.

# 3.3.3 Patient Agency and Choice

Shay and Lafata's (2015) meta-analysis suggests that shared decision-making produced better affective-cognitive outcomes. Although the collaborative setting of treatment goals in neurorehabilitation has been considered in the literature (see e.g., McClain, 2005), active treatment *choice* by patients has, to our knowledge, not been empirically investigated in individuals with ABI. A novel intervention would give individuals with ABI the agency to *choose* a strategy that suits their strengths and circumstances.

#### 3.3.4 Data Analysis

The majority of studies in Webb et al.'s (2012) meta-analysis used quantitative measures, but a few used qualitative approaches. We suggest the use of a well-established quantitative measure of anger, with an additional qualitative component. An example of the former would be the State-Trait Anger Expression Inventory-2 (Spielberger, 1999), or the Overt Behavior Scale (Kelly et al., 2006), both of which include verbal *and* physical aggression subscales. An example of the latter would be semi-structured interviews on anger and the use of ER

strategies. This combination is useful for two reasons: (1) it could yield insights into mechanisms behind the efficacy of interventions; and (2) it provides an alternative way to analyze data from underpowered clinical studies.

# 3.3.5 Telemedicine

In light of the COVID-19 pandemic, delivery of many clinical services has shifted from inperson to virtually (Wosik et al., 2020), and telehealth has demonstrated advantages over inperson care<sup>27</sup> (see Molini-Avejonas et al., 2015). Although there are limitations to virtual service delivery<sup>28</sup> (Cole et al., 2019; Mubaraki et al., 2021; Shaw et al., 2018), evidence for the clinical effectiveness of telemedicine across a range of health sectors (see Bensink et al., 2006) supports virtually administered over in-person interventions (e.g., Rietdijk et al., 2020).

Furthermore, while evidence for telehealth in ABI is still emerging, results are encouraging, and show promise for future service delivery. For example, a patient with an ABI, who has been identified by their General Practitioner as someone with difficulties regulating anger, could be referred to an ER-based virtual intervention program. This program would consist of one-to-one Zoom meetings that focus on practical application of one or more ER strategies, with a homework component.

# **3.3.6** Conclusion

The field of ER has grown dramatically over the last three decades, highlighting its importance for understanding emotions in both clinical and non-clinical populations. While

<sup>&</sup>lt;sup>27</sup>Such as access to services, greater outreach for individuals living in rural areas, and reduced to no travel and wait times (Molini-Avejonas et al., 2015).

<sup>&</sup>lt;sup>28</sup>Such as access to efficient internet, technical difficulties, diagnostic challenges due to the lack of physical contact, and negative perceptions about telecare (Cole et al., 2019; Mubaraki et al., 2021; Shaw et al., 2018).

there has been tremendous progress in certain areas of the field, ER as a rehabilitative tool after ABI remains under-developed. ER interventions have the potential to help individuals with ABI manage their lives, in areas where they and their loved ones have substantial difficulties. These interventions can also contribute to the understanding of the brain basis of managing anger, and the underpinning mechanisms of change.

# 4. Chapter Four

"I thought, you know, if at the beginning I'd been given these techniques, it would have made life so much easier. Your brain goes into panic...you feel like you've got no control. Those two techniques at the beginning, I felt an instant change. How amazing would that have been quite soon...when it became apparent how difficult things were. [The techniques are] relatively simple things...even at the early stages of brain injury."

~ Talk and Chalk Study Participant [Post-intervention interview, Spring 2022]

# 4. Talk and Chalk: An emotion regulation intervention for anger after acquired brain injury<sup>29</sup>

# 4.1 Abstract

Uncontrollable anger is a debilitating consequence of acquired brain injury (ABI). This proof-of-concept study investigated the preliminary efficacy of an emotion regulation-based intervention for managing post-ABI anger. A secondary objective was to determine which participant characteristics were related to intervention gains. With a pre-post intervention design and three-month follow-up, there were five individually administered meetings on Zoom, over a four-month period. 24 adults who had sustained an ABI were enrolled. Participants were mostly males, from 24 to 85 years old. A series of one-way repeated-measures ANOVAs were conducted to determine the intervention's efficacy, and Spearman's rho bivariate correlations for the association between participant characteristics and intervention gains. Significant differences were observed in external anger from baseline to post-treatment; there were no further changes from post-treatment to follow-up. Of the participant characteristics, only readiness to change and anxiety were correlated. The proposed intervention presents a brief, feasible, and preliminary efficacious alternative for regulating post-ABI anger. Intervention gains are associated with readiness to change and anxiety, which has important implications for clinical delivery.

<sup>&</sup>lt;sup>29</sup>The updated and final version of this chapter has been published: Witten, J. A., Coetzer, R., Rowlands, L., & Turnbull, O. H. (2023). 'Talk and chalk': An emotion regulation intervention for anger after acquired brain injury. *Applied Neuropsychology: Adult*.

#### **4.2 Introduction**

Acquired brain injuries (ABIs) have been identified as one of the leading causes of death and disability worldwide (Dewan et al., 2018; Institute for Health Metrics and Evaluation, 2018). An ABI is an insult to the brain that occurs after birth and is unrelated to a genetic or degenerative condition (World Health Organisation, 1996). Causes include a traumatic brain injury, cerebrovascular accident, infections, tumours, and hypoxic or anoxic events (Chan et al., 2013). Notably, aggression is a common and long-term consequence of an ABI, affecting up to 41% of survivors during the first five years after injury (Baguley et al., 2006; Roy et al., 2017).

Verbal aggression is particularly prevalent, and is often characterized by a short temper, outbursts of swearing and yelling, and threats of violence (Gould, 2019; Rao et al., 2009; Roy et al., 2017). Understandably, this behaviour has detrimental effects on personal relationships, especially with family members and loved ones, who describe a loss of their pre-injury loving relationship (Gould, 2019; Saban et al., 2015; Yasmin & Riley, 2022). Apart from these relational consequences, aggression is also emotionally maladaptive for survivors of ABI, with depression and anxiety being important and lasting correlates (Baguley et al., 2006; Caplan et al., 2017; Gould, 2019; Roy et al., 2017; Tateno et al., 2003). Thus, targeted anger modulation interventions are much needed, for the wellbeing of both survivors and their loved ones (Cattelani et al., 2010; Demark & Gemeinhardt, 2002).

#### 4.2.1 Effectiveness of Existing Interventions

The primary approach for interventions to manage anger has been cognitive behavioural therapy or CBT (Aboulafia-Brakha et al., 2013; Hart et al., 2012; Medd & Tate, 2000; Walker et al., 2010). This appears to be moderately effective at reducing anger after ABI (see Byrne & Coetzer, 2016; Cattelani et al., 2010; Iruthayarajah et al., 2018 for reviews). Anger outcome measures such as the State-Trait Anger Expression Inventory-2 (STAXI-2;

Spielberger, 1999) and the Aggression Questionnaire (AQ-12; Bryant & Smith, 2001; Buss & Perry, 1992) speak to issues of the duration of treatment effectiveness and the type of anger response.

In terms of short-term effectiveness, CBT-based interventions typically show clear gains from baseline to post-treatment, on measures of external but not internal manifestations of anger. For example, survivors of ABI might display external manifestations of anger by shouting or cursing at others, or internal manifestations of irritability (Choi-Kwon & Kim, 2022; Lefkovits et al., 2021). Findings from Byrne and Coetzer's (2016) and Iruthayarajah and colleagues' (2018) reviews of previous post-ABI anger management interventions demonstrated significant improvements in externally directed anger (as measured by the Trait Anger [TA], Anger Expression-Outwards [AXO], and Anger Control [AC] subscales of the STAXI-2), except for one study (no significant changes were observed on the AQ-12; Aboulafia-Brakha et al., 2013). However, internally directed anger seems unaffected (as measured by the Anger Expression-Inwards [AXI] subscale of the STAXI-2). Thus, CBTbased interventions appear to improve external (but not internal) anger management immediately after treatment.

In terms of long-term effectiveness, the picture is more complicated, but includes the suggestion that these interventions may maintain or improve not only externally directed anger, but also show some internal gains (Byrne & Coetzer, 2016; Iruthayarajah et al., 2018). This literature suggests that post-treatment gains were, in some cases, maintained when no significant changes were observed on external measures of anger (Walker et al., 2010). In other cases, gains continued when significant improvements were observed from baseline to follow-up on these external measures (including the AQ-12; Aboulafia-Brakha et al., 2013; Aboulafia-Brakha & Ptak, 2016). Moreover, internally directed anger (i.e., AXI) sometimes improved from baseline to follow-up (Aboulafia-Brakha & Ptak, 2016). Thus, CBT-based

interventions demonstrate mixed evidence of improvement in external anger months after completing treatment, with the added advantage of sometimes also improving internal anger.

#### 4.2.2 Limitations of CBT

Although CBT appears effective for post-ABI anger, it is accompanied by several practical (e.g., number of sessions, type of administration; see Alderman et al., 2013 for a review) and theoretical challenges (Witten et al., 2022).

One limitation relates to the number of sessions. Some studies include as many as 12 (e.g., Hart et al., 2015; Walker et al., 2010). Predictably, these have resulted in substantial recruitment difficulties, and attrition rates as high as 25% (Iruthayarajah et al., 2018). Multiple sessions also typically comprise several different components (e.g., psychoeducation, relaxation techniques, emotion regulation), potentially obscuring which of the treatment components had the most impact on outcomes (Aboulafia-Brakha & Ptak, 2016; Hart et al., 2012; Rochet et al., 2019).

A second limitation relates to individual versus group administration. Most CBT interventions are group-based (Iruthayarajah et al., 2018). While there are social and cost-effective benefits (Demark & Gemeinhardt, 2002; Walker et al., 2010), a group setting is not always ideal for individuals who may have varying levels of cognitive impairment (Alderman et al., 2013; Cattelani et al., 2010; Iruthayarajah et al., 2018). In these situations, such interventions would benefit from custom-designed content that caters to the nature of cognitive disorders (see Aboulafia-Brakha et al., 2013; Hart et al., 2012, 2015; Walker et al., 2010 for examples), or be administered one-to-one, so the patient can receive individualised attention from the therapist (Hart et al., 2012; Medd & Tate, 2000).

A third limitation relates to the theoretical foundations of existing CBT-based interventions for post-ABI anger. This approach does have elements relating to emotion regulation (i.e., the ability to modify and control emotional experiences and reactions; Gross,

1998a, 2002), such as cognitive restructuring or alternative thinking (Beck, 1976; Fenn & Byrne, 2013). However, emotion regulation (ER) strategies are not central to the design and implementation of CBT-based interventions. Given the important role of executive functions in emotion management, it should be no surprise that individuals who have sustained lesions to the frontal lobes are especially vulnerable to anger dysregulation (Gyurak, et al., 2012; Holley et al., 2017; Öner, 2018; Potegal, 2012; Schmeichel & Tang, 2015). An ER-based theoretical approach would therefore provide the opportunity to design targeted interventions for survivors of ABI, that apply one or several ER strategies to reduce anger in everyday situations (Salas et al., 2019; Witten et al., 2022).

#### 4.2.3 An ER Approach to Post-ABI Anger

The Process Model of ER (Gross, 1998b, 2014) has informed emotion management interventions for survivors of ABI (Rowlands et al., 2020, 2021; Salas et al., 2013, 2014). This framework presents five groups of ER strategies that can be applied at varying stages of the emotion generation experience (Gross, 2015). Antecedent-focused strategies (i.e., cognitive change, attentional deployment, situation modification, situation selection) are used to manipulate an emotional response before it occurs, whereas response-focused strategies (i.e., response modulation) are used to manipulate an emotional response after it occurs (John & Gross, 2004; Mauss et al., 2007). Further details on these strategies and their use for post-ABI anger are discussed in Witten et al., (2022). Importantly, incorporating at least two types of ER techniques could be advantageous for survivors of ABI, as this design would cater to individual preferences as well as cognitive strengths or vulnerabilities (Witten et al., 2022).

An example of a cognitive change technique is *reappraisal* (i.e., changing the perception of a situation; Gross, 2014). This is the most widely investigated ER technique, and the only one that has been explored as part of an emotion management intervention for survivors of ABI. Although reappraisal has demonstrated the ability to reduce the intensity of

negative emotions, its implementation relies on cognitive abilities that are susceptible to impairment following brain injury (Rowlands et al., 2020, 2021, Salas et al., 2013, 2014). For this reason, a less cognitively demanding technique, such as *distraction* (i.e., redirecting attention towards memories that are not connected to the target emotion; Gross, 1998b), has been suggested as part of an anger regulation intervention (Witten et al., 2022).

#### **4.2.4** Correlates of Intervention Gains

Determining which participant characteristics are associated with intervention gains is an important component of evaluating treatment outcomes (Cattelani et al., 2010; Hart et al., 2012, 2023). However, such relationships are not always investigated in post-ABI anger. Four important participant characteristics that warrant exploration are *mental health*, *readiness to change, use of ER techniques*, and *cognitive abilities*.

**Mental health.** Depression and anxiety are common and lasting consequences of ABI (see Juengst et al., 2017; Menzel, 2008; Osborn et al., 2016; Scholten et al., 2016, for reviews). ER-based work in this clinical group has either only reported on the *presence* and *severity* of mental health symptomology (Salas et al., 2014), or on the association between *depression* and the regulation of *positive* emotions (Rowlands et al., 2020). It seems critical to investigate whether symptoms of both depression and anxiety are associated with intervention gains for *anger* modulation after ABI, especially considering their relationship (Baguley et al., 2006; Caplan et al., 2017; Roy et al., 2017; Tateno et al., 2003).

**Readiness to change.** Openness to change a targeted behaviour has been associated with treatment outcome in several anger management interventions (see Howells & Day, 2003, for a discussion). For example, higher scores have been correlated with larger improvements in offender populations (Howells et al., 2005; Williamson et al., 2003). In relation to ABI, readiness to change was first measured as an associate of alcohol consumption (Bombardier et al., 1997; Sander et al., 2012). One study has investigated this

variable as a predictor of treatment outcome in post-ABI anger, with the paradoxical finding that lower readiness to change was associated with greater improvement (Hart et al., 2023).

**Daily strategy use.** The daily use of an ER strategy has been significantly associated with its effectiveness for emotion management after ABI (Rowlands et al., 2021). However, the influence on *anger*, in particular, is less well known. Participating in an anger management intervention has significantly increased the use of ER techniques, such as reappraisal, in the daily lives of survivors of ABI (Aboulafia-Brakha & Ptak, 2016). Hence, this seems like a worthy line of research.

**Cognitive abilities.** Cognitive impairment is another common and long-term consequence of ABI (Cattelani et al., 2010; Marsh et al., 2016), and is suggested to be a significant correlate of treatment outcome (Hart et al., 2012, 2015). When selecting cognitive measures, we were mindful of previous ER work in survivors of ABI. Thus, measures of *working memory, verbal fluency*, and *inhibition* were employed, as these three cognitive domains have been associated with the implementation of reappraisal in survivors of ABI (Rowlands et al., 2020, 2021; Salas et al., 2013; 2014). Importantly, despite the presence of cognitive difficulties, survivors of ABI *can* still benefit from an anger reduction intervention (e.g., Aboulafia-Brakha & Ptak, 2016; Rochat et al., 2019).

#### 4.2.5 Study Aims

The present study is the first to investigate the preliminary efficacy of a Process Model-based intervention for regulating anger after ABI. The intervention was designed to be efficient: administered individually, and virtually, to participants in as brief as a single session. Furthermore, it includes *two* ER techniques (see Witten et al., 2022 for a justification of the chosen techniques), allowing participants to select one for use in their daily lives, based on their personal preferences and circumstances.

As regards the intervention's preliminary efficacy, we predicted significant differences in the subscales of the main outcome measures (i.e., STAXI-2 and AQ-12) for *characteristic anger, anger expression*, and *anger control* between: (1) baseline and post-treatment and (2) baseline and 3-month follow-up (3MFU). We predicted no significant differences in these same subscales between (3) post-treatment and 3MFU.

As regards the correlates of intervention gains, we predicted significant associations between the differences in the main outcome measures (from baseline to 3MFU) and (1) mental health; (2) readiness to change; (3) ER strategy use; and (4) cognitive functioning.

# 4.3 Method

#### 4.3.1 Design

The present study used a pre-post intervention design with a further 3MFU. There were five individually administered, 1-hour Zoom meetings with the Lead Researcher [JAW], over a period of approximately four months. The first four meetings (Pre-T1, T1, T2, and Post-T1) were scheduled to occur once a week, and the follow-up (Post-T2) three months after the intervention (T2). Realistically, the first four meetings occurred, on average, every two weeks (M = 13.60; SD = 3.59) depending on the participant's availability, and the follow-up, three months and two weeks after the intervention (M = 101.04; SD = 10.72). See Figure 4.1 for an overview of the study's administration.

#### 4.3.2 Participants

24 participants with an ABI were recruited from brain injury support organisations in the United Kingdom (UK). 14 participants were from Headway UK, two from the Active Care Group, two from Global Brain Injury Awareness (GBIA), and six were recruited via word-ofmouth from these organisations (see Appendix C for the recruitment flyer). Like Rowlands and colleagues (2021), this sample size was governed by the highest number of participants





that we were able to recruit, in this case, under conditions of the COVID-19 pandemic (across 2021 and 2022).

Eligible participants were identified during a screening interview on Zoom by JAW. All were fluent English-speakers (including Welsh-English bilinguals), who had sustained any type of ABI at least nine months prior to recruitment. Exclusion criteria included any major perceptual or motor impairments that would interfere with task completion, or major neurological or mental health conditions unrelated to the ABI. All screened individuals met the study inclusion criteria (n = 29). However, five did not enrol; four for personal reasons. A total of 24 participants enrolled in and completed the study; none were lost to follow-up. See Figure 4.2 for an overview of the recruitment process.





10 females and 14 males participated in the study. Participants were, on average, 50.08 years old (SD = 16.85; range 24 – 85) with 14.63 years of education (SD = 3.49; range 10 – 22). In addition, they had sustained an ABI an average of 7.88 years ago (median = 5.13; SD = 7.82; range 11 months – 32 years). Mann-Whitney U tests demonstrated no significant

differences between males and females with regards to age [U = 85.00, p = .40] and time since injury [U = 70.00, p = 1.00]. A series of paired sample investigations between premorbid and post-injury anger demonstrated significant differences in characteristic anger [STAXI-2 Trait Anger t(21) = -3.42, p < .01; AQ-12 t(21) = -3.79, p < .01] and in the outward control of this emotion [t(21) = 2.75, p < .05], with medium to large effect sizes. See Table 4.1 for a description of each participant's demographic and injury characteristics.

# 4.3.3 Materials

Anger elicitation. The <u>Affective Story Recall</u> (ASR; Turnbull et al., 2005) is an autobiographical recall task used for emotion elicitation. The psychometric properties of ASR have not been investigated. However, this task has been used in previous studies to elicit emotions in neurologically healthy individuals (Salas et al., 2012) and those with ABI (Rowlands et al., 2020, 2021; Salas Riquelme et al., 2015; Tondowski et al., 2007). During this task, participants have three minutes to verbally recall a personal event where someone from a particular relationship category (i.e., *family member, romantic partner, friend or colleague, stranger*, or *abstract*) made them feel frustrated or angry. These categories were chosen by the researchers as they have previously been identified as relationship types affected by uncontrolled anger (Beames et al., 2019).

Anger outcome measures. The <u>STAXI-2</u> (Spielberger, 1999) was chosen as the primary outcome measure of anger. In terms of its psychometric properties, it has demonstrated acceptable reliability and validity (Culhane & Morera, 2010; Etzler et al., 2014), and is a widely used measure of anger in survivors of ABI (see Byrne & Coetzer, 2016; Iruthayarajah et al., 2018, for reviews). The STAXI-2 has a total of 57 items and contains three major subscales relating to various components of anger.

*Current anger.* The <u>State Anger</u> subscale of the STAXI-2 was used as a measure of current anger intensity during the intervention tasks. It has 15 items scored on a 4-point

	Age	Gender	Education	Time Since	ABI	ABI Description
ID	(years)		(years)	Injury (years)	Aetiology	-
1	47	Male	19	1	MCA aneurysm	Rupture resulted in intracranial hemorrhage.
2	68	Male	14	10	TBI	Injury information obtained through self-report; no further information provided.
3	52	Female	14	1	TBI	Subarachnoid hemorrhage involving bilateral frontal and right temporal-occipital lobes. GCS of 12.
4	45	Male	17	7	TBI	Subdural hemorrhage in right frontoparietal region. GCS of 14.
5	28	Female	21	15	TBI	Involving frontal lobes.
6	24	Female	16	4	TBI	Severe diffuse axonal injury. GCS of 7.
7	24	Male	19	4	Hypoxia	Involving basal ganglia.
8	63	Female	11	6	Aneurysm	Rupture resulted in subarachnoid hemorrhage. GCS of 3.
9	53	Male	15	6	Tumor resection	Right frontotemporal meningioma.
10	36	Male	16	3	TBI	Diffuse axonal injury involving left postero-inferior temporal
						lobe and right superior frontal gyrus. GCS of 14.
11	51	Male	12	7	TBI	Involving frontal lobes.
12	85	Male	14	1	CVA	Injury information obtained through self-report; no further information provided.
13	37	Female	19	32	Tumor	Astrocytoma involving right side of brain stem; injury information obtained through self-report.
14	81	Male	14	15	CVA	Involving right frontal lobe; injury information obtained through self-report.
15	26	Male	15	5	TBI	Injury information obtained through self-report; no further information provided.
16	72	Male	12	11 months	CVA	Injury information obtained through self-report; no further information provided.
17	59	Female	13	2	TBI	Right temporal hemorrhage.
18	51	Female	14	1	CVA	Involving left frontal lobe, posterior limb of left internal capsule, and pons.

