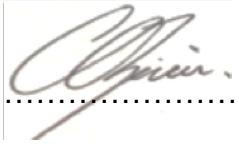
Psychological therapies for depression following acquired brain injury: An evaluation of existing evidence in adults and a novel intervention for adolescents

Submitted by Conor O'Brien to the University of Exeter
as a thesis for the degree of Doctor of Clinical Psychology, 25th May 2021

I certify that all material in this thesis which is not my own work has been identified and that no material has previously been submitted and approved for the award of a degree by this or any other University.

Signature: ……  ……..

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LITERATURE REVIEW

‘Evidence-based’ psychological therapies for depression in adults with acquired brain injury: A systematic review

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Abstract

Background: Depression following acquired brain injury (ABI) in adults is common. Psychological therapies are important for treating depression following ABI and improve overall rehabilitation gains. Previous reviews have investigated the literature on psychological therapies for depression following ABI. However, many of these therapies included in the review are not available in the UK's NHS, nor considered 'evidence-based' by NICE guidance.

Method: Studies conducted since NICE guidance for depression was released in October 2009 investigating 'evidence-based' psychological therapies for depression in a sample of adults with ABI were included in the review. A total 1,533 studies were screened, leading to the identification of five eligible studies for review.

Results: Four studies investigated cognitive behavioural therapy (CBT); two one-to-one CBT studies and two CBT group studies using the Window to Hope protocol. One study investigated behavioural activation (BA). Results were mixed; though, studies reporting non-significant results were methodologically less robust and of lower quality. Two CBT studies and the BA study showed promising results, with reliable change in depression scores at post-treatment compared to baseline. Effect sizes for significant studies were 'medium' to 'large', and were 'very small' and 'small' for non-significant studies.

Discussion: The findings suggest that 'evidence-based' therapies for depression in adults with ABI could be effective. However, more high-quality research with robust methodology is needed to reach more substantial conclusions. Suggestions for future research, including investigating other 'evidence-based' therapies, like behavioural couples' therapy and interpersonal therapy, are discussed.

Keywords: acquired brain injury, adults, depression, NICE guidance

Introduction

Acquired brain injury (ABI) is a term used to describe the outcome of a number of different incidents that adversely impact the brain, including traumatic brain injury (TBI), stroke, brain tumour, encephalitis and other pathologies. The most common causes of ABI in adults and children are TBI and stroke (Menon & Bryant, 2019). Between 2016-17, Headway (2018) reported 348,453 admissions to UK hospitals following ABI; 531 admissions per 100,000 people in the UK. This number has risen by 10% since 2005-06 (Headway, 2018).

ABI survivors are likely to experience prolonged or even lifelong behavioural, physical, emotional, cognitive and communication impairments compared with the typical population, which can lead to a reduction in quality of life (QoL; Nestvold & Stavem, 2009). However, QoL is moderated by sociodemographic and injury-related factors, such as time since injury, degree of dependence and inactivity or unemployment prior to the injury (Verdugo et al., 2019).

Depression Following Acquired Brain Injury

Depression

In the Diagnostic and Statistical Manual of Mental Disorders (DSM-V; American Psychiatric Association, 2013), there are several ‘depressive disorders’, including ‘major depressive disorder’ (MDD), ‘persistent depressive disorder’, and ‘disruptive mood dysregulation disorder’, amongst others (American Psychiatric Association, 2013). Generally, ‘depression’ can be used as a diagnostic term that encapsulates the experience of low mood, a loss of interest or pleasure in usual activities, and a sense of worthlessness (National Health Service, 2021).

In the UK, it is estimated that 3 in 100 people experience depression at any one time (McManus et al., 2016), with 24% of women and 13% of men receiving a

depressive diagnosis in their lifetime (Craig et al., 2014). Prevalence rates of depression have been exacerbated by the emergence of the COVID-19 pandemic due to increased fears regarding health, reduced activity due to social restrictions, and reduced contact with family and friends (Shevlin et al., 2020).