**Table 4.1** Demographic and injury characteristics of the current sample (N = 24)

19	66	Male	14	2	CVA	Hemorrhage involving right basal ganglia.
20	50	Male	10	14	TBI	Injury information obtained through self-report; no further
						information provided.
21	52	Female	10	1	CVA	Left frontal subarachnoid hemorrhage.
22	48	Female	10	4	Neurosurgery	Lesion resection in right anterior temporal lobe.
					Post-operative CVA	Post-operative infarction resulting in atrophy of the right amygdala and anterior hippocampus.
23	36	Female	22	15	TBI	Diffuse axonal injury. Left anterior temporal and parietal lobe contusions. Parenchymal hemorrhage in right frontal and occipital lobes. GCS of 11.
24	48	Male	10	21	Neurotoxicity	Mefloquine prescribed for malaria prevention.

*Note*. ABI = acquired brain injury; CVA = cerebrovascular accident; GCS = Glasgow Coma Scale; MCA = middle cerebral artery; TBI = traumatic brain injury. Where possible, ABI information was confirmed through personal medical records provided by the participants.

Likert scale, with response options ranging from 1 ("not at all") to 4 ("very much so"). Higher scores on this subscale indicate more intense feelings of anger.

*Characteristic anger.* The <u>Trait Anger</u> subscale of the STAXI-2 was used as the primary measure of characteristic anger. It has 10 items scored on a 4-point Likert scale, with response options ranging from 1 ("almost never") to 4 ("almost always"). Higher scores on this subscale indicate more frequent experiences of anger over time.

The <u>AQ-12</u> (Bryant & Smith, 2001; Buss & Perry, 1992) was used as a secondary outcome measure of characteristic anger. In terms of its psychometric properties, it has demonstrated satisfactory reliability and validity (Bryant & Smith, 2001), and has been used to measure aggression in survivors of ABI (see Byrne & Coetzer, 2016; Iruthayarajah et al., 2018, for reviews). This brief measure has 12 items scored on a 6-point Likert scale, with response options ranging from 1 ("extremely uncharacteristic of me") to 6 ("extremely characteristic of me"). Higher scores on this measure indicate a higher predisposition towards aggressive behaviour.

Anger expression and control. The <u>Anger Expression</u> and <u>Anger Control</u> subscales of the STAXI-2 was used as a measure of the inwards and outwards expression and control of anger. Collectively, these two subscales have 32 items scored on a 4-point Likert scale, with response options ranging from 1 ("almost never") to 4 ("almost always"). Higher scores on the Expression subscales indicate more frequent outward expressions or inward suppressions of anger. Higher scores on the Control subscales indicate more control over anger.

**Mental health.** The <u>Hospital Anxiety and Depression Scale</u> (HADS; Zigmond & Snaith, 1983) was used as a measure of anxiety and depression. In terms of its psychometric properties, the HADS has demonstrated good reliability and validity (see Bjelland et al., 2002, for a review), and is commonly used to measure mood in survivors of ABI (Aboulafia-Brakha et al., 2013; Medd & Tate, 2000; Rowlands et al., 2020; Salas et al., 2014). It has 14

items scored on a scale of 0 to 3, with response options varying according to each item. Higher scores on this measure indicate a higher state of anxiety or depression.

**Readiness to change.** The <u>Anger Readiness to Change Questionnaire</u> (ARCQ; Rollnick et al., 1992; Williamson et al., 2003) was used as a measure of openness to change anger-related behaviour. In terms of its psychometric properties, the ARCQ has demonstrated acceptable reliability and validity (Bombardier & Heinemann, 2000; Heather et al., 1993; Rollnick et al., 1992; Williamson et al., 2003), and has been used to measure readiness to change certain behaviours in survivors of ABI (Bombardier et al., 1997; Sander et al., 2012). It has 12 items (4 items representing a subscale for each of the three stages of change) scored on a 5-point Likert scale, with response options ranging from -2 ("strongly disagree") to 2 ("strongly agree"). Participants are classified into the *pre-contemplation, contemplation*, or *action* stages according to their highest score on the relevant subscale. Higher scores on this measure indicate more readiness to change.

**Emotion regulation.** The Emotion Regulation Questionnaire (ERQ; Gross & John, 2003) was used as a measure of the use of ER strategies in daily life. In terms of its psychometric properties, the ERQ has demonstrated good reliability and validity (Preece et al., 2019, 2021), and is a widely used measure of ER in survivors of ABI (Mantua et al., 2018; McDonald et al., 2010; Salas et al., 2013, 2014). It has 10 items measuring the use of cognitive reappraisal and expressive suppression, scored on a 7-point Likert scale with response options ranging from 1 ("disagree strongly") to 7 ("agree strongly"). As the ERQ does not have any items measuring the use of attentional deployment, members of the research team created six additional questions pertaining to this strategy. Higher scores on this measure indicate the more frequent use of ER strategies.

**Neuropsychological assessment.** A short battery of tests measured the cognitive domains associated with reappraisal implementation in ABI (Rowlands et al., 2020, 2021;

Salas et al., 2014). *Working memory* was measured using the Digit Span and Sequencing subtests from the Wechsler Adult Intelligence Scale – Fourth Edition (WAIS-IV; Wechsler, 2010). *Verbal generativity* was measured using the Verbal Fluency Test from the Delis-Kaplan Executive Function System (DKEFS; Delis et al., 2001). *Inhibition* was measured using the Hayling Sentence Completion Test from the Hayling and Brixton Tests (Burgess & Shallice, 1997). All tests have demonstrated satisfactory psychometric properties (Burgess & Shallice, 1997; Delis et al., 2001; Strong et al., 2010; Wechsler, 2010), and have been used as cognitive measures in survivors of ABI (e.g., Aboulafia-Brakha & Ptak, 2016; McDonald et al., 2010; Rowlands et al., 2020, 2021; Salas et al., 2014; Salas Riquelme et al., 2015).

# 4.3.4 Procedure

Ethical approval was granted by the Research Ethics and Governance Committee at Bangor University's School of Human and Behavioural Sciences (reference no. 2020-16812). Informed consent was obtained from all participants (see Appendix D for an example of the Participant Information Sheet and Consent Form). See Figure 4.3 for a description of each meeting's content.



#### Figure 4.3 Meeting content.
**Talk and Chalk intervention.** Before commencing the main trials, the participant completed a practice trial, where they could familiarise themselves with the tasks. For each main trial, they recalled an anger-inducing event for one of the five relationship categories (i.e., ASR), after rating their attachment to the specified individual or entity. Next, the participant deployed one of the two ER techniques to regulate their anger for this event (i.e., *reappraisal*/Talk or *distraction*/Chalk). Their current feelings of anger were captured by the State Anger subscale of the STAXI-2 twice: Immediately after recalling the event, and then again after deploying one of the ER techniques. The purpose of these two measurements was to determine whether the ER technique produced any changes in anger intensity for the event. See Figure 4.4 for an example of the visual aids that accompanied the main trials.





For example, one participant described a situation where a parent did not approve of his current romantic relationship. This situation was reappraised as bringing him closer to his parent, as well as leading to the re-evaluation of his relationships in general (including friendships). Another participant described a situation where her daughter had neglected her responsibilities to care for her pets. She then engaged in the distraction task, by drawing and describing a picture of a particular path that she enjoys walking on, which is surrounded by trees and wildflowers.

This block of tasks (i.e., ASR > State Anger > ER technique > State Anger) was administered up to five times according to the five relationship categories. These categories, and the use of reappraisal or distraction, were counterbalanced to avoid practice effects (see Appendix B). See Figure 4.5 for the Talk and Chalk intervention process.

Figure 4.5 Talk and Chalk intervention process.



Debrief

Homework diary. Like previous anger reduction interventions for survivors of ABI (e.g., Medd & Tate, 2000; Rochat et al., 2019), participants had the option to practice applying the ER techniques to everyday situations of anger using a diary (based on Deffenbacher & Stark, 1992). For each situation, they were encouraged to provide a brief description of what occurred, along with an anger intensity rating (from "0" or "no anger" to "10" or "the most angry I have ever been"). Next, they chose and documented one of the two

ER techniques, and rated their anger intensity for the situation after deploying their chosen technique (see Appendix E for an example of the homework diary).

10 of the 24 participants (41.7%) used the diary. The group recorded a total of 32 events, with an average of 3 (range 1 - 11). Reappraisal was chosen for 26 events (81.2%) and distraction for 6 (18.8%). Common reasons for not using the diary were related to practicalities (e.g., no events to record, not having the diary on them when an event occurred), memory (i.e., forgetting to use it), and personal preference (e.g., not being a "diary" person, already having effective emotion management techniques).

**Methodological comment.** The intervention was designed with the aim of being as clinically realistic and practical as possible. Therefore, the number of trials that participants completed in the 60-minute session was tailored to their individual circumstances. The only requirement was to complete a minimum of two trials, to practice deploying each of the ER strategies at least once. Participants' individual circumstances were governed by time and relationship category.

Regarding time, the majority of participants grasped the tasks easily, and were able to complete most (if not all) of the trials efficiently. However, some required more time during the practice trial to familiarise themselves with the tasks, resulting in less time allocation for the main trials. As a result, the group completed between two to five main trials: Three of the 24 participants (12.5%) completed all five, 12 participants (50%) completed four, one participant (4.17%) completed three, and eight participants (33.3%) completed two.

Regarding relationship categories, some participants were not able to recall an event for a specific category. This was because they could not identify an individual or entity belonging to this category that angered them. As a result, the "Friend" category was completed by 19 of the 24 participants (79.2%), "Abstract" by 18 (75%), "Stranger" by 16 (66.7%), "Partner" by 15 (62.5%), and "Family" by 14 (58.3%).

### 4.4 Data Management and Statistical Analyses

All statistical analyses were conducted using SPSS. The threshold for statistical significance was set at  $\alpha = .05$ , unless indicated otherwise.

# 4.4.1 Intervention's Preliminary Efficacy

The intervention's preliminary efficacy was evaluated through *three* categories of change: *characteristic anger* (measured by the Trait Anger subscale of the STAXI-2 and the AQ-12), *anger expression* (measured by the Anger Expression-In [AXI] and Anger Expression-Out [AXO] subscales of the STAXI-2), and *anger control* (measured by the Anger Control-In [ACI] and Anger Control-Out [ACO] subscales of the STAXI-2).

All three categories were measured across three timepoints: baseline, post-treatment, and 3MFU. *T*-scores were used for the STAXI-2 subscales (i.e., scaled scores adjusted for gender and age), and raw scores for the AQ-12. A series of one-way repeated-measures ANOVAs were conducted, and, in the case where sphericity was violated (this only applied to ACI), the Greenhouse-Geisser correction was used. Score differences were calculated between: (1) baseline and post-treatment; (2) baseline and 3MFU; and (3) post-treatment and 3MFU.

# **4.4.2 Correlates of Intervention Gains**

**Participant characteristics.** A set of secondary analyses were conducted to explore any relationships between the four participant factors and intervention gains.

The first factor, *mental health*, was derived by calculating the total raw scores for the depression and anxiety subscales on the HADS. The second factor, *readiness to change*, was derived by converting data from the ARCQ to a continuous variable, by summing the reverse scored precontemplation score with the contemplation and action scores (see Williamson et al., 2003 for further details). The third factor, *ER strategy use*, was derived by calculating the total raw score for the reappraisal subscale on the ERQ, and for the attentional deployment

items. The fourth factor, *cognitive functioning*, was derived by converting the following subtests' total or overall raw scores to scaled scores: Digit Span (working memory), Letter Fluency (verbal generativity) and Hayling sentences (Inhibition).

Intervention gains were calculated through difference scores between baseline and 3MFU for the measures representing characteristic anger. A series of Spearman's rho bivariate correlations were then conducted (as the data were not normally distributed) between the difference scores and the four participant factors.

**Diary usage.** Secondary analyses were also conducted to explore the relationship between diary use and intervention gains. A series of Pearson's bivariate correlations were conducted between baseline and 3MFU difference scores for the two measures of characteristic anger (continuous variable) and diary use (coded as a dichotomous "yes/no" categorical variable).

# 4.5 Results

# **4.5.1 Emotional and Cognitive Functioning**

To characterize the group's emotional and cognitive functioning, and to explore participant factors that could predict the magnitude of improvement, data were collected on four categories: (1) mental health (HADS), (2) readiness to change (ARCQ), (3) ER strategy use (ERQ), and (4) for the three cognitive abilities of working memory (Digit Span), verbal generativity (Letter Fluency), and inhibition (Hayling Sentences). See Table 4.2 for a descriptive summary of their performance on these measures.

Regarding mental health, the group scored, on average, within the normal range for symptoms of depression (4/24 scored within the clinical range) and anxiety (8/24 scored within the clinical range). Regarding readiness to change, most participants were classified as being in the contemplation (9/24) or action (10/24) stages. There was no difference between the reported use of reappraisal and attentional deployment in daily life [t(23) = 0.85, p = .41,

	Depression	Anxiety	Open to Change	Reappraisal	AD	Working	Verbal	Inhibition
	(HADS)	(HADS)	(ARCQ)	(ERQ)	(ERQ)	Memory	Generativity	
M (SD)	5.75 (4.18)	7.54 (4.86)		26.67 (9.42)	25.71 (9.40)	25.17 (5.64)	34.08 (9.15)	16.58 (2.57)
M(SD) scaled score						9.04 (2.79)	9.13 (2.64)	5.25 (1.07)
Borderline abnormal/Impaired								
Score range [scaled score]	8 - 10	8 - 10				[6]	[4 - 6]	[3]
<i>n</i> Borderline [%]	4 [17%]	6 [25%]				3 [13%]	5 [21%]	2 [8%]
Clinical/Impaired								
Score range [scaled score]	11 - 21	11 - 21				[1-5]	[1 - 3]	[1 - 2]
n Clinical/Impaired [%]	4 [17%]	8 [33%]				2 [8%]	0 [0%]	0 [0%]
Stage designation								
<i>n</i> [%] Pre-contemplation			5 [21%]					
<i>n</i> [%] Contemplation			9 [37%]					
n [%] Action			10 [42%]					

**Table 4.2** Descriptive statistics for the sample's emotional and cognitive functioning (N = 24)

Note. AD = Attentional Deployment; ARCQ = Anger Readiness to Change Questionnaire (Rollnick et al., 1992; Williamson et al., 2003); ERQ

= Emotion Regulation Questionnaire (Gross & John, 2003); HADS = Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983).

Working memory was measured using Digit Span from the Wechsler Adult Intelligence Scale – Fourth Edition (Wechsler, 2010).

Verbal generativity was measured using Letter Fluency from the Delis-Kaplan Executive Function System (Delis et al., 2001).

Inhibition was measured using Hayling Sentences from the Hayling and Brixton Tests (Burgess & Shallice, 1997).

small effect size]. Regarding cognitive abilities, the group scored, on average, within the normal range for working memory (2/24 scored within the impaired range), verbal generativity (no participants scored within the impaired range), and inhibition (no participants scored within the impaired range).

### 4.5.2 Intervention's Preliminary Efficacy

To determine the intervention's preliminary efficacy, data were collected on six outcome measures representing *characteristic anger* (Trait Anger subscale, AQ-12), *anger expression* (AXI and AXO subscales), and *anger control* (ACI and ACO subscales), at baseline, post-treatment, and 3-month follow-up (3MFU). Overall, the group demonstrated significant improvements from baseline to 3MFU on five of the six outcome measures. The exception was AXI, where no improvements were evident. See Table 4.3 for a descriptive summary of their performance on these measures.

**Characteristic anger.** As seen in Table 4.3, scores on Trait Anger improved from baseline (M = 56.33; SD = 14.55) to 3MFU (M = 47.00; SD = 8.69). A series of one-way repeated measures ANOVAs confirmed significant improvements between baseline and post-treatment [F(1, 23) = 16.59, p < .001,  $\eta^2 = 0.42$  (large effect size), Power = 97%], and baseline and 3MFU [F(1, 23) = 14.06, p = .001,  $\eta^2 = 0.38$  (large effect size), Power = 95%], demonstrating that the greatest gains were observed during the intervention period. Scores on Trait Anger continued to improve from post-treatment to 3MFU, however this improvement was not significant.

Scores on the AQ-12 also improved from baseline (M = 30.38; SD = 10.48) to 3MFU (M = 23.50; SD = 9.12). This improvement was significant [F(1, 23) = 30.39, p < .001,  $\eta^2 = 0.57$  (large effect size), Power = 100%], as was that between post-treatment and 3MFU [F(1, 23) = 14.81, p < .01,  $\eta^2 = 0.39$  (large effect size), Power = 96%], demonstrating that the greatest gains were observed after the intervention period. Scores on the AQ-12 also

	Baseline	Post-Treatment	3MFU
Outcome Measure	M (SD), Range	M (SD), Range	M (SD), Range
STAXI-2 (T-Scores)			
Trait Anger	56.33 (14.55), 34 - 80	49.00 (11.93), 34 - 80	47.00 (8.69), 36 – 72
Anger Expression-In [AXI]	56.83 (13.03), 30 - 80	57.33 (9.79), 32 – 72	57.75 (11.64), 32 – 76
Anger Expression-Out [AXO]	55.83 (15.92), 26 - 80	49.50 (13.64), 26 – 76	47.67 (11.78), 26 – 68
Anger Control-In [ACI] <sup>a</sup>	44.50 (10.50), 24 - 60	46.92 (9.38), 28 – 64	51.42 (9.41), 30 - 66
Anger Control-Out [ACO] <sup>a</sup>	40.42 (12.89), 20 - 64	44.33 (12.01), 24 – 64	46.83 (9.99), 26 - 64
AQ-12 (Raw Score)	30.38 (10.48), 12 – 50	27.54 (10.01), 12 – 51	23.50 (9.12), 13 – 43

**Table 4.3** Descriptive statistics for anger outcome measures at three timepoints (N = 24)

*Note*. AQ-12 = Aggression Questionnaire (Bryant & Smith, 2001; Buss & Perry, 1992); STAXI-2 = State-Trait Anger Expression Inventory-2 (Spielberger, 1999); 3MFU = 3-month follow-up.

<sup>a</sup>Higher scores represents better anger control.

improved from baseline to post-treatment, however this improvement was not significant.

Anger expression. As seen in Table 4.3, scores on AXI improved slightly from baseline (M = 56.83; SD = 13.03) to 3MFU (M = 57.75; SD = 11.64). However, a series of one-way repeated measures ANOVAs confirmed no significant improvements between any of the three time points. Scores on AXO also improved from baseline (M = 55.83; SD =15.92) to 3MFU (M = 47.67; SD = 11.78). This improvement was significant [F(1, 23) =9.55, p < .01,  $\eta^2 = 0.29$  (large effect size), Power = 84%], as was that between baseline and post-treatment [F(1, 23) = 7.21, p < .05,  $\eta^2 = 0.24$  (large effect size), Power = 73%], demonstrating that the greatest gains were observed during the intervention period. Scores on AXO continued to improve from post-treatment to 3MFU, however this improvement was not significant.

Anger control. As seen in Table 4.3, scores on ACI improved from baseline (M = 44.50; SD = 10.50) to 3MFU (M = 51.42; SD = 9.41). A series of one-way repeated measures ANOVAs confirmed that this was the only subscale where significant improvements were observed between all three time points [F(2, 46) = 7.66, p < .01,  $\eta^2 = 0.25$  (large effect size), Power = 85%], demonstrating that the greatest gains were observed both during and after the intervention period.

Scores on ACO also improved from baseline (M = 40.42; SD = 12.89) to 3MFU (M = 46.83; SD = 9.99). This improvement was significant [F(1, 23) = 7.89, p < .05,  $\eta^2 = 0.26$  (large effect size), Power = 77%], as was that between baseline and post-treatment [F(1, 23) = 5.65, p < .05,  $\eta^2 = 0.20$  (large effect size), Power = 62%], demonstrating that the greatest gains were observed during the intervention period. Scores on the ACO continued to improve from post-treatment to 3MFU, however this improvement was not significant.

**Time since injury as a predictor of intervention gains.** To determine whether time since injury predicted intervention gains, a series of simple regression analyses were conducted with the difference scores between baseline and 3MFU for each of the six outcome measures (dependent variable) and months since injury (predictor variable). These investigations confirmed that time since injury did *not* significantly predict the amount of change observed for any of the six outcome measures: Trait Anger  $R^2 = .01$ , F(1, 23) = 0.22, p > .05; AQ-12  $R^2 = .01$ , F(1, 23) = 0.32, p > .05; AXI  $R^2 = .01$ , F(1, 23) = 0.13, p > .05; AXO  $R^2 = .01$ , F(1, 23) = 0.20, p > .05; ACI  $R^2 = .00$ , F(1, 23) = 0.05, p > .05; ACO  $R^2 = .00$ , F(1, 23) = 0.04, p > .05.

### **4.5.3** Correlates of Intervention Gains

**Participant characteristics.** To determine the correlates of intervention gains, a series of bivariate correlations for non-normally distributed data were conducted between the four participant factors, and the baseline to 3MU difference scores for the *characteristic anger* outcome measures. Overall, anxiety and readiness to change were significantly associated, whereas depression, the use of ER strategies, and levels of cognitive functioning were not (see Table 4.4).

Variable	Outcome Measure $(r)$			
	Trait Anger (STAXI-2)	AQ-12		
Mental Health (HADS)				
Depression	.29	.34		
Anxiety	.42*	.36		
Readiness to Change (ARCQ)	.54**	.46*		
ER Strategy Use (ERQ)				
Reappraisal	05	.18		
Attentional deployment	08	.04		
Cognitive Functioning				
Digit Span (WAIS-IV)	01	.10		
Letter Fluency (DKEFS)	.33	.15		
Sentence Completion (Hayling)	.03	.14		

**Table 4.4** Relationship between participant characteristics and intervention gains (N = 24)

*Note.* AQ-12 = Aggression Questionnaire (Bryant & Smith, 2001; Buss & Perry, 1992); ARCQ = Anger Readiness to Change Questionnaire (Rollnick et al., 1992; Williamson et al., 2003); DKEFS = Delis-Kaplan Executive Function System (Delis et al., 2001); ER = emotion regulation; ERQ = Emotion Regulation Questionnaire (Gross & John, 2003); HADS = Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983); STAXI-2 = State-Trait Anger Expression Inventory-2 (Spielberger, 1999); WAIS-IV = Wechsler Adult Intelligence Scale (Wechsler, 2010).

Scores for the ARCQ ranged from -24 to +24; higher numbers indicated more readiness to change.

\*p < .05. \*\*p < .01. All p-values are two-tailed.

*Readiness to change* was the most significant correlate of intervention gains in characteristic anger. While correlation does not imply causality, as seen in Table 4.4, this positive relationship suggests that increases in readiness to change are associated with increases in intervention gains (Trait Anger subscale, p = .007; AQ-12. p = .03). *Anxiety* was also positively correlated to intervention gains (Trait Anger subscale, p = .04).

**Diary usage.** A second set of bivariate correlations were conducted to determine whether diary usage was associated with intervention gains. These findings demonstrated a significant positive relationship for the AQ-12 (r = .46, p < .05), but not Trait Anger (r = .19, p = .38). It may be of clinical importance that increases in diary entries are associated with increases in intervention gains.

### 4.5.4 Methodological Note

One concern with the varying number of main trials completed during the Talk and Chalk intervention, is the possible advantage that the completion of more trials has on the intervention's efficacy. Thus, a series of investigations confirmed that the number of trials completed did *not* significantly influence intervention gains for any of the anger outcome measures: Trait Anger F(3, 20) = 1.69, p = .20; AQ-12 F(3, 20) = 2.23, p = .12; AXI F(3, 20) = 1.27, p = .31; AXO F(3, 20) = 0.08, p = .97; ACI F(3, 20) = 0.09, p = .97; ACO F(3, 20) = 0.61, p = .62.

### 4.6 Discussion

The present proof-of-concept study evaluated the initial efficacy of a virtually administered, ER-based intervention for managing post-ABI anger. Although existing interventions are effective (Byrne & Coetzer, 2016; Iruthayarajah et al., 2018), limitations to previous studies include multiple intervention sessions, group administration, and varying conceptual frameworks. Thus, Talk and Chalk was designed as a response to these limitations, by providing a theoretically driven, pragmatic yet comparably efficacious alternative. Additional benefits include its delivery via a videoconferencing platform, and the choice between two ER techniques. The main findings are discussed in relation to: (1) the intervention's shortand long-term efficacy and (2) participant characteristics that are associated with intervention gains.

### 4.6.1 Talk and Chalk Reduces Anger in the Short-Term

Determining whether the proposed intervention demonstrates short-term benefits has important implications for its efficacy and acceptability to patients and clinicians. Our results demonstrated clear gains from baseline to post-treatment on external (but not internal) measures of anger. Consistent with existing interventions (Byrne & Coetzer, 2016; Iruthayarajah et al., 2018), participants experienced, and outwardly expressed, less anger, and had better control over this emotion, after the intervention. On the other hand, there were no changes in the way that they internalised their anger.

One possible explanation for this finding is that changing internal anger may require time beyond the intervention period, as this process involves a level of reflection and practice from the individual (Iruthayarajah et al., 2018). Future work may therefore explore this possibility, by extending the follow-up period to six or 12 months. Another explanation may be that self-report measures are not sensitive enough to detect changes in internal anger. Therefore, future work may consider using objective approaches such as physiological measures. Nonetheless, although improvements in internal anger would have been beneficial, external expressions are arguably more important, as these are the types of behaviours that affect family members and loved ones (Gould, 2019; Saban et al., 2015; Yasmin & Riley, 2022). Taken together, these findings support the initial efficacy of Talk and Chalk for post-ABI anger modulation in the short-term. Given these promising results, it was of significant interest to determine whether these gains are maintained over time.

# 4.6.2 Talk and Chalk Shows Promise in the Long-Term

Determining whether the proposed intervention demonstrates long-term benefits has important implications for its real-world applicability. Our results demonstrated that the *type* of gains observed for external measures of anger depend on the evaluation period. Consistent with existing interventions (Byrne & Coetzer, 2016; Iruthayarajah et al., 2018), improvements *continued* from pre-treatment to follow-up, in the way that participants experienced and outwardly expressed anger, as well as their control over this emotion. However, there were no *further* improvements from post-treatment to follow-up.

These findings suggest a noteworthy real-world implication, in that individuals can, indeed, demonstrate improvements in external anger over time. However, as a group, gains stabilized at post-treatment. In addition, consistent with short-term findings, internal anger

remained non-significant over time. Building upon Iruthayarajah and colleagues' (2018) explanation, future studies may consider extending their follow-up period to 6 or 12 months. However, this recommendation is less urgent, as improvements in external anger remain important for personal relationships with family members and loved ones. Taken together, these findings support the notion that Talk and Chalk potentially has long-lasting benefits for post-ABI anger modulation, with important consequences for the field.

### 4.6.3 Relevance to the Field

In sum, Talk and Chalk produced similar short- and long-term gains to existing interventions (Byrne & Coetzer, 2016; Iruthayarajah et al., 2018), by improving external (but not internal) anger, and maintaining these gains at follow-up. Not only is it an efficient, feasible, and initially efficacious alternative for regulating post-ABI anger, Talk and Chalk also has other advantages over existing interventions.

Firstly, Talk and Chalk can be administered in a *single* session, minimizing attrition rates (cf., Hart et al., 2015; Walker et al., 2010). Relatedly, this session focused on ER, while existing interventions address multiple topics (e.g., psychoeducation, relaxation techniques), making it difficult to establish which produced therapeutic gains (Aboulafia-Brakha & Ptak, 2016; Hart et al., 2012; Rochet et al., 2019). Secondly, Talk and Chalk was administered *individually*, suggesting that this type of delivery is comparable to group designs (and perhaps contributed to the low drop-out rate), while allowing the practitioner to tailor the content to the participant's cognitive needs. Thirdly, the intervention's theoretical foundation is based on improving *ER* for manageable anger, through the application of two techniques. These relatively simple techniques avoid abstract theories and skills that may require a level of metacognitive ability (cf., CBT; Moritz et al., 2022; Sassaroli et al., 2014).

Two additional benefits to the study design are notable. Firstly, Talk and Chalk was delivered *online*, via a videoconferencing platform. Despite the limitations to virtual care (see

Tenforde et al., 2017 for a review), our participants reported in their post-treatment interview (see Appendix F for the interview protocol) that this mode of delivery was preferrable, as it circumvented travel and logistical requirements of an in-person appointment. Secondly, this is the first study to investigate *patient choice* in an ER intervention for post-ABI anger (Witten et al., 2022). Our participants were provided with two ER techniques, and, during the homework activity, chose one based on personal preferences or situational practicalities. Thus, in addition to addressing some of the limitations in the field, these additional benefits might make Talk and Chalk a more appealing and flexible option to patients.

# 4.6.4 Readiness to Change and Anxiety are Important Correlates

Identifying which participant characteristics are related to intervention gains may have implications for clinical care (Cattelani et al., 2010; Hart et al., 2012, 2023). Firstly, in keeping with similar research in offender populations (Howells et al., 2005; Williamson et al., 2003) and those with ABI (Hart et al., 2023), readiness to change appears to be an important factor for improvements in characteristic anger. That is, the more ready a participant was to change their anger-related behaviour, the more they gained from the intervention. This finding has noteworthy clinical implications, as it suggests that readiness to change could be a barrier to post-ABI intervention gains. Clinicians may therefore consider implementing a pre-intervention work up for potential candidates with no or low levels of readiness to change.

The second important factor was anxiety, which could be explained by the finding that anxious individuals have demonstrated behavior improvements due to increased perfectionism (see Hewitt et al., 2002). Nonetheless, considering the high prevalence of post-ABI anxiety (Osborn et al., 2016; Scholten et al., 2016), clinicians could have concerns regarding Talk and Chalk's suitability for anxious patients, and may therefore, along with

readiness to change, include these two variables as part of their criteria for potential intervention candidates.

### 4.6.5 Depression, Strategy Use, and Cognitive Functioning were not Related

Identifying which participant characteristics are unrelated to intervention gains are equally important. Depression and the use of ER strategies were not associated with treatment outcome, although our findings are inconsistent with previous studies that found an association between depression and the modulation of positive emotions (Rowlands et al., 2020), or between the use of ER strategies and the effectiveness of an ER technique (Rowlands et al., 2021). Regarding domains of cognitive functioning (i.e., working memory, verbal generativity, inhibition), our results are consistent with a previous study that found these variables were not correlated (Rowlands et al., 2020). Thus, it appears that depression, the use of an ER strategy, and certain cognitive domains should not be included as contraindications for potential Talk and Chalk candidates.

### 4.6.6 Adapting Talk and Chalk

Tailoring the Talk and Chalk content to suit each participant's individual circumstances highlighted further considerations for its clinical implementation. Firstly, some patients may be able to complete all five trials relatively quickly, whereas others may complete as few as two if they require more time to grasp the task. Importantly, our results suggested that the number of trials completed did not influence the intervention's initial efficacy. Secondly, clinicians may consider skipping a relationship category if a patient is unable to recall an anger-inducing event, if, for example, they have never had a romantic partner. Finally, diary use was associated with intervention gains. It therefore may be appropriate for clinicians to encourage patients to use this resource to apply the ER techniques to their day-to-day situations of anger. Notably, these adaptions were possible due to the one-on-one

therapy.

### 4.6.7 Limitations

Although the present study has important clinical implications, there are several limitations to consider when interpreting the results. Like previous exploratory studies (Aboulafia-Brakha et al., 2013; Hart et al., 2012) we used a pre-post intervention design as the first step in establishing proof-of-concept. As such, our findings are governed by a small sample size and the lack of a comparison group. Nonetheless, considering that our outcome measures demonstrated changes in the anticipated direction, the next step would be to conduct a randomized control trial (RCT) with a waitlist control group and larger sample size. In this RCT study, the influence of clinically important variables (e.g., pre-treatment strategies) on the main outcome measures would be investigated through analytic approaches such as an ANCOVA. Furthermore, although the varying number of completed trials did not influence the intervention's initial efficacy, the RCT should ensure that all participants complete the same number of trials for purposes of consistency and treatment fidelity. In addition, although some of our participants had mild-to-moderate levels of clinical or cognitive impairment, overall, the group scored within the normal range on these measures. Thus, our results may not generalise to a more severely impaired population, and future work may consider using a sample of persons with more severe cognitive impairment.

Furthermore, injury severity could not be established given the heterogeneous nature of the group's ABI aetiologies. Relatedly, a small number of participants provided diagnostic data via self-report only, which would have potentially limited the accuracy of grading injury severity in these cases. Thus, future work may consider establishing injury severity through a single aetiology (e.g., TBI), and investigating this variable's potential influence on outcome measures. Nonetheless, our mixed group is arguably also a strength of the study, as it is reflective of the diverse ABI population (Rowlands et al., 2021). Lastly, although our study,

like many others in the field (Byrne & Coetzer, 2016; Iruthayarajah et al., 2018) measures efficacy through self-report measures, there is always the risk that responses are susceptible to demand characteristics. Thus, future research may consider including a supplementary outcome measure that is, for example, physiological in nature, to overcome some of the limitations inherent to self-report data after brain injury (e.g., subjectivity, impact of potential cognitive difficulties, differences in self-awareness).

# 4.6.8 Conclusion

The present proof-of-concept study evidences the preliminary efficacy of a virtually administered, Process Model-based, ER intervention for post-ABI anger. Talk and Chalk presents an efficient and possibly more patient-friendly alternative to existing interventions such as CBT. It improves external manifestations of anger in the short-term and maintains treatment gains over time. Furthermore, personal characteristics, such as readiness to change and anxiety, are associated with intervention gains. These findings justify a RCT, and are relevant to healthcare professionals who are providing clinical care to survivors of ABI.

# **5.** Chapter Five

"I had a couple of weeks where my limits have been tested. I feel like I've dealt with it better than if I'd not had any of the tools. Not to say that I haven't lost my temper...I feel like it's taken me longer to get there. I feel at least in my own mind, I can hear the steps we have talked about...like cogs in the back of my mind."

~ Talk and Chalk Study Participant [Exit interview, Autumn 2021]

# 5. Discussion

This chapter provides a summary of the thesis' empirical findings and considers their clinical implications in relation to five key themes. Suggestions for the intervention's scalability are also considered, as well as the limitations of the research and opportunities for future work.

### **5.1 Summary and Implications**

This thesis had two primary objectives. The first was to establish a personally salient anger elicitation tool using various categories of relationship in a group of neurologically healthy adults (viz. Chapter Two). The second primary objective was to determine whether two ER strategies from the Process Model of ER (Gross, 1998a, 2014; Gross & Thompson, 2007) could reduce anger in this same group of individuals (viz. Chapter Two). Once confirmed, the thesis then explored their preliminary efficacy as part of an ER-based intervention for managing anger in a group of survivors of ABI (viz. Chapter Four). The empirical findings associated with these objectives and their implications are discussed in relation to five key themes of relationships, efficacy and its predictors, and telerehabilitation.

### 5.1.1 Relationship Categories Elicit Varying Levels of Anger

Chapter Two's empirical study is the first to demonstrate how different categories of relationship, which were derived from those who are directly affected by uncontrolled anger (Beames et al., 2019; Choi-Kwon & Kim, 2022; Saban et al., 2016), elicit varying intensities of this emotion. Personalising an autobiographical recall task through four categories of relationship (i.e., Family, Friend, Stranger, Abstract) selectively elicited anger without the simultaneous elicitation of other non-target emotions. The Partner category also elicited high

levels, however, this co-occurred with elevated levels of sadness.<sup>30</sup> Furthermore, different categories of relationship elicited varying intensities of anger, such that Stranger elicited higher levels than Friend or Abstract, but not Partner or Family.

These findings have clinical implications for anger management interventions. Firstly, clinicians may consider adapting the emotion elicitation task from recalling any event, to recalling one that elicits *powerful* emotional intensities, such as an encounter with a stranger, family member or spouse. Secondly, they may consider recommending an ER strategy based on the *frequency* and *emotional intensity* of the situation. This recommendation is in keeping with the strategy preference literature, which suggests that individuals prefer to use distraction in *once-off* situations of *high* emotional intensities, as it provides momentary but instant emotional relief through disengagement (Denson et al., 2012; Feldman & Freitas, 2021; Martins et al., 2018; Scheibe et al., 2015; Shafir et al., 2015; Sheppes et al., 2011; Van Bockstaele et al., 2020). Clinicians may therefore recommend distraction for once-off situations with a stranger, partner, or family member that elicits high levels of anger. On the other hand, individuals may prefer to use reappraisal in *repeated* situations of *low* emotional intensities, as it cognitively resolves such situations through engagement (Denson et al., 2012; Scheibe et al., 2015; Shafir et al., 2015; Sheppes et al., 2011; Van Bockstaele et al., 2020). Clinicians may therefore recommend reappraisal for repeated situations with a friend or abstract entity (e.g., illness, death) that elicits low levels of anger, especially when these situations are uncontrollable (Rowlands et al., 2021).

<sup>&</sup>lt;sup>30</sup>One implication of this finding is that perhaps the focus should not be on selectively eliciting anger, but on eliciting high levels of this emotion even if it co-occurs with other non-target emotions, with the understanding it represents the authenticity of the emotional experience in an experimental setting.

### **5.1.2 Reappraisal and Distraction Reduce Anger**

Chapter Two's empirical study is the first to compare reappraisal and distraction, and to demonstrate how both reduced anger across all categories of relationship. This finding supports previous research which suggests that both techniques modulate negative emotions like anger (Denson et al., 2012; Fabiansson et al., 2012; Webb et al., 2012). Furthermore, it supports the recommendation to provide individuals with multiple options of ER techniques, which can be selected and applied to a range of real-life situations accordingly (Miles et al., 2016). Therefore, this finding has clinical implications for patient choice. That is, as both strategies have demonstrated an ability to downregulate anger, clinicians may consider giving patients the *autonomy* to *choose* one in situations with a family member, partner, friend, or abstract entity. It may very well be that the patient will base this decision on personal factors such as their age or level of cognitive control, or situational factors such as the emotional intensity or frequency of the event (Allen & Windsor, 2019; Denson et al., 2012; Feldman & Freitas, 2021; Martins et al., 2018; Scheibe et al., 2015; Shafir et al., 2015; Sheppes et al., 2011; Van Bockstaele et al., 2020; Wirth & Kunzmann, 2018; Witten et al., 2022). Importantly, though, they would have the opportunity to be active decision-makers in their own treatment process.

Chapter Two's empirical study also demonstrated that, when comparing the two techniques, distraction produced larger reductions for situations involving a stranger. This finding is consistent with previous research which suggests that a disengagement strategy like distraction is both more effective *and* preferred for reducing anger in once-off emotionally intense situations (Denson et al., 2012; Feldman & Freitas, 2021; Martins et al., 2018; Scheibe et al., 2015; Shafir et al., 2015; Sheppes et al., 2011; Van Bockstaele et al., 2020). In terms of the clinical implications, as previously suggested, clinicians may consider providing

patients with the option of selecting a technique of their personal choice. However, they may still wish to inform them that for situations with a stranger, distraction may be more effective.

### 5.1.3 Reducing Post-ABI Anger

Chapter Four's empirical study is the first to evidence the preliminary efficacy of an ERbased intervention for managing post-ABI anger. In keeping with existing CBT-based interventions (Byrne & Coetzer, 2016; Iruthayarajah et al., 2018), Talk and Chalk demonstrated clear short-term improvements, such that survivors of ABI had better control over, and experienced and outwardly expressed less anger, after the intervention. Furthermore, these improvements were maintained three months after the intervention was completed. Qualitative feedback from participants supports favourability of the intervention, noting its relevance, applicability, usefulness, and ease. Talk and Chalk may therefore be an alternative or additional approach to CBT for managing post-ABI anger.

These findings have important clinical implications with regards to the practicalities of delivering an intervention. Firstly, clinicians may consider recommending Talk and Chalk to patients who have limited availability due to employment or personal commitments. Compared to the multi-session approach of CBT (Byrne & Coetzer, 2016; Iruthayarajah et al., 2018), the intervention component can be administered in a single session (see Miles et al., 2016 for a similar example). Secondly, Talk and Chalk may also be recommended to patients who are socially anxious. Compared to most CBT-based interventions that are administered in a group setting (Byrne & Coetzer, 2016; Iruthayarajah et al., 2018), Talk and Chalk can be administered in dividually.

These findings also have theoretical implications. By providing evidence to support the limited but growing literature on using the Process Model of ER (Gross, 1998a, 2014; Gross & Thompson, 2007) for post-ABI emotion management (Rowlands et al., 2020, 2021; Salas et al., 2013, 2014, 2016, 2019; Witten et al., 2022), these findings suggest that an ER-

based approach can be an effective and alternative model to existing theoretical approaches, especially for anger (Alderman, 2003, 2013; Byrne & Coetzer, 2016; Cattelani et al., 2010; Iruthayarajah et al., 2018). These findings encourage further exploration of other Process Model-based techniques for managing post-ABI anger.

### **5.1.4 Online Interventions are a Promising Alternative**

Chapter Four's empirical study supports the online delivery of ER interventions for survivors of ABI. Talk and Chalk had a 100% attendance rate for all five sessions, which is higher than that reported in a previous study (Tsaousides et al., 2014). In addition, similar to this same study (Tsaousides et al., 2014), participants of Talk and Chalk were satisfied with the intervention and able to complete the self-report questionnaires online, by verbally responding to items with the support of the 'share screen' function. Interestingly, and consistent with the merits of telerehabilitation for survivors of ABI (Tsaousides et al., 2014, 2017), most participants of Talk and Chalk, if given an option, expressed a preference for online participation. Furthermore, in keeping with Tsaousides and colleagues (2017), Talk and Chalk demonstrated initial evidence of reductions in anger post-treatment. Importantly, the delivery of Talk and Chalk through a VC platform (like Tsaousides et al., 2014, 2017) may have contributed to its positive reception from participants, as its face-to-face feature offers an opportunity for a similar sense of connection and cohesion as in-person approaches (Banbury et al., 2018).

These findings have several clinical implications with regards to the individual circumstances of the patient. First, this mode of delivery provides a low-cost and efficient alternative to in-person approaches, facilitating greater outreach to those living in geographical regions where access to specialised services is limited (Banbury et al., 2018; Carrillo de Albornoz et al., 2022; Jadhakhan et al., 2022; Tsaousides et al., 2014, 2017; Wilkie et al., 2021). Clinicians may consider recommending Talk and Chalk to patients living

in remote areas where access to healthcare resources are limited, or to those who are socially isolated because of their physical location (Banbury et al., 2018). Second, it provides a comfortable environment where individuals can access the intervention from home, circumventing any transportation or travel requirements (Tsaousides et al., 2014, 2017). Clinicians may consider recommending the intervention to patients with reduced mobility, where travelling to an in-person appointment would be challenging (Banbury et al., 2018). Third, the virtual environment is suggested to be less distracting, and associated with less fatigue (Tsaousides et al., 2014, 2017). Clinicians may consider recommending the intervention to patients who are easily distracted (i.e., who experience attentional difficulties), or to those who suffer from injury-related fatigue (Ezekiel et al., 2021).

The limitations of virtual delivery should also be acknowledged, as they can exclude certain members of the population, such as those who do not have access to privacy in their homes or a stable internet connection, or those who may not be digitally literate, especially older individuals (Jadhakhan et al., 2022; Lieneck et al., 2021; Nedeljko et al., 2022; Rasekaba et al, 2022; Sansom-Daly & Bradford, 2020). However, these limitations may be overcome with the support from relatives, neighbours, or healthcare providers (Rasekaba et al, 2022).

These findings also have theoretical implications. Firstly, they contribute to the broader telehealth literature which advocates for the feasibility, acceptability, and effectiveness of this approach for clinical service delivery both before and during the COVID-19 pandemic (Banbury et al., 2018; Barnett et al., 2021; Doraiswamy et al., 2020; Dores et al., 2020; Witteveen et al., 2022). Secondly, they contribute to the growing field of telerehabilitation for survivors of ABI (Chen et al., 2015; Wilkie et al., 2021), especially in relation to ER interventions (Tsaousides et al., 2014, 2017). Thus, they encourage further exploration of online interventions for managing post-ABI anger.

### **5.1.5 Factors That May Enhance Efficacy**

Several correlates of efficacy were identified across both empirical chapters. These were: adult attachment types, use of ER techniques, age, mental health, readiness to change, use of a homework diary, and cognitive abilities.

Adult attachment types. Neuropsychologists have not traditionally evaluated adult attachment types as part of an intervention's efficacy. However, Chapter Two's empirical study is the first to demonstrate how these can influence the magnitude of reduced anger through distraction for situations with a stranger. In this light, it was an especially interesting finding that attachment style was a significant predictor of efficacy. That is, an avoidant attachment style was associated with the largest reductions in anger, whereas an anxious attachment style was associated with the least reductions.

These findings have two important clinical implications. Firstly, it raises the question as to whether neuropsychologists should evaluate attachment style as part of their intervention's efficacy. This evaluation can take no more than a few minutes and may generate useful information to guide intervention and management. Secondly, for situations with a stranger, clinicians may consider recommending distraction to individuals with an avoidant attachment style, and reappraisal (whose effectiveness was not predicted by attachment type for any of the relationship categories) to individuals with an anxious attachment style.

**ER strategy use.** A further finding was that, in keeping with previous research on reappraisal (Rowlands et al., 2021), the largest reductions in anger through distraction for situations with a stranger were obtained through the daily use of attentional deployment techniques. Interestingly, Chapter Four's empirical study is the first to demonstrate that the daily use of ER techniques was not associated with levels of characteristic anger. Thus, it may be that the everyday use of these strategies can influence anger as a state, but not

necessarily as a long-term trait. In terms of its clinical implications, these findings suggest that clinicians may especially encourage individuals to use attentional deployment in daily life, if they use distraction in anger-inducing situations with a stranger. However, for those who require long-term changes in characteristic anger, the daily use of ER techniques may be less helpful.

**Age.** Chapter Two's empirical study also demonstrated that the largest reductions in anger through distraction for situations with a stranger was observed with older age. This finding is consistent with previous research which suggests that older adults use attentional deployment techniques to reduce the intensity of negative emotions more frequently and efficiently (Allen & Windsor, 2019; Scheibe et al., 2015; Wirth & Kunzmann, 2018). In terms of its clinical implications, this finding suggests that clinicians may especially recommend distraction for situations involving a stranger to older individuals.

**Mental health and readiness to change.** Chapter Four's empirical study is also the first to demonstrate that, in relation to mental health, symptoms of anxiety but not depression were correlated with levels of characteristic anger. It also identified readiness to change as a correlate, a finding that is consistent with another post-ABI anger management intervention (Hart et al., 2023). In terms of its clinical implications, these findings suggest that clinicians may consider how levels of anxiety and readiness to change are related to any observable changes in characteristic anger, particularly in relation to whether these factors impede or enhance intervention gains.

**Homework component.** Chapter Four's empirical study also demonstrated that using a diary to practice applying the techniques to real-life anger events was associated with levels of characteristic anger. The inclusion of a homework component is in keeping with previous psychological interventions for ABI, and supports the rehabilitation literature's suggestion to, as part of the evaluation process, determine whether the imparted skills are transferred and

applied to daily life (Aboulafia-Brakha et al., 2013; Hart et al., 2012, 2015; Medd & Tate, 2000; Rochat et al., 2019; Tsaousides et al., 2014, 2017; Walker et al., 2010). In terms of its clinical implications, this finding suggests that clinicians should consider including a homework component as part of the intervention's delivery, and, to determine how this supplementary resource influences intervention gains.

**Cognitive functioning.** Chapter Two's empirical study is also the first to demonstrate how the cognitive abilities of working memory, verbal fluency, and inhibition did not influence the magnitude of reduced anger that can be obtained through either technique in situations involving any of the relationship categories. In addition, Chapter Four demonstrated that these three cognitive abilities were not associated with Talk and Chalk's preliminary efficacy, a finding that is consistent with previous research which suggests that they may be implicated in the implementation, but not necessarily the efficacy of, an ER technique (Rowlands et al. 2020, 2021; Salas et al., 2013, 2014). In terms of its clinical implications, these findings suggest that clinicians may recommend reappraisal or distraction for any anger-inducing situation. However, they may still wish to consider the patient's level of cognitive functioning, which could pose execution challenges.

**Summary.** In sum, this thesis' empirical findings have clinical implications for telerehabilitation interventions targeting post-ABI anger. Applying specific relationship categories to an autobiographical task may promote elicitation. As both reappraisal and distraction reduce anger, patients can choose a technique of their preference. Nonetheless, with strangers, they may still consider using distraction, especially if they have an avoidant attachment style, use attentional deployment in their daily lives, or are older individuals. Adult attachment style, levels of anxiety, and readiness to change appear to be important considerations for potential candidates, and the inclusion of a homework component may be beneficial. Although levels of depression and cognitive functioning were not significant

correlates, it may still be advisable to evaluate these factors. Notably, the practicalities of Talk and Chalk render the intervention particularly suitable for patients who have time constraints, live in rural areas or with reduced mobility.

### 5.1.6 Suggestions for Scalability

An important yet less prioritised question is how to support the scalability of an intervention, particularly in relation to increasing its accessibility to the wider ABI community. This initiative should pose minimal constraints on existing human and financial resources, considering that high practitioner turnover rates and associated costs have been identified as barriers to implementing therapeutic programs within healthcare settings in the UK (King et al., 2018). One suggestion would be to implement a randomised control trial (RCT) which recruits from healthcare settings and support groups.

On a primary care level, general practitioners and community-based brain injury rehabilitation teams would be suitable out-patient sources, as they are the first point of contact in these settings. On a secondary care level, psychological therapy services (i.e., the NHS' Adult Improving Access to Psychological Therapies [IAPT] programme) could provide another recruitment source. Brain injury organisations such as Headway UK would be ideal for recruiting individuals who are living in the community, through their staff members and volunteers who lead local support groups. Social media may also facilitate recruitment among younger people, through platforms such as Instagram, Facebook, or TikTok. Importantly, as the highest rates of aggression have been found at six- and 12-months post-injury (Roy et al., 2017), recruiting participants for the RCT who are earlier in their recovery process may be especially beneficial.

### **5.2 Limitations and Suggestions for Future Research**

The empirical work of this thesis has contributed to the existing literature by addressing several notable gaps. First, it has shown how different categories of relationship elicit varying levels of anger, with important implications for ER strategy/patient choice. Second, it has shown how an ER-based approach can be used to inform post-ABI anger management interventions, with important implications for alternative theoretical approaches to existing interventions. Third, it has shown initial evidence for the efficacy of Talk and Chalk, with implications for the wellbeing of both survivors and their loved ones. Fourth, it has shown that telerehabilitation may be an effective and alternative mode of delivery compared to inperson approaches, with important implications for intervention accessibility and outreach. And fifth, it has shown that an individually administered and single-session treatment dose is a promising alternative to multi-session group settings, with implications for patient circumstances and preferences. Despite these areas of progress, there are several methodological limitations that future work should consider addressing.

# 5.2.1 Study Design

Both empirical studies used a pre-post within-subjects design. This design may decrease sampling error (Webb et al., 2012) and is frequently used in post-ABI anger management or ER interventions that aim to establish the preliminary efficacy of a novel intervention (e.g., Aboulafia-Brakha et al., 2013; Hart et al., 2012; Tsaousides et al., 2017). The purpose is therefore to justify a RCT, by first establishing proof-of-concept, or that the main outcome measures change in the intended direction after the intervention, through a simple study design (Hart et al., 2012).

The obvious limitation is that without a control group, any improvements across outcome measures cannot, with certainty, be attributed to the intervention itself (Tsaousides et al., 2017; Walker et al., 2010; Westermann et al., 1996). However, as findings from both

empirical studies support the preliminary efficacy of the ER techniques, the next step would be to conduct a RCT with a wait-list control group and powered sample sizes, which could demonstrate more robust findings.

The EDER Model (Frederickson et al., 2018) proposes that ER is a consequence of *experiencing* the emotion (Grecucci et al., 2020; Vandekerckhove et al., 2012). In terms of its design, the RCT could therefore include a control group where participants recall an angerinducing event through the ASR, but do *not* apply the 'Talk and Chalk' techniques. This would support the finding that anger reductions were due to the 'Talk and Chalk' techniques, rather than the process of re-experiencing anger during the ASR trials (viz. Chapters Two and Four).

### **5.2.2 Self-Report Measures**

Both empirical studies used self-report questionnaires as their outcome measures. These are the most widely used measures for evaluating changes in emotion elicitation and regulation (Ferrer et al., 2015; Joseph et al., 2020; Lench et al., 2011; Webb et al., 2012), particularly in survivors of ABI (Byrne & Coetzer, 2016; Iruthayarajah et al., 2018). However, self-report measures are still vulnerable to, for example, demand effects, or compromised selfawareness, and therefore it cannot be said with certainty that participants' subjective responses are true reflections of their emotional states (Alderman et al., 2003; Clark, 1983; Engebretson et al., 1999; Larsen & Sinnett, 1991; Webb et al., 2012; Westermann et al., 1996).

Importantly, self-report measures were the only available option for data collection during the COVID-19 pandemic. Furthermore, both empirical chapters used a counterbalanced design, which has been identified as one way to minimize demand effects (Webb et al., 2012). In addition, the administration of self-report measures to survivors of ABI via VC appears to be as effective and reliable as those administered in-person (Rietdijk

et al., 2017). However, future work may consider supplementing subjective measures of anger with objective approaches, such as physiological measures (e.g., skin conductance), neuroimaging data, or even secondary self-report measures from a significant other (SO).

### 5.2.3 Collateral Information

Impairments in self-awareness can result in issues of validity, as survivors of ABI may underrepresent their difficulties (Alderman et al., 2013). For this reason, some (but not all, e.g., Aboulafia-Brakha et al., 2013; Tsaousides et al., 2017) interventions are designed with the optional inclusion of collateral information from a family member or SO (e.g., Hart et al., 2012; Walker et al., 2010). In addition to corroborating the survivors' subjective responses, support from loved ones may also assist with the application of strategies in daily life, potentially maintaining intervention gains long-term (Rochat et al., 2019).

The study design of Chapter Four therefore incorporated the optional inclusion of a family member or SO, who would complete the same outcome measures as the participant. However, at the start of recruitment, some of the potential participants who initially expressed interest declined participation due to this component. As the COVID-19 pandemic exacerbated recruitment difficulties that are already inherent to working with clinical populations, this component was removed from the protocol to maximise the sample size under these exceptional conditions.

The empirical evidence from Chapter Four suggests that survivors of ABI still benefited from the Talk and Chalk intervention. This finding is in keeping with the notion that there is insufficient evidence to confirm the efficacy of family involvement in post-ABI behavioral management (see Fisher et al., 2015 for a review), and that the inclusion of these individuals is not always associated with additional intervention gains (Walker et al., 2010). Nonetheless, future work may consider including a family member or SO as part of the intervention process, even if only to provide supplemental evidence.

### **5.2.4 Participant Characteristics**

Both empirical studies were comprised of samples with specific participant characteristics, which limits the generalisability of the findings. Firstly, like previous anger elicitation and regulation research in neurotypical populations (e.g., Denson et al., 2012; Engebretson et al., 1999), participants of Chapter Two were mostly undergraduate students (age range 19 - 52; median = 27), preventing the application of these findings to older adults. Future work may therefore consider recruiting older adults living in the community.

Secondly, like previous post-ABI anger management interventions (e.g., Aboulafia-Brakha et al., 2013), according to their performance on tests of executive function, participants of Chapter Four had relatively low levels of cognitive impairment. Here, it is important to acknowledge the limitations of executive function tests in terms of their ability to capture *real-world* difficulties (see Chaytor & Schmitter-Edgecombe, 2003 for a review). For example, these tests have demonstrated limited ecological validity in survivors of severe brain injury with lesions to the frontal lobe (Wood & Liossi, 2006). These individuals performed within the normal range despite declaring difficulties (corroborated by their relatives) with executive tasks in daily life. These findings suggest that tests of executive function are generally *not* sensitive to detecting real life problems in these areas.

It is also important to acknowledge that there are typically *two* types of executive function. As explained in their review, Salehinejad and colleagues (2021) describe 'hot' functions as emotion-based (e.g., emotion/anger regulation) and associated with the orbitofrontal cortex, and 'cold' functions as cognitive-based (e.g., working memory, fluency, inhibition) and associated with the dorsolateral PFC. Thus, standard cognitive tests are designed to measure *cold* rather than hot functions (Salehinejad et al., 2021). This categorisation may provide an explanation for the findings in Chapter Four. That is, working memory, fluency, and inhibition did not predict intervention gains, which are more closely

related to *hot* (i.e., uncontrolled anger due to poor ER) rather than cold functions. A future RCT may therefore consider deploying a hot measure of executive function to both the participant and their family member or SO, such as the St Andrew's-Swansea Neurobehavioural Outcome Scale (Alderman et al., 2011), or the Dysexecutive Questionnaire from the Behavioural Assessment of the Dysexecutive Syndrome (Wilson et al., 1996).

### 5.2.5 Heterogeneous Clinical Descriptors

Participants of Chapter Four reflect the diverse nature of ABI clinical descriptors, such as mixed aetiologies, times since injury, and injury locations and severities (Cattelani et al., 2010). This is arguably a strength of the study, as the findings are representative of this heterogeneous clinical population (Rowlands et al., 2021). On the other hand, it is also a well-known limitation, as heterogeneous descriptors complicate the evaluation of an intervention's efficacy (Cattelani et al., 2010). Nonetheless, our diverse group reflects the clinical profile of individuals who access community rehabilitation services where this intervention's RCT would be delivered in. In addition, it highlights the commonality of ER difficulties amongst our participants.

### **5.3 Conclusion**

Survivors of ABI are often overwhelmed by outbursts of anger that spill over into their shared lives with loved ones. Simple yet effective ways to manage this emotion in daily life are much needed, and this thesis has demonstrated that there are, indeed, such tools available. However, the paucity of accessible psychological resources, which are especially needed during the early stages of the recovery process, is a notable barrier for many patients. This thesis therefore demonstrated how a brief and individually administered online intervention can dismantle this barrier by improving accessibility to otherwise excluded populations. The

field of emotion rehabilitation after brain injury has much to offer clinical practice, and, more importantly, can make a positive contribution to the lives of patients and those they care for.

### References

- Aboulafia-Brakha, T., Allain, P., & Ptak, R. (2016). Emotion regulation after traumatic brain injury: Distinct patterns of sympathetic activity during anger expression and recognition. *Journal of Head Trauma Rehabilitation*, *31*(3), E21-E31.
- Aboulafia-Brakha, T., Greber Buschbeck, C., Rochat, L., & Annoni, J. M. (2013). Feasibility and initial efficacy of a cognitive-behavioural group programme for managing anger and aggressiveness after traumatic brain injury. *Neuropsychological Rehabilitation*, *23*(2), 216-233.
- Adamczyk, A. K., Wyczesany, M., & van Peer, J. M. (2022). High working memory load impairs reappraisal but facilitates distraction – An event-related potential investigation. *Biological Psychology*, 171.
- Alderman, N. (2003). Contemporary approaches to the management of irritability and aggression following traumatic brain injury. *Neuropsychological Rehabilitation*, *13*(1-2), 211-240.
- Alderman, N., Knight, C., & Brooks, J. (2013). Rehabilitation approaches to the management of aggressive behaviour disorders after acquired brain injury. *Brain Impairment*, 14(1), 5-20.
- Alderman, N., Wood, R. L., & Williams, C. (2011). The development of the St Andrew's-Swansea Neurobehavioural Outcome Scale: Validity and reliability of a new measure of neurobehavioural disability and social handicap. *Brain Injury*, 25(1), 83–100.
- Alia-Klein, N., Gan, G., Gilam, G., Bezek, J., Bruno, A., Denson, T. F., Hendler, T., Lowe,
  L., Mariotti, V., Muscatello, M. R., Palumbo, S., Pellegrini, S., Pietrini, P., Rizzo, A.,
  & Verona, E. (2020). The feeling of anger: From brain networks to linguistic
  expressions. *Neuroscience & Biobehavioral Reviews*, *108*, 480-497.

- Allen, V. C., & Windsor, T. D. (2019). Age differences in the use of emotion regulation strategies derived from the process model of emotion regulation: A systematic review. *Aging & Mental Health*, 23(1), 1-14.
- Arciniegas, D. B., & Wortzel, H. S. (2014). Emotional and behavioral dyscontrol after traumatic brain injury. *Psychiatric Clinics*, 37(1), 31-53.
- Arene, N., & Hidler, J. (2009). Understanding motor impairment in the paretic lower limb after a stroke: A review of the literature. *Topics in Stroke Rehabilitation*, 16(5), 346-356.
- Armstrong, E., McAllister, M., Hersh, D., Katzenellenbogen, J. M., Thompson, S. C., Coffin, J., Flicker, L., Woods, D., Hayward, C., & Ciccone, N. (2020). A screening tool for acquired communication disorders in Aboriginal Australians after brain injury: Lessons learned from the pilot phase. *Aphasiology*, *34*(11), 1388-1412.
- Bagozzi, R. P. (1993). An examination of the psychometric properties of measures of negative affect in the PANAS-X scales. *Journal of Personality and Social Psychology*, 65(4), 836–851.
- Baguley, I. J., Cooper, J., & Felmingham, K. (2006). Aggressive behavior following traumatic brain injury: How common is common? *Journal of Head Trauma Rehabilitation*, 21(1), 45-56.
- Banbury, A., Nancarrow, S., Dart, J., Gray, L., & Parkinson, L. (2018). Telehealth interventions delivering home-based support group videoconferencing: Systematic review. *Journal of Medical Internet Research*, 20(2), 1-17.
- Barnett, P., Goulding, L., Casetta, C., Jordan, H., Sheridan-Rains, L., Steare, T., Williams, J.,
  Wood, L., Gaughran, F., & Johnson, S. (2021). Implementation of telemental health
  services before COVID-19: Rapid umbrella review of systematic reviews. *Journal of Medical Internet Research*, 23(7), 1-45.
Barquet, J., & Balam, E. M. (2015). Clothing preferences of college students: What factors Matter? *Journal of Undergraduate Ethnic Minority Psychology*, 1(1), 4-6.

Barrett, L. F. (2012). Emotions are real. *Emotion*, 12(3), 413–429.

- Barrett, L. F., & Russell, J. A. (1999). The structure of current affect: Controversies and emerging consensus. *Current Directions in Psychological Science*, 8(1), 10-14.
- Beames, J. R., O'Dean, S. M., Grisham, J. R., Moulds, M. L., & Denson, T. F. (2019). Anger regulation in interpersonal contexts: Anger experience, aggressive behavior, and cardiovascular reactivity. *Journal of Social and Personal Relationships*, 36(5), 1441-1458.
- Bechara, A. (2004). Disturbances of emotion regulation after focal brain lesions. In R. J.
   Bradley (Ed.). *International review of neurobiology* (pp. 159-189). Elsevier Academic Press.
- Beck, A. T. (1976). Cognitive therapy and the emotional disorders. Penguin.
- Benedictus, M. R., Spikman, J. M., & van der Naalt, J. (2010). Cognitive and behavioral impairment in traumatic brain injury related to outcome and return to work. *Archives of Physical Medicine and Rehabilitation*, *91*(9), 1436-1441.
- Bensink, M., Hailey, D., & Wootton, R. (2006). A systematic review of successes and failures in home telehealth: Preliminary results. *Journal of Telemedicine and Telecare*, 12(3), 8-16.
- Benton Sivan, A. (1991). *Benton visual retention test fifth edition manual*. The Psychological Corporation.
- Berkowitz, L., & Troccoli, B. T. (1986). An examination of the assumptions in the demand characteristics thesis: With special reference to the Velten mood induction procedure. *Motivation and Emotion*, 10(4), 337-349.

- Bichard, H., Byrne, C., Saville, C. W., & Coetzer, R. (2022). The neuropsychological outcomes of non-fatal strangulation in domestic and sexual violence: A systematic review. *Neuropsychological Rehabilitation*, 32(6), 1164-1192.
- Bigdeli, I., Najafy, M., & Rostami, M. (2013). The relation of attachment styles, emotion regulation, and resilience to well-being among students of medical sciences. *Iranian Journal of Medical Education*, 13(9), 721-729.
- Bjelland, I., Dahl, A. A., Haug, T. T., & Neckelmann, D. (2002). The validity of the hospital anxiety and depression scale: An updated literature review. *Journal of Psychosomatic Research*, 52(2), 69-77.
- Blair, R. J. R. (2012). Considering anger from a cognitive neuroscience perspective. *Wiley Interdisciplinary Reviews: Cognitive Science*, *3*(1), 65-74.
- Blake, K. R., Hopkins, R. E., Sprunger, J. G., Eckhardt, C. I., & Denson, T. F. (2018).
  Relationship quality and cognitive reappraisal moderate the effects of negative urgency on behavioral inclinations toward aggression and intimate partner violence. *Psychology of Violence*, 8(2), 218-228.
- Bombardier, C. H., Ehde, D., & Kilmer, J. (1997). Readiness to change alcohol drinking habits after traumatic brain injury. *Archives of Physical Medicine and Rehabilitation*, 78(6), 592-596.
- Bombardier, C. H., & Heinemann, A. W. (2000). The construct validity of the readiness to change questionnaire for persons with TBI. *The Journal of Head Trauma Rehabilitation*, *15*(1), 696-709.
- Brandão, T., Brites, R., Hipólito, J., & Nunes, O. (2023). Attachment orientations, emotion goals, and emotion regulation. *Personality and Individual Differences*, 204.

- Brandão, T., Matias, M., Ferreira, T., Vieira, J., Schulz, M. S., & Matos, P. M. (2020). Attachment, emotion regulation, and well-being in couples: Intrapersonal and interpersonal associations. *Journal of Personality*, 88(4), 748-761.
- Brennan, D. M., Tindall, L., Theodoros, D., Brown, J., Campbell, M., Christiana, D., Smith,
  D., Cason, J., & Lee, A. (2011). A blueprint for telerehabilitation guidelines—
  October 2010. *Telemedicine and e-Health*, 17(8), 662-665.
- Brenning, K. M., & Braet, C. (2013). The emotion regulation model of attachment: An emotion-specific approach. *Personal Relationships*, 20(1), 107-123.
- Brockman, R., Ciarrochi, J., Parker, P., & Kashdan, T. (2017). Emotion regulation strategies in daily life: Mindfulness, cognitive reappraisal and emotion suppression. *Cognitive Behaviour Therapy*, 46(2), 91-113.
- Bryant, R. A., Dawson, K. S., Keyan, D., Azevedo, S., Yadav, S., Tran, J., Rawson, N., & Harvey, S. (2022). Effectiveness of a videoconferencing-delivered psychological intervention for mental health problems during COVID-19: A proof-of-concept randomized clinical trial. *Psychotherapy and Psychosomatics*, *91*(1), 63-72.
- Bryant, F. B., & Smith, B. D. (2001). Refining the architecture of aggression: A measurement model for the Buss–Perry Aggression Questionnaire. *Journal of Research in Personality*, 35(2), 138-167.
- Buhle, J. T., Silvers, J. A., Wager, T. D., Lopez, R., Onyemekwu, C., Kober, H., Weber, J., & Ochsner, K. N. (2014). Cognitive reappraisal of emotion: A meta-analysis of human neuroimaging studies. *Cerebral Cortex*, 24(11), 2981-2990.
- Burgess, P. W., & Shallice, T. (1997). *The Hayling and Brixton tests*. Thames Valley Test.

- Burgkart, P. L., Vuzic, X., Fuchshuber, J., & Unterrainer, H. F. (2021). Attachment styles, personality organization, and substance use as predictors of emotion regulation strategies "suppression" and "reappraisal" in young adults. *Frontiers in Psychiatry*, *12*.
- Buss, A. H., & Perry, M. (1992). The aggression questionnaire. *Journal of Personality and Social Psychology*, 63(3), 452-459.
- Byrne, C., & Coetzer, R. (2016). The effectiveness of psychological interventions for aggressive behavior following acquired brain injury: A meta-analysis and systematic review. *NeuroRehabilitation*, *39*(2), 205-221.
- Byrne, C., Saville, C. W., Coetzer, R., & Ramsey, R. (2022). Stroke survivors experience elevated levels of loneliness: A multi-year analysis of the national survey for Wales. *Archives of Clinical Neuropsychology*, 37(2), 390-407.
- Canli, T., Ferri, J., & Duman, E. A. (2009). Genetics of emotion regulation. *Neuroscience*, *164*(1), 43-54.
- Caplan, B., Bogner, J., Brenner, L., Bailie, J. M., Cole, W. R., Ivins, B., Boyd, C., Lewis, S., Neff, J., & Schwab, K. (2015). The experience, expression, and control of anger following traumatic brain injury in a military sample. *Journal of Head Trauma Rehabilitation*, 30(1), 12-20.
- Caplan, B., Bogner, J., Brenner, L., Neumann, D., Malec, J. F., & Hammond, F. M. (2017).
   The relations of self-reported aggression to alexithymia, depression, and anxiety after traumatic brain injury. *Journal of Head Trauma Rehabilitation*, 32(3), 205-213.
- Carrillo de Albornoz, S., Sia, K. L., & Harris, A. (2022). The effectiveness of teleconsultations in primary care: Systematic review. *Family Practice*, 39(1), 168-182.

- Carver, C. S., & Harmon-Jones, E. (2009). Anger is an approach-related affect: Evidence and implications. *Psychological Bulletin*, *135*(2), 183-204.
- Cattelani, R., Zettin, M., & Zoccolotti, P. (2010). Rehabilitation treatments for adults with behavioral and psychosocial disorders following acquired brain injury: A systematic review. *Neuropsychology Review*, *20*(1), 52-85.
- Chan, V., Zagorski, B., Parsons, D., & Colantonio, A. (2013). Older adults with acquired brain injury: A population based study. BMC Geriatrics, 13, 1-12.
- Chaytor, N., & Schmitter-Edgecombe, M. (2003). The ecological validity of neuropsychological tests: A review of the literature on everyday cognitive skills. *Neuropsychology Review*, 13, 181-197.
- Chen, J., Jin, W., Zhang, X. X., Xu, W., Liu, X. N., & Ren, C. C. (2015). Telerehabilitation approaches for stroke patients: Systematic review and meta-analysis of randomized controlled trials. *Journal of Stroke and Cerebrovascular Diseases*, 24(12), 2660-2668.
- Chen, W. L., & Liao, W. T. (2021). Emotion regulation in close relationships: The role of individual differences and situational context. *Frontiers in Psychology*, *12*, 1-11.
- Cheung, E. O., Gardner, W. L., & Anderson, J. F. (2015). Emotionships: Examining people's emotion-regulation relationships and their consequences for well-being. *Social Psychological and Personality Science*, 6(4), 407-414.
- Choi-Kwon, S., & Kim, J. S. (2022). Anger, a result and cause of stroke: A narrative review. *Journal of Stroke*, 24(3), 311-322.
- Ciurli, P., Bivona, U., Barba, C., Onder, G., Silvestro, D., Azicnuda, E., Rigon, J., & Formisano, R. (2010). Metacognitive unawareness correlates with executive function impairment after severe traumatic brain injury. *Journal of the International Neuropsychological Society*, *16*(2), 360-368.

- Colantonio, A., Gerber, G., Bayley, M., Deber, R., Yin, J., & Kim, H. (2011). Differential profiles for patients with traumatic and non-traumatic brain injury. *Journal of Rehabilitation Medicine*, *43*(4), 311-315.
- Cole, B., Pickard, K., & Stredler-Brown, A. (2019). Report on the use of telehealth in early intervention in Colorado: Strengths and challenges with telehealth as a service delivery method. *International Journal of Telerehabilitation*, 11(1), 33-40.
- Contreras, J. M., & Kerns, K. A. (2000). Emotion regulation processes: Explaining links between parent-child attachment and peer relationships. In K. A. Kerns, J. M.
  Contreras, & A. M. Neal-Barnett (Eds.), *Family and peers: Linking two social worlds* (pp. 1–25). Praeger Publishers/Greenwood Publishing Group.
- Cook, T. D., & Campbell, D. T. (1979). *Quasi-experimentation: Design & analysis issues for field settings*. Houghton Mifflin.
- Clark, D. M. (1983). On the induction of depressed mood in the laboratory: Evaluation and comparison of the Velten and musical procedures. *Advances in Behaviour Research and Therapy*, *5*, 27-49.
- Culhane, S. E., & Morera, O. F. (2010). Reliability and validity of the Novaco Anger
   Scale and Provocation Inventory (NAS-PI) and State-Trait Anger Expression
   Inventory-2 (STAXI-2) in hispanic and non-hispanic white student samples. *Hispanic Journal of Behavioral Sciences*, 32(4), 586-606.

Darwin, C. (1872). The expression of the emotions in man and animals. John Murray.

- Darwin C. (1998). *The expression of emotions in man and animals* (3rd ed.). Oxford University Press.
- Deffenbacher, J. L., & Stark, R. S. (1992). Relaxation and cognitive-relaxation treatments of general anger. *Journal of Counseling Psychology*, *39*(2), 158–167.

- Delis, D. C., Kaplan, E., & Kramer, J. H. (2001). *Delis-Kaplan executive function system (D-KEFS)*. The Psychological Corporation.
- Demark, J., & Gemeinhardt, M. (2002). Anger and it's management for survivors of acquired brain injury. *Brain Injury*, *16*(2), 91-108.
- Denson, T. F. (2015). Four promising psychological interventions for reducing reactive aggression. *Current Opinion in Behavioral Sciences*, *3*, 136-141.
- Denson, T. F., Moulds, M. L., & Grisham, J. R. (2012). The effects of analytical rumination, reappraisal, and distraction on anger experience. *Behavior Therapy*, *43*(2), 355-364.
- Dewan, M. C., Rattani, A., Gupta, S., Baticulon, R. E., Hung, Y. C., Punchak, M., Agrawal,
  A., Adeleye, A. O., Mark G. Shrime, M. G., Rubiano, A. M., Rosenfeld, J. V., &
  Park, K. B. (2018). Estimating the global incidence of traumatic brain injury. *Journal* of Neurosurgery, 130(4), 1080-1097.
- Dhaka, S., & Kashyap, N. (2017). Explicit emotion regulation: Comparing emotion inducing stimuli. *Psychological Thought*, *10*(2), 303-314.
- Dollard, J., Doob, L., Miller, N., Mowrer, O., & Sears, R. (1939). Frustration and aggression. Yale University Press.
- Doraiswamy, S., Abraham, A., Mamtani, R., & Cheema, S. (2020). Use of telehealth during the COVID-19 pandemic: Scoping review. *Journal of Medical Internet Research*, 22(12), 1-15.
- Dores, A. R., Geraldo, A., Carvalho, I. P., & Barbosa, F. (2020). The use of new digital information and communication technologies in psychological counseling during the COVID-19 pandemic. *International Journal of Environmental Research and Public Health*, 17, 1-24.

- Dörfel, D., Lamke, J. P., Hummel, F., Wagner, U., Erk, S., & Walter, H. (2014). Common and differential neural networks of emotion regulation by detachment, reinterpretation, distraction, and expressive suppression: A comparative fMRI investigation. *NeuroImage*, *101*, 298-309.
- Dougherty, D. D., Chou, T., Buhlmann, U., Rauch, S. L., & Deckersbach, T. (2020). Early amygdala activation and later ventromedial prefrontal cortex activation during anger induction and imagery. *Journal of Medical Psychology*, *22*(1), 3-10.
- Dunning, D. L., Westgate, B., & Adlam, A. L. R. (2016). A meta-analysis of working memory impairments in survivors of moderate-to-severe traumatic brain injury. *Neuropsychology*, 30(7), 811-819.
- Eatough, V., & Smith, J. (2006). I was like a wild wild person: Understanding feelings of anger using interpretative phenomenological analysis. *British Journal of Psychology*, 97(4), 483-498.
- Ekman, P. (1992). An argument for basic emotions. Cognition and Emotion, 6, 169–200.
- Ekman, P., & Cordaro, D. (2011). What is meant by calling emotions basic. *Emotion Review*, *3*(4), 364-370.
- Ekman, P., Friesen, W. V., & Ellsworth, P. (1972). *Emotion in the human face: Guidelines* for research and an integration of findings. Pergamon Press.
- Engebretson, T. O., Sirota, A. D., Niaura, R. S., Edwards, K., & Brown, W. A. (1999). A simple laboratory method for inducing anger: A preliminary investigation. *Journal of Psychosomatic Research*, 47(1), 13-26.
- English, T., John, O. P., & Gross, J. J. (2013). Emotion regulation in close relationships.In J. A. Simpson & L. Campbell (Eds.), *The Oxford handbook of close relationships* (pp. 500-513). Oxford University Press.

- English, T., Lee, I. A., John, O. P., & Gross, J. J. (2017). Emotion regulation strategy selection in daily life: The role of social context and goals. *Motivation and Emotion*, 41, 230-242.
- Etkin, A., Büchel, C., & Gross, J. J. (2015). The neural bases of emotion regulation. *Nature Reviews Neuroscience*, *16*(11), 693-700.
- Etzler, S. L., Rohrmann, S., & Brandt, H. (2014). Validation of the STAXI-2: A study with prison inmates. *Psychological Test and Assessment Modeling*, *56*(2), 178-194.
- Ezekiel, L., Field, L., Collett, J., Dawes, H., & Boulton, M. (2021). Experiences of fatigue in daily life of people with acquired brain injury: A qualitative study. *Disability and Rehabilitation*, 43(20), 2866-2874.
- Fabiansson, E. C., Denson, T. F., Moulds, M. L., Grisham, J. R., & Schira, M. M. (2012).
  Don't look back in anger: Neural correlates of reappraisal, analytical rumination, and angry rumination during recall of an anger-inducing autobiographical memory. *Neuroimage*, 59(3), 2974-2981.
- Feinstein, J. S. (2013). Lesion studies of human emotion and feeling. *Current Opinion in Neurobiology*, 23(3), 304-309.
- Feldman, J. L., & Freitas, A. L. (2021). The generality of effects of emotional experience on emotion-regulation choice. *Emotion*, 21(1), 211–219.
- Fenn, K., & Byrne, M. (2013). The key principles of cognitive behavioural therapy. *InnovAiT*, 6(9), 579-585.
- Fernández, C., Pascual, J. C., Soler, J., Elices, M., Portella, M. J., & Fernández-Abascal, E. (2012). Physiological responses induced by emotion-eliciting films. *Applied Psychophysiology and Biofeedback*, 37(2), 73-79.

- Fernández-Aguilar, L., Navarro-Bravo, B., Ricarte, J., Ros, L., & Latorre, J. M. (2019). How effective are films in inducing positive and negative emotional states? A metaanalysis. *PloS One*, 14(11).
- Ferrer, R. A., Grenen, E. G., & Taber, J. M. (2015). Effectiveness of internet-based affect induction procedures: A systematic review and meta-analysis. *Emotion*, 15(6), 752– 762.
- Ferro, J. M., & Santos, A. C. (2020). Emotions after stroke: A narrative update. *International Journal of Stroke*, 15(3), 256-267.
- Fisher, A., Lennon, S., Bellon, M., & Lawn, S. (2015). Family involvement in behaviour management following acquired brain injury (ABI) in community settings: A systematic review. *Brain Injury*, 29(6), 661-675.
- Flujas-Contreras, J. M., García-Palacios, A., & Gómez, I. (2021). Effectiveness of a web-based intervention on parental psychological flexibility and emotion regulation:
  A pilot open trial. *International Journal of Environmental Research and Public Health*, 18(6), 1-18.
- Ford, B. Q., Karnilowicz, H. R., & Mauss, I. B. (2017). Understanding reappraisal as a multicomponent process: The psychological health benefits of attempting to use reappraisal depend on reappraisal success. *Emotion*, 17(6), 905-911.
- Foster, P. S., & Webster, D. G. (2001). Emotional memories: the relationship between age of memory and the corresponding psychophysiological responses. *International Journal* of Psychophysiology, 41(1), 11-18.
- Frederickson, J., J., Messina, I., & Grecucci, A. (2018). Dysregulated anxiety and dysregulating defenses: Toward an emotion regulation informed dynamic psychotherapy. *Frontiers in Psychology*, 9.

- Gerrards-Hesse, A., Spies, K., & Hesse, F. W. (1994). Experimental inductions of emotional states and their effectiveness: A review. *British Journal of Psychology*, 85(1), 55–78.
- Gillath, O., Hart, J., Noftle, E. E., & Stockdale, G. D. (2009). Development and validation of a state adult attachment measure (SAAM). *Journal of Research in Personality*, 43(3), 362-373.
- Goldin, P. R., McRae, K., Ramel, W., & Gross, J. J. (2008). The neural bases of emotion regulation: Reappraisal and suppression of negative emotion. *Biological Psychiatry*, 63(6), 577-586.
- Göritz, A. S. (2007). The induction of mood via the WWW. *Motivation and Emotion*, *31*, 35–47.
- Göritz, A. S., & Moser, K. (2006). Web-based mood induction. *Cognition and Emotion*, 20(6), 887-896.
- Gould, K. R., Hicks, A. J., Hopwood, M., Kenardy, J., Krivonos, I., Warren, N., & Ponsford, J. L. (2019). The lived experience of behaviours of concern: A qualitative study of men with traumatic brain injury. *Neuropsychological Rehabilitation*, 29(3), 376-394.
- Grauwmeijer, E., Heijenbrok-Kal, M. H., Haitsma, I. K., & Ribbers, G. M. (2012). A prospective study on employment outcome 3 years after moderate to severe traumatic brain injury. *Archives of Physical Medicine and Rehabilitation*, *93*(6), 993-999.
- Grecucci, A., Messina, I., Amodeo, L., Lapomarda, G., Crescentini, C., Dadomo, H., Panzeri,
  M., Theuninck, A., & Frederickson, J. (2020). A dual route model for regulating
  emotions: Comparing models, techniques and biological mechanisms. *Frontiers in Psychology*, 11.
- Gross, J. J. (1998a). Antecedent- and response-focused emotion regulation:
   Divergent consequences for experience, expression, and physiology. *Journal of Personality and Social Psychology*, 74(1), 224–237.

- Gross, J. J. (1998b). The emerging field of emotion regulation: An integrative review. *Review of General Psychology*, 2(3), 271–299.
- Gross, J. J. (2002). Emotion regulation: Affective, cognitive, and social consequences. *Psychophysiology*, *39*(3), 281-291.
- Gross, J. J. (2013). Emotion regulation: Taking stock and moving forward. *Emotion*, *13*(3), 359-365.
- Gross, J. J. (2014). Emotion regulation: Conceptual and empirical foundations. In J. J. Gross(Ed.), *Handbook of emotion regulation* (pp. 3-20). Guilford Press.
- Gross, J. J. (2015). Emotion regulation: Current status and future prospects. *Psychological Inquiry*, 26(1), 1-26.
- Gross, J. J., & Jazaieri, H. (2014). Emotion, emotion regulation, and psychopathology: An affective science perspective. *Clinical Psychological Science*, *2*(4), 387-401.
- Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology*, 85(2), 348–362.
- Gross, J. J., & Levenson, R. W. (1995). Emotion elicitation using films. *Cognition & Emotion*, *9*(1), 87-108.
- Gross, J. J., & Levenson, R. W. (1997). Hiding feelings: The acute effects of inhibiting negative and positive emotion. *Journal of Abnormal Psychology*, *106*(1), 95–103.
- Gross, J., & Thompson, R. (2007). Emotion regulation: Conceptual foundations. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 3-24). Guilford Press.
- Gyurak, A., Goodkind, M. S., Kramer, J. H., Miller, B. L., & Levenson, R. W. (2012).
  Executive functions and the down-regulation and up-regulation of emotion. *Cognition* & *Emotion*, 26(1), 103-118.

- Haidt, J. (2003). The moral emotions. In R. J. Davidson, K. R. Scherer, & H. H. Goldsmith (Eds.). *Handbook of affective sciences* (pp. 852-870). Oxford University Press.
- Haney, A. M., Fleming, M. N., Wycoff, A. M., Griffin, S. A., & Trull, T. J. (2023).
  Measuring affect in daily life: A multilevel psychometric evaluation of the PANAS-X across four ecological momentary assessment samples. *Psychological Assessment*, 35(6), 469–483.
- Harding, R., Gao, W., Jackson, D., Pearson, C., Murray, J., & Higginson, I. J. (2015).
  Comparative analysis of informal caregiver burden in advanced cancer, dementia, and acquired brain injury. *Journal of Pain and Symptom Management*, 50(4), 445-452.
- Harmon-Jones, E., Harmon-Jones, C., & Summerell, E. (2017). On the importance of both dimensional and discrete models of emotion. *Behavioral Sciences*, *7*(4), 1-16.
- Hart, T., Brockway, J. A., Fann, J. R., Maiuro, R. D., & Vaccaro, M. J. (2015).
  Anger self-management in chronic traumatic brain injury: Protocol for a psychoeducational treatment with a structurally equivalent control and an evaluation of treatment enactment. *Contemporary Clinical Trials*, 40, 180-192.
- Hart, T., Maiuro, R. D., Fann, J. R., Vaccaro, M. J., & Chervoneva, I. (2023). Predictors of treatment response to a psychoeducational intervention for anger in chronic moderate-severe traumatic brain injury. *The Journal of Neuropsychiatry and Clinical Neurosciences*, 35(2), 158-164.
- Hart, T., Vaccaro, M. J., Hays, C., & Maiuro, R. D. (2012). Anger self-management training for people with traumatic brain injury: A preliminary investigation. *The Journal of Head Trauma Rehabilitation*, 27(2), 113-122.
- Heather, N., Rollnick, S., & Bell, A. (1993). Predictive validity of the readiness to change questionnaire. *Addiction*, 88(12), 1667-1677.

- Hendricks, M. A., & Buchanan, T. W. (2016). Individual differences in cognitive control processes and their relationship to emotion regulation. *Cognition and Emotion*, 30(5), 912-924.
- Hewig, J., Hagemann, D., Seifert, J., Gollwitzer, M., Naumann, E., & Bartussek, D. (2005).A revised film set for the induction of basic emotions. *Cognition and Emotion*, 19(7), 1095-1109.
- Hewitt, P. L., Caelian, C. F., Flett, G. L., Sherry, S. B., Collins, L., & Flynn, C. A.
  (2002). Perfectionism in children: Associations with depression, anxiety, and anger. *Personality and Individual Differences*, 32(6), 1049-1061.
- Hicks, A. J., Clay, F. J., Hopwood, M., James, A. C., Jayaram, M., Perry, L. A., Batty, R., & Ponsford, J. L. (2019). The efficacy and harms of pharmacological interventions for aggression after traumatic brain injury—Systematic review. *Frontiers in Neurology*, *10*.
- Hlatshwako, T. G., Shah, S. J., Kosana, P., Adebayo, E., Hendriks, J., Larsson, E. C., Hensel,
  D. J., Erausquin, J. T., Marks, M., Michielsen, K., Saltis, H., Francis, J. M., Wouters,
  E., & Tucker, J. D. (2021). Online health survey research during COVID-19. *The Lancet Digital Health*, 3(2), e76-e77.
- Hofmann, S. G. (2014). Interpersonal emotion regulation model of mood and anxiety disorders. *Cognitive Therapy and Research*, *38*, 483-492.
- Holley, S. R., Ewing, S. T., Stiver, J. T., & Bloch, L. (2017). The relationship between emotion regulation, executive functioning, and aggressive behaviors. *Journal of Interpersonal Violence*, 32(11), 1692-1707.
- Holroyd, K. A. (1978). Effects of social anxiety and social evaluation on beer consumption and social interaction. *Journal of Studies on Alcohol*, *39*(5), 737-744.

- Howells, K., & Day, A. (2003). Readiness for anger management: Clinical and Theoretical issues. *Clinical Psychology Review*, *23*(2), 319-337.
- Howells, K., Day, A., Williamson, P., Bubner, S., Jauncey, S., Parker, A., & Heseltine,
  K. (2005). Brief anger management programs with offenders: Outcomes and
  predictors of change. *The Journal of Forensic Psychiatry & Psychology*, *16*(2), 296-311.
- Huang, J., Xu, D., Peterson, B., Hu, J., Cao, L., Wei, N., Zhang, Y., Xu, W., Xu, Y., & Hu, S. (2015). Affective reactions differ between Chinese and American healthy young adults: A cross-cultural study using the international affective picture system. *BMC Psychiatry*, 15(1).
- Hyder, A. A., Wunderlich, C. A., Puvanachandra, P., Gururaj, G., & Kobusingye, O. C. (2007). The impact of traumatic brain injuries: A global perspective. *NeuroRehabilitation*, 22(5), 341-353.
- Institute for Health Metrics and Evaluation (IHME). (2018). Findings from the global burden of disease study 2017 [Policy report].

https://www.healthdata.org/sites/default/files/files/policy\_report/2019/GBD\_2017\_Bo oklet.pdf

- Iruthayarajah, J., Alibrahim, F., Mehta, S., Janzen, S., McIntyre, A., & Teasell, R., (2018). Cognitive behavioural therapy for aggression among individuals with moderate to severe acquired brain injury: A systematic review and meta-analysis. *Brain Injury*, 32(12), 1443-1449.
- Jadhakhan, F., Blake, H., Hett, D., & Marwaha, S. (2022). Efficacy of digital technologies aimed at enhancing emotion regulation skills: Literature review. *Frontiers in Psychiatry*, 13, 1-15.

- Jallais, C., & Gilet, A. L. (2010). Inducing changes in arousal and valence: Comparison of two mood induction procedures. *Behavior Research Methods*, 42(1), 318-325.
- Judd, L. L., Paulus, M. P., Wells, K. B., & Rapaport, M. H. (1996). Socioeconomic burden of subsyndromal depressive symptoms and major depression in a sample of the general population. *American Journal of Psychiatry*, 153(11), 1411-1417.
- Juengst, S. B., Kumar, R. G., & Wagner, A. K. (2017). A narrative literature review of depression following traumatic brain injury: Prevalence, impact, and management challenges. *Psychology Research and Behavior Management*, 10, 175-186.
- John, O. P., & Gross, J. J. (2004). Healthy and unhealthy emotion regulation: Personality processes, individual differences, and lifespan development. *Journal of Personality*, 72(6), 1301–1333.
- Joseph, D. L., Chan, M. Y., Heintzelman, S. J., Tay, L., Diener, E., & Scotney, V. S. (2020). The manipulation of affect: A meta-analysis of affect induction procedures. *Psychological Bulletin*, 146(4), 355-375.
- Kalokerinos, E. K., Greenaway, K. H., & Denson, T. F. (2015). Reappraisal but not suppression downregulates the experience of positive and negative emotion. *Emotion*, 15(3), 271-275.
- Kangas, M., & McDonald, S. (2011). Is it time to act? The potential of acceptance and commitment therapy for psychological problems following acquired brain injury. *Neuropsychological Rehabilitation*, 21(2), 250-276.
- Kanske, P., Heissler, J., Schönfelder, S., Bongers, A., & Wessa, M. (2011). How to regulate emotion? Neural networks for reappraisal and distraction. *Cerebral Cortex*, 21(6), 1379-1388.

- Karreman, A., & Vingerhoets, A. J. J. M (2012). Attachment and well-being: The mediating role of emotion regulation and resilience. *Personality and Individual Differences*, 53(7), 821-826.
- Kelly, G., Todd, J., Simpson, G., Kremer, P., & Martin, C. (2006). The overt behaviour scale (OBS): A tool for measuring challenging behaviours following ABI in community settings. *Brain Injury*, 20(3), 307-319.
- Kenealy, P. M. (1986). The Velten mood induction procedure: A methodological review. *Motivation and Emotion*, *10*(4), 315-335.
- Khan, F., Baguley, I. J., & Cameron, I. D. (2003). 4: Rehabilitation after traumatic brain injury. *Medical Journal of Australia*, 178(6), 290-295.
- King, J. C., Hibbs, R., Saville, C. W., & Swales, M. A. (2018). The survivability of dialectical behaviour therapy programmes: A mixed methods analysis of barriers and facilitators to implementation within UK healthcare settings. *BMC Psychiatry*, 18, 1-11.
- Koole, S. L. (2009). The psychology of emotion regulation: An integrative review. *Cognition and Emotion*, 23(1), 4-41.
- Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (2008). International affective picture system (IAPS): Affective ratings of pictures and instruction manual. Technical Report A-8.
   University of Florida.
- Larsen, R. J. (2000). Toward a science of mood regulation. *Psychological Inquiry*, *11*(3), 129-141.
- Larsen, R. J., & Sinnett, L. M. (1991). Meta-analysis of experimental manipulations: Some factors affecting the Velten mood induction procedure. *Personality and Social Psychology Bulletin*, 17(3), 323-334.

- Lee, A. H., & DiGiuseppe, R. (2018). Anger and aggression treatments: A review of meta-analyses. *Current Opinion in Psychology*, 19, 65-74.
- Lefkovits, A. M., Hicks, A. J., Downing, M., & Ponsford, J. (2021). Surviving the "silent epidemic": A qualitative exploration of the long-term journey after traumatic brain injury. *Neuropsychological Rehabilitation*, *31*(10), 1582-1606.
- Lemay, E. P., Jr., Overall, N. C., & Clark, M. S. (2012). Experiences and interpersonal consequences of hurt feelings and anger. *Journal of Personality and Social Psychology*, 103(6), 982–1006.
- Lench, H. C., Flores, S. A., & Bench, S. W. (2011). Discrete emotions predict changes in cognition, judgment, experience, behavior, and physiology: A meta-analysis of experimental emotion elicitations. *Psychological Bulletin*, 137(5), 834–855.
- Leonard, K. E., Quigley, B. M., & Collins, R. L. (2002). Physical aggression in the lives of young adults: Prevalence, location, and severity among college and community samples. *Journal of Interpersonal Violence*, 17(5), 533-550.
- Lieneck, C., Weaver, E., & Maryon, T. (2021). Outpatient telehealth implementation in the United States during the COVID-19 global pandemic: A systematic review. *Medicina*, 57(5), 1-17.
- Lindsey, E. W. (2020). Relationship context and emotion regulation across the life span. *Emotion*, 20(1), 59-62.
- Livingstone, K. M., & Isaacowitz, D. M. (2015). Situation selection and modification for emotion regulation in younger and older adults. *Social Psychological and Personality Science*, 6(8), 904-910.
- Livny, A., Biegon, A., Kushnir, T., Harnof, S., Hoffmann, C., Fruchter, E., & Weiser,M. (2017). Cognitive deficits post-traumatic brain injury and their association withinjury severity and gray matter volumes. *Journal of Neurotrauma*, *34*(7), 1466-1472.

- Lobbestael, J., Arntz, A., Cima, M., & Chakhssi, F. (2009). Effects of induced anger in patients with antisocial personality disorder. *Psychological Medicine*, *39*(4), 557-568.
- Lobbestael, J., Arntz, A., & Wiers, R.W. (2008). How to push someone's buttons: A comparison of four anger-induction methods. *Cognition and Emotion*, 22(2), 353-373.
- Lohani, M., & Isaacowitz, D. M. (2014). Age differences in managing response to sadness elicitors using attentional deployment, positive reappraisal and suppression. *Cognition and Emotion*, 28(4), 678-697.
- Lopes, P. N., Salovey, P., Côté, S., Beers, M., & Petty, R. E. (2005). Emotion regulation abilities and the quality of social interaction. *Emotion*, *5*(1), 113-118.
- Ma, V. Y., Chan, L., & Carruthers, K. J. (2014). Incidence, prevalence, costs, and impact on disability of common conditions requiring rehabilitation in the United States: Stroke, spinal cord injury, traumatic brain injury, multiple sclerosis, osteoarthritis, rheumatoid arthritis, limb loss, and back pain. *Archives of Physical Medicine and Rehabilitation*, 95(5), 986-995.
- Mallya, S., Sutherland, J., Pongracic, S., Mainland, B., & Ornstein, T. J. (2015). The manifestation of anxiety disorders after traumatic brain injury: A review. *Journal of Neurotrauma*, 32(7), 411-421.
- Manstead, A. S. R., Tetlock, P. E., & Manstead, T. (1989). Cognitive appraisals and emotional experience: Further evidence. *Cognition & Emotion*, *3*(3), 225-239.
- Mantua, J., Helms, S. M., Weymann, K. B., Capaldi, V. F., & Lim, M. M. (2018).Sleep quality and emotion regulation interact to predict anxiety in veterans with PTSD. *Behavioural Neurology*.
- Marci, C. D., Glick, D. M., Loh, R., & Dougherty, D. D. (2007). Autonomic and prefrontal cortex responses to autobiographical recall of emotions. *Cognitive, Affective, & Behavioral Neuroscience*, 7(3), 243-250.

- Marcusson-Clavertz, D., Kjell, O. N., Persson, S. D., & Cardeña, E. (2019). Online validation of combined mood induction procedures. *PloS One*, *14*(6), 1-16.
- Marroquín, B. (2011). Interpersonal emotion regulation as a mechanism of social support in depression. *Clinical Psychology Review*, *31*(8), 1276-1290.
- Marroquín, B., & Nolen-Hoeksema, S. (2015). Emotion regulation and depressive symptoms: Close relationships as social context and influence. *Journal of Personality* and Social Psychology, 109(5), 836–855.
- Marsh, N. V., Ludbrook, M. R., & Gaffaney, L. C. (2016). Cognitive functioning following traumatic brain injury: A five-year follow-up. *NeuroRehabilitation*, 38(1), 71-78.
- Martin, M. (1990). On the induction of mood. Clinical Psychology Review, 10(6), 669-697.
- Martins, B., Sheppes, G., Gross, J. J., & Mather, M. (2018). Age differences in emotion regulation choice: Older adults use distraction less than younger adults in highintensity positive contexts. *The Journals of Gerontology: Series B*, 73(4), 603-611.
- Mauss, I. B., Cook, C. L., Cheng, J. Y., & Gross, J. J. (2007). Individual differences in cognitive reappraisal: Experiential and physiological responses to an anger provocation. *International Journal of Psychophysiology*, 66(2), 116-124.
- McClain, C. (2005). Collaborative rehabilitation goal setting. *Topics in Stroke Rehabilitation*, *12*(4), 56-60.
- McDonald, S., Hunt, C., Henry, J. D., Dimoska, A., & Bornhofen, C. (2010). Angry responses to emotional events: The role of impaired control and drive in people with severe traumatic brain injury. *Journal of Clinical and Experimental Neuropsychology*, 32(8), 855-864.

- McInnes, K., Friesen, C. L., MacKenzie, D. E., Westwood, D. A., & Boe, S. G. (2017). Mild Traumatic Brain Injury (mTBI) and chronic cognitive impairment: A scoping review. *PloS One*, *12*(4), e0174847.
- McRae, K., Ciesielski, B., & Gross, J. J. (2012). Unpacking cognitive reappraisal: Goals, tactics, and outcomes. *Emotion*, *12*(2), 250–255.
- McRae, K., Hughes, B., Chopra, S., Gabrieli, J. D. E., Gross, J. J., & Ochsner, K. N. (2010).
  The neural bases of distraction and reappraisal. *Journal of Cognitive Neuroscience*, 22(2), 248-262.
- Medd, J. & Tate, R. L. (2000). Evaluation of an anger management therapy programme following acquired brain injury: A preliminary study. *Neuropsychological Rehabilitation*, 10(2), 185-201.
- Mendes-Santos, C., Andersson, G., Weiderpass, E., & Santana, R. (2020). MitigatingCOVID-19 impact on the Portuguese population mental health: The opportunity thatlies in digital mental health. *Frontiers in Public Health*, *8*, 1-8.
- Menzel, J. C. (2008). Depression in the elderly after traumatic brain injury: A systematic review. *Brain Injury*, 22(5), 375-380.
- Meyer, S., Karttunen, A. H., Thijs, V., Feys, H., & Verheyden, G. (2014). How do somatosensory deficits in the arm and hand relate to upper limb impairment, activity, and participation problems after stroke? A systematic review. *Physical Therapy*, 94(9), 1220-1231.
- Mikels, J. A., Fredrickson, B. L., Larkin, G. R., Lindberg, C. M., Maglio, S. J., &
  Reuter-Lorenz, P. A. (2005). Emotional category data on images from the
  International Affective Picture System. *Behavior Research Methods*, *37*(4), 626-630.
- Mikulincer, M., & Shaver, P. R. (2016). *Attachment in adulthood: Structure, dynamics, and change*. Guilford Press.

- Mikulincer, M., & Shaver, P. R. (2019). Attachment orientations and emotion regulation. *Current Opinion in Psychology*, 25, 6-10.
- Miles, S. R., Thompson, K. E., Stanley, M. A., & Kent, T. A. (2016). Single-session emotion regulation skills training to reduce aggression in combat veterans: A clinical innovation case study. *Psychological Services*, 13(2), 170-177.
- Mills, C., & D'Mello, S. (2014). On the validity of the autobiographical emotional memory task for emotion induction. *PloS One*, *9*(4), e95837.
- Molini-Avejonas, D. R., Rondon-Melo, S., de La Higuera Amato, C. A., & Samelli, A.G. (2015). A systematic review of the use of telehealth in speech, language and hearing sciences. *Journal of Telemedicine and Telecare*, *21*(7), 367-376.
- Moritz, S., Klein, J. P., Lysaker, P. H., & Mehl, S. (2022). Metacognitive and cognitive-behavioral interventions for psychosis: New developments. *Dialogues in Clinical Neuroscience*, 21(3), 309-317.
- Morton, M. V., & Wehman, P. (1995). Psychosocial and emotional sequelae of individuals with traumatic brain injury: A literature review and recommendations. *Brain Injury*, *9*(1), 81-92.
- Mosak, H. H., & Dreikurs, R. (1973). Adlerian psychotherapy. In R. Corsini (Ed.), *Current psychotherapies* (pp. 52-95). Peacock.
- Mubaraki, A. A., Alrabie, A. D., Sibyani, A. K., Aljuaid, R. S., Bajaber, A. S., & Mubaraki,
  M. A. (2021). Advantages and disadvantages of telemedicine during the COVID-19
  pandemic era among physicians in Taif, Saudi Arabia. *Saudi Medical Journal*, 42(1), 110-115.
- Nedeljko, A. M., Bogataj, D. D., Perović, A. P. D. B. T., & Kaučič, A. P. D. B. M. (2022). Digital literacy during the coronavirus pandemic in older adults: Literature review and research agenda. *IFAC-PapersOnLine*, 55(39), 153-158.

- Neumann, D., Malec, J. F., & Hammond, F. M. (2017). Negative attribution bias and anger after traumatic brain injury. *The Journal of Head Trauma Rehabilitation*, *32*(3), 197-204.
- Nezlek, J. B., & Kuppens, P. (2008). Regulating positive and negative emotions in daily life. *Journal of Personality*, 76(3), 561-580.
- Nielsen, S. K. K., Lønfeldt, N., Wolitzky-Taylor, K. B., Hageman, I., Vangkilde, S., & Daniel, S. I. F. (2017). Adult attachment style and anxiety – The mediating role of emotion regulation. *Journal of Affective Disorders*, 218, 253-259.
- Norlander, B., & Eckhardt, C. (2005). Anger, hostility, and male perpetrators of intimate partner violence: A meta-analytic review. *Clinical Psychology Review*, 25(2), 119-152.
- Nummenmaa, L., & Niemi, P. (2004). Inducing affective states with success-failure manipulations: A meta-analysis. *Emotion*, 4(2), 207–214.
- Offredi, A., Caselli, G., Manfredi, C., Ruggiero, G. M., Sassaroli, S., Liuzzo, P., & Rovetto, F. (2016). Effects of anger rumination on different scenarios of anger: An experimental investigation. *The American Journal of Psychology*, *129*(4), 381-390.
- Okuda, M., Picazo, J., Olfson, M., Hasin, D. S., Liu, S. M., Bernardi, S., & Blanco, C. (2015). Prevalence and correlates of anger in the community: Results from a national survey. *CNS Spectrums*, 20(2), 130-139.
- Öner, S. (2018). Neural substrates of cognitive emotion regulation: A brief review. *Psychiatry and Clinical Psychopharmacology*, 28(1), 91-96.
- Orgeta, V. (2009). Specificity of age differences in emotion regulation. *Aging & Mental Health*, *13*(6), 818-826.

- Osborn, A. J., Mathias, J. L., & Fairweather-Schmidt, A. K. (2016). Prevalence of anxiety following adult traumatic brain injury: A meta-analysis comparing measures, samples and postinjury intervals. *Neuropsychology*, *30*(2), 247–261.
- Özkarar-Gradwohl, F. G., & Turnbull, O. H. (2021). Gender effects in personality: A cross-cultural affective neuroscience perspective. *Culture and Brain*.
- Panksepp, J. (1998). Affective neuroscience: The foundations of human and animal emotions. Oxford University Press.
- Panksepp, J. (2005a). Affective consciousness: Core emotional feelings in animals and humans. *Consciousness and Cognition*, 14(1), 30–80.
- Panksepp, J. (2005b). On the embodied neural nature of the core emotional affects. *Journal* of Consciousness Studies, 12(8-10), 158–184.
- Panksepp J. (2007). Criteria for basic emotions: Is DISGUST a primary "emotion"? *Cognition & Emotion*, 21(8), 1819–1828.
- Panksepp, J., & Watt, D. (2011). What is basic about basic emotions? Lasting lessons from affective neuroscience. *Emotion Review*, *3*(4), 387-396.
- Parkinson, B. (1996). Emotions are social. British Journal of Psychology, 87, 663-683.
- Plonsky, L., & Oswald, F. L. (2014). How big is "big"? Interpreting effect sizes in L2 research. *Language Learning*, 64(4), 878-912.
- Ponsford, J. L., Downing, M. G., Olver, J., Ponsford, M., Acher, R., Carty, M., & Spitz, G. (2014). Longitudinal follow-up of patients with traumatic brain injury: Outcome at two, five, and ten years post-injury. *Journal of Neurotrauma*, *31*(1), 64-77.
- Potegal, M. (2012). Temporal and frontal lobe initiation and regulation of the top-down escalation of anger and aggression. *Behavioural Brain Research*, *231*(2), 386-395.

- Pouwels, C. G. J. G., Spauwen, P. J. J., Bus, B. A. A., Winkens, I., & Ponds, R. W. H. M. (2019). [Prevalence and manifestations of aggression in adult patients with acquired brain injury: A review]. *Tijdschrift Voor Psychiatrie*, 61(12), 862-878.
- Preece, D. A., Becerra, R., Hasking, P., McEvoy, P. M., Boyes, M., Sauer-Zavala, S.,
  Chen, W., & Gross, J. J. (2021). The emotion regulation questionnaire: Psychometric properties and relations with affective symptoms in a United States general community sample. *Journal of Affective Disorders*, 284, 27-30.
- Preece, D. A., Becerra, R., Robinson, K., & Gross, J. J. (2019). The emotion regulation questionnaire: Psychometric properties in general community samples. *Journal of Personality Assessment*, 102(3), 348-356.
- Ramos-Perdigués, S., Mané-Santacana, A., & Pintor-Pérez, L. (2015). Prevalence and associated factors of anger post stroke: A systematic review. *Revista de Neurologia*, 60(11), 481-489.
- Rao, V., Rosenberg, P., Bertrand, M., Salehinia, S., Spiro, J., Vaishnavi, S., Rastogi, P.,
  Noll, K., Schretlen, D. J., Brandt, J., Cornwell, E., Makley, M., & Miles, Q. S. (2009).
  Aggression after traumatic brain injury: Prevalence and correlates. *The Journal of Neuropsychiatry and Clinical Neurosciences*, 21(4), 420-429.
- Rasekaba, T. M., Pereira, P., Rani. G, V., Johnson, R., McKechnie, R., & Blackberry, I.
  (2022). Exploring telehealth readiness in a resource limited setting: Digital and health literacy among older people in rural India (DAHLIA). *Geriatrics*, 7(2), 1-14.
- Rietdijk, R., Power, E., Attard, M., Heard, R., & Togher, L. (2020). A clinical trial investigating telehealth and in-person social communication skills training for people with traumatic brain injury: Participant-reported communication outcomes. *The Journal of Head Trauma Rehabilitation*, *35*(4), 241-253.

- Rietdijk, R., Power, E., Brunner, M., & Togher, L. (2017). Reliability of videoconferencing administration of a communication questionnaire to people with traumatic brain injury and their close others. *The Journal of Head Trauma Rehabilitation*, *32*(6), E38-E44.
- Rochat, L., Manolov, R., Aboulafia-Brakha, T., Berner-Burkard, C., & Van der Linden, M.
   (2019). Reducing anger outbursts after a severe TBI: A single-case study.
   *Neuropsychological Rehabilitation*, 29(1), 107-130.
- Rollnick, S., Heather, N., Gold, R., & Hall, W. (1992). Development of a short 'readiness to change' questionnaire for use in brief, opportunistic interventions among excessive drinkers. *British Journal of Addiction*, 87(5), 743-754.
- Ross, J., Quayle, E., Newman, E., & Tansey, L. (2013). The impact of psychological therapies on violent behaviour in clinical and forensic settings: A systematic review. *Aggression and Violent Behavior*, 18(6), 761-773.
- Rowlands, L., Coetzer, R., & Turnbull, O. H. (2020). Good things better? Reappraisal and discrete emotions in acquired brain injury. *Neuropsychological Rehabilitation*, 30(10), 1947-1975.
- Rowlands, L., Coetzer, R., & Turnbull, O. (2021). This time it's personal: Reappraisal after acquired brain injury. *Cognition and Emotion*, *35*(2), 305-323.
- Roy, D., Vaishnavi, S., Han, D., & Rao, V. (2017). Correlates and prevalence of aggression at six months and one year after first-time traumatic brain injury. *The Journal of Neuropsychiatry and Clinical Neurosciences*, 29(4), 334-342.
- Ruet, A., Jourdan, C., Bayen, E., Darnoux, E., Sahridj, D., Ghout, I., Azerad, S., Diehl, P. P.,
  Aegerter, P., Charanton, J., Azouvi, C. V., & Azouvi, P. (2018). Employment
  outcome four years after a severe traumatic brain injury: Results of the Paris severe
  traumatic brain injury study. *Disability and Rehabilitation*, 40(18), 2200-2207.

- Russell, J. A. (1978). Evidence of convergent validity on the dimensions of affect. *Journal of Personality and Social Psychology*, *36*(10), 1152–1168.
- Saban, K. L., Griffin, J. M., Urban, A., Janusek, M. A., Pape, T. L. B., & Collins, E.
  (2016). Perceived health, caregiver burden, and quality of life in women partners providing care to veterans with traumatic brain injury. *Journal of Rehabilitation Research & Development*, *53*(6), 681-692.
- Saban, K. L., Hogan, N. S., Hogan, T. P., & Pape, T. L. B. (2015). He looks normal but... challenges of family caregivers of veterans diagnosed with a traumatic brain injury. *Rehabilitation Nursing*, 40(5), 277-285.
- Sabaz, M., Simpson, G. K., Walker, A. J., Rogers, J. M., Gillis, I., & Strettles, B. (2014).
  Prevalence, comorbidities, and correlates of challenging behavior among communitydwelling adults with severe traumatic brain injury: A multicenter study. *The Journal of Head Trauma Rehabilitation*, 29(2), E19-E30.
- Sabri, S., & Prasada, B. (1985). Video conferencing systems. *Proceedings of the IEEE*, 73(4), 671-688.
- Salas, C. E., Casassus, M., Rowlands, L., Pimm, S., & Flanagan, D. A. J. (2018). "Relating through sameness": A qualitative study of friendship and social isolation in chronic traumatic brain injury. *Neuropsychological Rehabilitation*, 28(7), 1161-1178.
- Salas, C. E., Castro, O., Yuen, K. S. L., Radovic, D., d'Avossa, G., & Turnbull, O. H. (2016).
  "Just can't hide it": A behavioral and lesion study on emotional response modulation after right prefrontal damage. *Social Cognitive and Affective Neuroscience*, *11*(10), 1528–1540.
- Salas, C. E., Gross, J. J., Rafal, R. D., Viñas-Guasch, N., & Turnbull, O. H. (2013). Concrete behaviour and reappraisal deficits after a left frontal stroke: A case study. *Neuropsychological Rehabilitation*, 23(4), 467-500.

- Salas, C. E., Gross, J. J., & Turnbull, O. H. (2014). Reappraisal generation after acquired brain damage: The role of laterality and cognitive control. *Frontiers in Psychology*, *5*, 1-10.
- Salas, C. E., Gross, J. J., & Turnbull, O. H. (2019). Using the process model to understand emotion regulation changes after brain injury. *Psychology & Neuroscience*, 12(4), 430-450.
- Salas, C. E., Radovic, D., & Turnbull, O. H. (2012). Inside-out: Comparing internally generated and externally generated basic emotions. *Emotion*, *12*(3), 568-578.
- Salas Riquelme, C. E., Radovic, D., Castro, O., & Turnbull, O. H. (2015). Internally and externally generated emotions in people with acquired brain injury: Preservation of emotional experience after right hemisphere lesions. *Frontiers in Psychology*, 6, 1-9.
- Salehinejad, M. A., Ghanavati, E., Rashid, M. H. A., & Nitsche, M. A. (2021). Hot and cold executive functions in the brain: A prefrontal-cingular network. *Brain and Neuroscience Advances*, 5, 1-19.
- Sander, A. M., Bogner, J., Nick, T. G., Clark, A. N., Corrigan, J. D., & Rozzell, M. (2012). A randomized controlled trial of brief intervention for problem alcohol use in persons with traumatic brain injury. *The Journal of Head Trauma Rehabilitation*, 27(5), 319-330.
- Sansom-Daly, U. M., & Bradford, N. (2020). Grappling with the "human" problem hiding behind the technology: Telehealth during and beyond COVID-19. *Psychooncology*, 29(9), 1404-1408.

- Sassaroli, S., Brambilla, R., Cislaghi, E., Colombo, R., Centorame, F., Veronese, G.,
  Favaretto, E., Fiore, F., Veronese, G., & Ruggiero, G. M. (2014). Emotion-abstraction
  patterns and cognitive interventions in a single case of standard cognitive-behavioral
  therapy. *Research in Psychotherapy: Psychopathology, Process and Outcome*, *17*(2),
  65–72.
- Scheibe, S., Sheppes, G., & Staudinger, U. M. (2015). Distract or reappraise? Age-related differences in emotion-regulation choice. *Emotion*, 15(6), 677-681.
- Schmeichel, B. J., & Tang, D. (2015). Individual differences in executive functioning and their relationship to emotional processes and responses. *Current Directions in Psychological Science*, 24(2), 93-98.
- Scholten, A. C., Haagsma, J. A., Cnossen, M. C., Olff, M., Van Beeck, E. F., & Polinder, S. (2016). Prevalence of and risk factors for anxiety and depressive disorders after traumatic brain injury: A systematic review. *Journal of Neurotrauma*, *33*(22), 1969-1994.
- Shafir, R., Schwartz, N., Blechert, J., & Sheppes, G. (2015). Emotional intensity influences pre-implementation and implementation of distraction and reappraisal. *Social Cognitive and Affective Neuroscience*, *10*(10), 1329-1337.
- Shahsavarani, A. M., & Noohi, S. (2015). Explaining the bases and fundamentals of anger: A literature review. *International Journal of Medical Reviews*, *1*(4), 143-149.
- Shames, J., Treger, I., Ring, H., & Giaquinto, S. (2007). Return to work following traumatic brain injury: Trends and challenges. *Disability and Rehabilitation*, 29(17), 1387-1395.
- Sharman, L., & Dingle, G. A. (2015). Extreme metal music and anger processing. *Frontiers in Human Neuroscience*, 9(272).

- Shaw, S., Wherton, J., Vijayaraghavan, S., Morris, J., Bhattacharya, S., Hanson, P.,
  Campbell-Richards, D., Ramoutar, S., Collard, A., Hodkinson, I., & Greenhalgh, T.
  (2018). Advantages and limitations of virtual online consultations in a NHS acute
  trust: The VOCAL mixed-methods study. *Health Services and Delivery Research*, 6(21).
- Shay, L. A., & Lafata, J. E. (2015). Where is the evidence? A systematic review of shared decision making and patient outcomes. *Medical Decision Making*, *35*(1), 114-131.
- Sheppes, G., Scheibe, S., Suri, G., & Gross, J. J. (2011). Emotion-regulation choice. *Psychological Science*, 22(11), 1391-1396.
- Siedlecka, E., Capper, M. M., & Denson, T. F. (2015). Negative emotional events that people ruminate about feel closer in time. *PloS ONE*, *10*(2), e0117105.
- Siedlecka, E., & Denson, T. F. (2019). Experimental methods for inducing basic emotions: A qualitative review. *Emotion Review*, *11*(1), 87-97.
- Soares, A. P., Pinheiro, A. P., Costa, A., Frade, C. S., Comesaña, M., & Pureza, R. (2015).
  Adaptation of the international affective picture system (IAPS) for European
  Portuguese. *Behavior Research Methods*, 47(4), 1159-1177.
- Song, S. Y., Curtis, A. M., & Aragón, O. R. (2021). Anger and sadness expressions situated in both positive and negative contexts: An investigation in South Korea and the United States. *Frontiers in Psychology*, 11(579509).
- Spielberger, C. D. (1999). STAXI-2: State-trait anger expression inventory-2. Professional manual. Psychological Assessment Resources.
- Sreeja, P. S., & Mahalakshmi, G. S. (2017). Emotion models: A review. International Journal of Control Theory and Applications, 10(8), 651-657.

- Stappenbeck, C. A., Gulati, N. K., Jaffe, A. E., Blayney, J. A., & Kaysen, D. (2021). Initial efficacy of a web-based alcohol and emotion regulation intervention for college women with sexual assault histories. *Psychology of Addictive Behaviors*, 35(7), 852– 865.
- Starkstein, S. E. & Robinson, R. G. (1991). The role of the human lobes in affective disorder following stroke. In H. S. Levin, H. M. Eisenberg, & A. L. Benton (Eds.), *Frontal lobe function and dysfunction*. Oxford University Press.
- Stocchetti, N., & Zanier, E. R. (2016). Chronic impact of traumatic brain injury on outcome and quality of life: A narrative review. *Critical Care*, 20.
- Strauss, G. P., Ossenfort, K. L., & Whearty, K. M. (2016). Reappraisal and distraction emotion regulation strategies are associated with distinct patterns of visual attention and differing levels of cognitive demand. *PloS ONE*, *11*(11), e0162290.
- Strong, C. A. H., Tiesma, D., & Donders, J. (2010). Criterion validity of the Delis-Kaplan Executive Function System (D-KEFS) fluency subtests after traumatic brain injury. *Journal of the International Neuropsychological Society*, 17(2), 230-237.
- Szasz, P. L., Szentagotai, A., & Hofmann, S. G. (2011). The effect of emotion regulation strategies on anger. *Behaviour Research and Therapy*, 49(2), 114-119
- Sznycer, D. (2019). Forms and functions of the self-conscious emotions. *Trends in Cognitive Sciences*, 23(2), 143-157.
- Tamir, M., Mitchell, C., & Gross, J. J. (2008). Hedonic and instrumental motives in anger regulation. *Psychological Science*, 19(4), 324–328.
- Tateno, A., Jorge, R. E., & Robinson, R. G. (2003). Clinical correlates of aggressive behavior after traumatic brain injury. *The Journal of Neuropsychiatry and Clinical Neurosciences*, 15(2), 155-160.

- Tenforde, A. S., Hefner, J. E., Kodish-Wachs, J. E., Iaccarino, M. A., & Paganoni, S.
  (2017). Telehealth in physical medicine and rehabilitation: A narrative review. *PM&R*, 9(5), S51-S58.
- Tondowski, M., Kovacs, Z., Morin, C., & Turnbull, O. H. (2007). Hemispheric asymmetry and the diversity of emotional experience in anosognosia. *Neuropsychoanalysis*, *9*(1), 67-81.
- Tracy, J. L., & Randles, D. (2011). Four models of basic emotions: A review of Ekman and Cordaro, Izard, Levenson, and Panksepp and Watt. *Emotion Review*, *3*(4), 397-405.
- Tracy, J. L., & Robins, R. W. (2004). Putting the self into self-conscious emotions: A theoretical model. *Psychological Inquiry*, 15(2), 103-125.
- Tsaousides, T., D'Antonio, E., Varbanova, V., & Spielman, L. (2014). Delivering group treatment via videoconference to individuals with traumatic brain injury: A feasibility study. *Neuropsychological Rehabilitation*, *24*(5), 784-803.
- Tsaousides, T., Spielman, L., Kajankova, M., Guetta, G., Gordon, W., & Dams-O'Connor, K. (2017). Improving emotion regulation following web-based group intervention for individuals with traumatic brain injury. *Journal of Head Trauma Rehabilitation*, 32(5), 354-365.
- Tulip, C., Fisher, Z., Bankhead, H., Wilkie, L., Pridmore, J., Gracey, F., Tree, J., & Kemp, A.
  H. (2020). Building wellbeing in people with chronic conditions: A qualitative evaluation of an 8-week positive psychotherapy intervention for people living with an acquired brain injury. *Frontiers in Psychology*, *11*.
- Tull, M. T., & Aldao, A. (2015). Editorial overview: New directions in the science of emotion regulation. *Current Opinion in Psychology*, 3, iv-x.
- Turnbull, O. H., Evans, C. E., & Owen, V. (2005). Negative emotions and anosognosia. *Cortex*, 41(1), 67-75.

- Turnbull, O. H., & Salas, C. E. (2021). The neuropsychology of emotion and emotion regulation: The role of laterality and hierarchy. *Brain Sciences*, *11*(8), 1-15.
- Uhrig, M. K., Trautmann, N., Baumgärtner, U., Treede, R. D., Henrich, F., Hiller, W., & Marschall, S. (2016). Emotion elicitation: A comparison of pictures and films. *Frontiers in Psychology*, 7(180).
- Urry, H. L., & Gross, J. J. (2010). Emotion regulation in older age. Current Directions in Psychological Science, 19(6), 352-357.
- Van Bockstaele, B., Atticciati, L., Hiekkaranta, A. P., Larsen, H., & Verschuere, B. (2020). Choose change: Situation modification, distraction, and reappraisal in mild versus intense negative situations. *Motivation and Emotion*, 44, 583–596.
- Vandekerckhove, M., Kestemont, J., Weiss, R., Schotte, C., Exadaktylos, V., Haex, B., Verbraecken, J., & Gross, J. J. (2012). Experimental versus analytical emotion regulation and sleep: Breaking the link between negative events and sleep disturbance: *Emotion*, 12(6), 1415-1421.
- VandenBos, G. R., & Williams, S. (2000). The Internet versus the telephone: What is telehealth anyway? *Professional Psychology: Research and Practice*, *31*(5), 490–492.
- Velten, E. (1968). A laboratory task for induction of mood states. *Behaviour Research and Therapy*, 6(4), 473–482.
- Vrana, S. R., & Rollock, D. (2002). The role of ethnicity, gender, emotional content, and contextual differences in physiological, expressive, and self-reported emotional responses to imagery. *Cognition & Emotion*, 16(1), 165-192.
- Vrtička, P., Bondolfi, G., Sander, D., & Vuilleumier, P. (2012). The neural substrates of social emotion perception and regulation are modulated by adult attachment style. *Social Neuroscience*, 7(5), 473-493.

- Waldstein, S. R., Kop, W. J., Schmidt, L. A., Haufler, A. J., Krantz, D. S., & Fox, N. A. (2000). Frontal electrocortical and cardiovascular reactivity during happiness and anger. *Biological Psychology*, 55(1), 3-23.
- Walker, A. J., Nott, M. T., Doyle, M., Onus, M., McCarthy, K., & Baguley, I. J. (2010). Effectiveness of a group anger management programme after severe traumatic brain injury. *Brain Injury*, 24(3), 517-524.
- Wang, M., & Saudino, K. J. (2013). Genetic and environmental influences on individual differences in emotion regulation and its relation to working memory in toddlerhood. *Emotion*, 13(6), 1055–1067.
- Watson, D., & Clark, L. A. (1994). *The PANAS-X. Manual for the positive and negative affect schedule –expanded form.* University of Iowa.
- Webster, S. W., Connors, E. C., & Sinclair, B. (2022). The social consequences of political anger. *The Journal of Politics*, 84(3), 1292-1305.
- Webb, T. L., Lindquist, K. A., Jones, K., Avishai, A., & Sheeran, P. (2018).Situation selection is a particularly effective emotion regulation strategy for people who need help regulating their emotions. *Cognition and Emotion*, *32*(2), 231-248.
- Webb, T. L., Miles, E., & Sheeran, P. (2012). Dealing with feeling: A meta-analysis of the effectiveness of strategies derived from the process model of emotion regulation. *Psychological Bulletin*, 138(4), 775–808.
- Wechsler, D. (2010). Wechsler adult intelligence scale fourth UK edition (WAIS-IV UK) administration manual. Pearson.
- Westermann, R., Spies, K., Stahl, G., & Hesse, F. W. (1996). Relative effectiveness and validity of mood induction procedures: A meta-analysis. *European Journal of Social Psychology*, 26(4), 557-580.

- Wilkie, L., Arroyo, P., Conibeer, H., Kemp, A. H., & Fisher, Z. (2021). The impact of psycho-social interventions on the wellbeing of individuals with acquired brain injury during the COVID-19 pandemic. *Frontiers in Psychology*, 12, 1-20.
- Williamson, P., Day, A., Howells, K., Bubner, S., & Jauncey, S. (2003). Assessing offender readiness to change problems with anger. *Psychology, Crime & Law*, 9(4), 295-307.
- Williamson, D., Frenette, A. J., Burry, L. D., Perreault, M., Charbonney, E., Lamontagne, F.,
  Potvin, M-J., Giguère, J-F., Mehta, S., & Bernard, F. (2019). Pharmacological
  interventions for agitated behaviours in patients with traumatic brain injury: A
  systematic review. *BMJ Open*, 9(7), 1-14.
- Wilson, B. A., Alderman, N., Burgess, P. W., Emslie, H., & Evans, J. J. (1996). Behavioural assessment of the dysexecutive syndrome: Test manual. Thames Valley Test Company.
- Winter, L., Moriarty, H. J., & Short, T. H. (2018). Beyond anger: Emotion regulation and social connectedness in veterans with traumatic brain injury. *Brain Injury*, 32(5), 593-599.
- Winterheld, H. A. (2016). Calibrating use of emotion regulation strategies to the relationship context: An attachment perspective. *Journal of Personality*, 84(3), 369-380.
- Wirth, M., & Kunzmann, U. (2018). Age differences in regulating negative emotions via attentional deployment. *Psychology and Aging*, *33*(3), 384–398.
- Witten, J. A., Coetzer, R., Rowlands, L., & Turnbull, O. H. (2023). "Talk and chalk": An emotion regulation intervention for anger after acquired brain injury. *Applied Neuropsychology: Adult.*

- Witten, J. A., Coetzer, R., & Turnbull, O. H. (2022). Shades of rage: Applying the process model of emotion regulation to managing anger after brain injury. *Frontiers in Psychology*, 13.
- Witten, J. A., Truss, E., Coetzer, R., & Turnbull, O. H. (in press). Rage at strangers: Anger elicitation and regulation as a function of relationship type. *American Journal of Psychology*.
- Witteveen, A. B., Young, S., Cuijpers, P., Ayuso-Mateos, J. L., Barbui, C., Bertolini, F.,
  Cabello, M., Cadorin, C., Downes, N., Franzoi, D., Gasior, M., John, A., Melchior,
  M., McDaid, D., Palantza, C., Purgato, M., Van der Waerden, J., Wang, S., &
  Sijbrandij, M. (2022). Remote mental health care interventions during the COVID-19
  pandemic: An umbrella review. *Behaviour Research and Therapy*, *159*, 1-13.
- Wood, R. L., & Liossi, C. (2006). The ecological validity of executive tests in a severely brain injured sample. *Archives of Clinical Neuropsychology*, *21*(5), 429-437.

World Health Organization. (1996). Geneva, Switzerland.

- Wosik, J., Fudim, M., Cameron, B., Gellad, Z. F., Cho, A., Phinney, D., Curtis, S., Roman, M., Poon, E. G., Ferranti, J., Katz, J. N., & Tcheng, J. (2020). Telehealth transformation: COVID-19 and the rise of virtual care. *Journal of the American Medical Informatics Association*, 27(6), 957-962.
- Yasmin, N., & Riley, G. A. (2022). Are spousal partner perceptions of continuity and discontinuity within the relationship linked to the symptoms of acquired brain injury? *Disability and Rehabilitation*, 44(16), 4249-4256.
- Zigmond, A. S., & Snaith, R. P. (1983). The hospital anxiety and depression scale. *Acta Psychiatrica Scandinavica*, 67(6), 361-370.
## List of Appendices

#### Empirical Study One / Chapter Two

Appendix A: Example of participant information sheet and consent formAppendix B: Counterbalance design for the Affective Story Recall relationship categoriesand the emotion regulation techniques (also used in Empirical Study Two/Chapter Four)

## Empirical Study Two / Chapter Four

Appendix C: Recruitment flyer

Appendix D: Example of participant information sheet and consent form

Appendix E: Example of the Talk and Chalk the homework diary

Appendix F: Post-treatment interview protocol

YSGOL SEICOLEG SCHOOL OF PSYCHOLOGY



Appendix A: Example of participant information sheet and consent form

## PARTICIPANT INFORMATION SHEET

**Study Title:** Understanding, Managing and Measuring Feelings **Ethics System Reference Number:** 2019-16654

## Invitation

Jade Witten (a PhD student at the School of Psychology) and her research team from Bangor University would like to invite you to take part in this research study. Before you decide if you would like to participate, it is important that you understand why this research is being done and how it would involve you. Please take your time to read the following information. We encourage you to ask questions if anything you read is unclear or if you would like further information.

## **Details of study**

Our research lab is interested in understanding emotions. This study is part of a larger research project investigating emotions in patients with brain injuries. In this study, we are particularly interested in how to generate feelings in an experimental setting.

## Why have I been asked to participate?

We are asking you to participate because we have identified you as someone who will be able to provide comparative data for our patient population.

## What will I have to do?

You will start by completing a few questionnaires about your background, relationship with others and how you manage your feelings. After this, you will share with us some personal events from your past that made you feel angry. You will also be asked to think about these personal events in a different way, and to draw a few of your own pictures. Before and after describing each event, we will ask you to complete a few questions about how the event makes you feel. We will also ask you to complete a few tasks looking at the way you think. This session will be conducted over a video-conferencing platform (i.e., Microsoft Teams), and will last between 60 and 90 minutes.

## Are there any benefits?

While there are no direct benefits for you, your data will inform a clinical research study in patients with brain injuries, who struggle to manage their emotions.

PRIFYSGOL BANGOR ADEILAD BRIGANTIA, FFORDD PENRALLT, BANGOR,GWYNEDD, LL57 2AS BANGOR UNIVERSITY BRIGANTIA BUILDING, PENRALLT ROAD, BANGOR, GWYNEDD, LL57 2AS

FFÖN: (01248) 382211

TEL:(01248) 382211

Registered charity number: 1141565 DR CAROLINE BOWMAN MA, PhD, SFHEA PENNAETH DROS DRO YR YSGOL INTERIM HEAD OF SCHOOL EBOST / EMAIL: c.bowman@bangor.ac.uk

www.bangor.ac.uk/psychology

YSGOL SEICOLEG SCHOOL OF PSYCHOLOGY



## What are the possible risks?

You may experience some discomfort when thinking and talking about a personal experience in relation to anger. Though people usually do not find this very distressing, in the unlikely event that you experience substantial discomfort, you can withdraw from the study at any time. We will also provide you with contact details for a support service should this be necessary.

## What will happen to my data?

Bangor University controls this data. Strict measures will be taken to ensure that your personal information is safeguarded throughout the study. All of your data will be confidential and anonymised.

You may withdraw your consent and data up to one month after participating, by emailing the Principal Investigator (contact details below).

All data from this study will be kept and stored for 10 years in a secure electronic database, after which it will be disposed of securely in accordance with university policy. We will give you some information about what we found at the end of the study.

## Who is sponsoring this research?

This research is sponsored by Bangor University and the Oppenheimer Memorial Trust.

## What if I do not want to take part or continue with the study?

Your participation is voluntary and you may withdraw at any point. You may also choose to omit questions you do not wish to answer.

## **Contact Information**

Ms Jade Witten (Principal Investigator) jade.witten@bangor.ac.uk

Concerns or complaints about this study, or the conduct of individuals conducting this study, can be directed to Mr Huw Ellis, College Manager for the College of Human Sciences, Bangor University, Bangor, Gwynedd LL57 2AS or e-mail huw.ellis@bangor.ac.uk.

Version 3 Dated 04-12-2020

PRIFYSGOL BANGOR ADEILAD BRIGANTIA, FFORDD PENRALLT, BANGOR,GWYNEDD, LL57 2AS

BANGOR UNIVERSITY BRIGANTIA BUILDING, PENRALLT ROAD, BANGOR, GWYNEDD, LL57 2AS DR CAROLINE BOWMAN MA, PhD, SFHEA PENNAETH DROS DRO YR YSGOL INTERIM HEAD OF SCHOOL EBOST/ EMAIL: c.bowman@bangor.ac.uk

FFŐN: (01248) 382211

TEL:(01248) 382211

Registered charity number: 1141565 www.bangor.ac.uk/psychology

YSGOL SEICOLEG SCHOOL OF PSYCHOLOGY



## **CONSENT FORM**

Study Title: Understanding, Managing and Measuring FeelingsPrincipal Investigator: Ms Jade Witten (jade.witten@bangor.ac.uk)Ethics Application Number: 2019-16654

I confirm that I have read and understood the *Participant Information Sheet* for this study. I have had the opportunity to consider the information and ask any questions, all of which have been answered satisfactorily.

I understand that my participation is voluntary, and that I am free to withdraw at any point and for any reason.

I understand that the data collected will be anonymised (i.e., no personally identifiable information will be included) in any written works and/or presentations.

I understand that documents connected to this study will be stored securely (separately from consent forms) for 10 years, after which they will be disposed of accordingly.

I consent to take part in this study.

If you agree with the above statements, please *reply* to this email with the following: *I consent to take part in this study – ethics application number 2019-16654*.

Version 3 Dated 04-12-2020

PRIFYSGOL BANGOR ADEILAD BRIGANTIA, FFORDD PENRALLT, BANGOR,GWYNEDD, LL57 2AS

FFÔN: (01248) 382211

BANGOR UNIVERSITY BRIGANTIA BUILDING,

PENRALLT ROAD, BANGOR, GWYNEDD, LL57 2AS DR CAROLINE BOWMAN MA, PhD, SFHEA PENNAETH DROS DRO YR YSGOL INTERIM HEAD OF SCHOOL EBOST/ EMAIL:

TEL:(01248) 382211

Registered charity number: 1141565 www.bangor.ac.uk/psychology

c.bowman@bangor.ac.uk

**Appendix B:** Counterbalance design for the five relationship categories applied to the Affective Story Recall and the two emotion regulation techniques (i.e., reappraisal and distraction)





Note. R = Reappraisal; AD = Attentional Deployment. ASR trials are color-coded.



# Managing Feelings after Brain Injury: Talk and Chalk Study

Bangor University's School of Human and Behavioural Sciences is conducting an **online research study** on **managing difficult feelings**, such as **irritation** or **frustration**, after brain injury.

# We are looking for people who:

- Have had a brain injury at least **9** months ago
- Are fluent English speakers (including Welsh-English bilinguals)
- Are between the ages of **20** and **85**
- Do not have any other major neurological or mental health conditions
- Are **not** being treated for problems with substance misuse

# What does the study entail?

- 5 meetings over several months
- Each meeting is 1-hour
- All meetings are on Zoom

If you are interested, **contact** the lead researcher, Ms. **Jade Witten**, to answer a few questions about your **eligibility** to take part: **Email**: jade.witten@bangor.ac.uk **Tel:** +44 7799 915731



Thank You! Diolch!

Ethics Reference: 2020-16812 Version 6 Dated 10-03-2022



**Appendix D:** Example of the participant information sheet and consent form for individuals who were recruited from Headway UK

## PARTICIPANT INFORMATION SHEET

**Study Title:** Talk and Chalk: Two Approaches to Managing Feelings after Brain Injury **Ethics Application Number:** 2020-16812

**Principal Investigator:** Ms Jade Witten (Psychology PhD Student) **First Supervisor:** Prof Oliver Turnbull (Professor of Neuropsychology) **Second Supervisor:** Dr Rudi Coetzer (Clinical Academic)

#### Invitation

You are invited to take part in this research study about managing difficult feelings, such as irritation or frustration, after an acquired brain injury (ABI). This information sheet will help you understand why we are doing this research and how it would involve you. Please read this information sheet carefully before deciding whether to take part. You can take your time to read this information and talk to your family, friends, and Headway organization, before you make any decisions. The Principal Investigator, Ms Jade Witten, will go through the information with you and answer any questions you have.

#### What is the purpose of this study?

Research has shown that it is common for people with an ABI to have trouble managing difficult feelings. This study looks at whether two ways of managing feelings are helpful for managing irritation or frustration. We hope that findings from this study will provide clinicians and patients with practical ways of managing difficult feelings after an ABI.

#### Why have I been invited?

This study is available for people with an ABI, who are part of a UK Headway organization. We have invited you to take part because your local Headway branch said you may be interested.

#### Do I have to take part?

No. It is entirely up to you to decide if you want to take part. Before you decide, please read this information sheet carefully. If there is anything that is not clear and that you do not understand or would like more information on, please ask the Principal Investigator. If you decide not to take part now or at any other time during the study, **you do not need to give a reason**, and this will not affect your relationship with Headway.

PRIFYSGOL BANGOR BANGOR, GWYNEDD, LL57 2DG

FFÔN: +44(0)1248 351151

BANGOR UNIVERSITY BANGOR, GWYNEDD, LL57 2DG

TEL: +44(0)1248 351151

DR CAROLINE BOWMAN MA, PhD, SHEA PENNAETH DROS DRO YR YSGOL INTERIM HEAD OF SCHOOL EBOST/ EMAIL: c.bowman@bangor.ac.uk

www.bangor.ac.uk/cy/gwyddoraudynol-ymddygiadol Registered charity number: 1141565

www.bangor.ac.uk/humanbehavioural-sciences





#### What will I have to do if I decide to take part?

If you decide to take part in this research, the Principal Investigator will contact you to arrange a time that is convenient for you for the first meeting. There are **five meetings** over a period of about **four months**, lasting no longer than **60 minutes** each. There will be regular intervals during each meeting, where you can take a short break. All meetings are conducted over Skype, Teams, or Zoom. You will therefore need access to a computer, the internet, and one of these online platforms.

The aim of the **first two meetings** are to get to know you a little better. We will do this by asking you some questions about your medical history and background. We will also ask you to complete some questionnaires about your irritation or frustration, mood, and how you manage your feelings. To get an idea of how your thinking has been effected since your ABI, we will ask you to complete a few tasks that looks at things like your concentration and memory.

The aim of the **third meeting** is to show you two ways of managing irritation or frustration. We will do this by asking you to share some personal events from your past, where someone or something made you feel irritated or frustrated. We will also ask you to complete the same questionnaire about these feelings a few times. After this meeting, we will ask you to complete an activity at home, where you can practice what you learned.

The aim of the **last two meetings** is to get your feedback on the study. We will do this by asking you to complete a few questionnaires about your irritation or frustration and mood. We will also ask you some questions about how you found the meetings.

#### What if I miss a meeting?

If you miss a meeting, from a safety management perspective, we would like your permission to inform your Headway branch. You may also reschedule any meetings, by contacting the Principal Investigator.

#### Are there any benefits of taking part?

We will show you ways of managing difficult feelings. Although we cannot promise that these techniques will be helpful for you, you may find the process of taking part in the study enjoyable. You may also find it rewarding to take part in a study that aims to help people with ABI manage irritation or frustration. We hope that this research can add to the scientific literature, and help clinicians support people with ABI who struggle to manage these feelings.

#### What are the possible disadvantages of taking part?

You may experience some discomfort when thinking and talking about a personal experience that made you feel irritated or frustrated. You may also experience some discomfort when answering questions relating to these feelings and your mood. Though people usually do not find this very distressing, in the unlikely event that you experience substantial discomfort, you can choose to stop talking about the personal experience, or to stop answering the questions. You can also choose to stop the process all together without

PRIFYSGOL BANGOR BANGOR, GWYNEDD, LL57 2DG FFÔN: +44(0)1248 351151	BANGOR UNIVERSITY BANGOR, GWYNEDD, LL57 2DG TEL: +44(0)1248 351151	DR CAROLINE BOWMAN ма, PhD, SFHEA PENNAETH DROS DRO YR YSGOL INTERIM HEAD OF SCHOOL EBOST/ EMAIL: c.bowman@bangor.ac.uk
www.bangor.ac.uk/cy/gwyddorau- dynol-ymddygiadol	Registered charity number: 1141565	www.bangor.ac.uk/human- behavioural-sciences



explaining why. In the unlikely event that you do experience substantial discomfort, we would like your permission to inform your Headway branch, so they can ensure that you make contact with your General Practitioner.

#### Will my information be confidential?

Yes, any information collected about you during this study will be strictly confidential. We will identify any information about you through a study number, known only to the researchers. Your data will not be linked to your personal details, and cannot be traced back to you. This anonymized data will be kept and stored for 10 years in a secure electronic database or locked cabinet at Bangor University, after which it will be disposed of securely according to university policy.

If any of the data you provide throughout the study suggests that you are experiencing symptoms of emotional distress, we would like your permission to inform your Headway branch, so they can ensure that you make contact with your General Practitioner. If you say something that makes us think that you or someone else is in danger, we would have to share what you tell us with your Headway branch, for further discussion and possible action. This is unlikely, but we would let you know if we needed to do this.

#### What happens when the study stops?

The whole study is likely to finish in March 2023. If you would like, we can send you a summary of the findings when it is finished.

#### What if I do not want to take part or continue with the study?

Your participation is **voluntary** and you may withdraw at any time **without giving a reason**. You may also choose not to provide a response to questions you do not wish to answer. If you decide to withdraw from the study, any information that we have collected will be destroyed securely in line with university policy.

#### Who is funding the research?

This research is funded by The Oppenheimer Memorial Trust, The British Psychological Society, and Bangor University.

#### Important contact details

If you wish to make a complaint about the study, you can contact: Dr Huw Roberts Deputy College Manager for the College of Human Sciences Bangor University, Bangor, Gwynedd LL57 2AS E-mail: huw.roberts@bangor.ac.uk

PRIFYSGOL BANGOR BANGOR, GWYNEDD,

LL57 2DG

BANGOR UNIVERSITY BANGOR, GWYNEDD,

TEL: +44(0)1248 351151

LL57 2DG

DR CAROLINE BOWMAN MA, PhD, SFHEA PENNAETH DROS DRO YR YSGOL INTERIM HEAD OF SCHOOL EBOST/ EMAIL: c.bowman@bangor.ac.uk

FFÔN: +44(0)1248 351151

www.bangor.ac.uk/cy/gwyddoraudynol-ymddygiadol Registered charity number: 1141565

www.bangor.ac.uk/humanbehavioural-sciences





If you have any questions about this research, or you would like more information, you can contact:

Principal Investigator Ms Jade Witten Psychology PhD Student jade.witten@bangor.ac.uk

<u>First Supervisor</u> Prof Oliver Turnbull Professor of Neuropsychology o.turnbull@bangor.ac.uk Second Supervisor Dr Rudi Coetzer Clinical Academic b.r.coetzer@bangor.ac.uk

Version 3 Dated 29-07-2021

PRIFYSGOL BANGOR BANGOR, GWYNEDD, LL57 2DG BANGOR UNIVERSITY BANGOR, GWYNEDD, LL57 2DG

TEL: +44(0)1248 351151

DR CAROLINE BOWMAN MA, PhD, SFHEA PENNAETH DROS DRO YR YSGOL INTERIM HEAD OF SCHOOL EBOST/ EMAIL: c.bowman@bangor.ac.uk

FFÔN: +44(0)1248 351151

www.bangor.ac.uk/cy/gwyddoraudynol-ymddygiadol Registered charity number: 1141565

www.bangor.ac.uk/humanbehavioural-sciences





## PARTICIPANT CONSENT FORM

**Study Title:** Talk and Chalk: Two Approaches to Managing Feelings after Brain Injury **Ethics Application Number:** 2020-16812

Principal Investigator: Ms Jade Witten (jade.witten@bangor.ac.uk) First Supervisor: Prof Oliver Turnbull (o.turnbull@bangor.ac.uk) Second Supervisor: Dr Rudi Coetzer (b.r.coetzer@bangor.ac.uk)

By consenting to participate in this study remotely:

- 1. I confirm that I have read and understood the *Participant Information Sheet*. I have had the opportunity to consider the information and ask any questions, which have been answered satisfactorily.
- 2. I understand that all meetings will be conducted remotely, through a videoconferencing platform.
- 3. I understand that to protect my own privacy, I may need to choose a private location to participate in the meetings.
- 4. I understand that all study materials are subject to copyright and professional restriction. I will not physically or electronically copy, store, record, or distribute any of these study materials or my responses to them.
- 5. I understand that my participation is **voluntary**, and that I am free to withdraw at any time without giving a reason.
- 6. I understand that my data will be treated confidentially and any publication resulting from this study will report data that does **not** identify me.
- 7. I understand that if I disclose any information that may suggest I or someone else is in danger then this information will be shared with the relevant authority with my knowledge.
- 8. I consent to my local Headway branch being informed of my participation in this study.
- 9. I consent to my local Headway branch being informed if I miss a meeting.

<b>PRIFYSGOL BANGOR</b> BANGOR, GWYNEDD, LL57 2DG FFÔN: +44(0)1248 351151	BANGOR UNIVERSITY BANGOR, GWYNEDD, LL57 2DG TEL: +44(0)1248 351151	DR CAROLINE BOWMAN MA, PhD, SFHEA PENNAETH DROS DRO YR YSGOL INTERIM HEAD OF SCHOOL EBOST/ EMAIL: c.bowman@bangor.ac.uk
www.bangor.ac.uk/cy/gwyddorau- dynol-ymddygiadol	Registered charity number: 1141565	www.bangor.ac.uk/human- behavioural-sciences





- 10. I consent to my local Headway branch, or relevant authority being informed in the unlikely event that I experience emotional distress or an emergency during my participation in this study.
- 11. I have read and understood the information above, and I freely agree to participate in this study.

If you agree/consent to all of the statements above, please *reply* to this email with the following: I consent to take part in this study – ethics application number 2020-16812.

Version 3 Dated 29-07-2021

PRIFYSGOL BANGOR BANGOR,

GWYNEDD,

LL57 2DG

BANGOR UNIVERSITY BANGOR, GWYNEDD, LL57 2DG

TEL: +44(0)1248 351151

DR CAROLINE BOWMAN MA, PhD, SFHEA PENNAETH DROS DRO YR YSGOL INTERIM HEAD OF SCHOOL EBOST/ EMAIL: c.bowman@bangor.ac.uk

www.bangor.ac.uk/humanbehavioural-sciences



FFÔN: +44(0)1248 351151

www.bangor.ac.uk/cy/gwyddoraudynol-ymddygiadol Registered charity number: 1141565

**Appendix E**: Example of the Talk and Chalk homework diary. Participants were encouraged to use this after the intervention session (T2) and until the three-month follow-up (Post-T2)



Appendix F: Post-treatment interview protocol

## Talk and Chalk: Post-Treatment Interview

Just a few questions to hear your thoughts about the study. I'd like to hear your honest opinion of what you feel was and was not useful. This could help us make the study better. A reminder that we looked at two strategies to manage anger: **talk**, where you spoke about the positive sides of a bad situation, and **chalk**, where you drew a picture of a happy memory.

## **Acceptability**

- 1. If you think back to when you saw the study flyer from Headway, what made you want to take part?
  - a. What difficulties with anger did you experience before the study?
  - b. Did your anger change during the study? How?
- 2. Which strategy was the **most** helpful? Why?
  - a. On a scale of **0** (not at all) to **10** (extremely), how **useful** was this strategy?
- **3.** Which strategy was **less** helpful to you? Why?
  - a. On a scale of **0** to **10**, how **useful** was this strategy?
- 4. How could we make the meetings better (prompt treatment session)?a. What should we include in future?

## **Appropriateness**

- 5. How much do you feel the meetings focused on areas that were useful?a. Rating on a scale of 0 to 10?
- 6. Would you recommend this to other people with brain injury? Why/why not?a. Rating on a scale of 0 (not at all) to 10 (definitely)?

## **Feasibility**

- 7. How do you feel about the length of the study (i.e., 5 meetings)?
- 8. Tell me about any difficulties you experienced attending the meetings?a. What made it easier for you to attend the meetings?
- 9. How did you find doing it online?
  - a. On a scale of **0** (not at all) to **10** (extremely), how **familiar** are you with using Zoom?
    - i. Before this study, how **often** did you use Zoom (i.e., how many times a week)?

b. Would you have preferred **in-person** meetings? Why or why not? (i.e., pros and cons of in-person versus online)

## Anger Diary

**10.** Tell me about your **experience** using the diary

- a. What did you find **useful** about the diary?
  - i. On a scale of **0** to **10**, how **useful** was the diary for managing anger **daily**?
- b. What are some of the **difficulties** or **obstacles** you experienced with the diary?
  - i. Tell me about any **difficulties** with using the strategies **outside** of the meetings?
  - ii. What made it **easier** to use the strategies **outside** of the meetings?

Thank you for your time and for sharing your insights. We hope to use this information to improve the study.