Prevalence of Depression After Acquired Brain Injury

Most research into depression following ABI focuses on TBI and stroke. Compared with the general population, ABI survivors are at increased risk of experiencing emotional difficulties (Osborn et al., 2014). One study reports that 20-40% of TBI patients experienced signs of depression a year after their injury (Fleminger et al., 2003), whilst another reported a prevalence of 15.8% at a one-year follow-up (Koponen et al., 2011). Similarly, studies on stroke survivors have shown prevalence rates of around 33% (Hackett et al., 2005; Mitchell et al., 2017). Depression is particularly more prevalent in non-TBI ABI populations compared with the TBI population (Colantonio et al., 2011). Reported prevalence rates vary as they are often subject to differences in screening procedures; however, depression after ABI is evidently common.

Causes of Depression After Acquired Brain Injury

ABI survivors are at risk of experiencing depression due to a mixture of neurological and psychosocial changes following injury. Neurological changes, including lesions and other damage to neuronal pathways, can result in difficulties with initiating activities, apathy, and emotional processing (Fayed et al., 2019). Research also suggests that damage or inflammation to the hypothalamic-pituitary-adrenal (HPA) axis, a common complication following ABI, can result in an increased risk of experiencing depressive symptoms due to neurological changes and cascade effects, such as a reduced capacity to respond well to stress (Tapp et al., 2019).

Psychosocial changes, such as adjusting to cognitive and physical changes after brain injury, as well as the social and psychological stressors they present, can also make ABI survivors more vulnerable to depression (Farner et al., 2010). A lower QoL and reduced participation can perpetuate the cycle of depression, meaning that depression after ABI is not just more likely, but also more pervasive (Nestvold & Stavem, 2009).

Psychological Therapies for Depression Following Acquired Brain Injury

Psychological therapy is widely regarded as important in neurorehabilitation settings, as it aids in addressing emotional, social and cognitive difficulties following ABI (Dams-O'Connor & Gordon, 2010). However, emotional difficulties can often go unnoticed when there is a greater emphasis on physical rehabilitation (Gómez-de-Regil et al., 2019), leading to less optimal results in rehabilitation processes. In particular, untreated depression in ABI survivors can result in poorer global rehabilitation outcomes compared with those who receive psychological therapy (Lewis & Horn, 2017).

Previous investigations have demonstrated that psychological therapies for treating depression in individuals with ABI have shown promising results (Stalder-Lüthy et al., 2013). Cognitive behavioural therapy (CBT) has been cited as the most commonly used approach for depression following TBI (Gómez-de-Regil et al., 2019). However, the literature for psychological therapies to treat depression in other ABIs is varied, with attempts involving different psychological approaches and the use of a wide range of screening procedures. Furthermore, whilst psychological therapies for depression are readily available in the UK's NHS in primary care, adults with ABI are often rejected by these on the basis of their ABI, despite the existence of primary care models for stroke (Gillham & Clark, 2011).

Krasny-Pacini et al. (2014) suggest a minimum time of six months of recovery following ABI before engaging in psychological work, allowing for the ABI survivor to adjust to ABI sequelae. They also suggest that older ABI survivors may take longer to recover and may experience more pervasive sequalae, meaning age can be a confounding factor in some research into psychological therapies for ABI. This is particularly important given older adults (aged >65 years) are also at increased risk of stroke (Yousufuddin & Young, 2019).

'Evidence-based' Psychological Therapies for Depression

'Evidence-based' psychological therapies are those that are recommended by the National Institute of Clinical and Health Excellence (NICE) in the UK. These are usually condition-specific and are based on empirical evidence. NICE (2009a) has outlined recommendations for the treatment of depression in the general population, which is implemented in the NHS. These NICE recommendations are based on a stepped-care approach where low-intensity interventions are offered first, and high-intensity interventions are offered to those who might need further support following low-intensity work. In some circumstances, high-intensity interventions will be offered as a first step for individuals with severe depression.

Low-intensity interventions as outlined by NICE guidance (2009a) are based on guided self-help, which includes behavioural activation (BA) and problem-solving; however, this does not encompass problem-solving therapy (PST), which is an altogether separate intervention for psychological distress (Pierce, 2012). Low-intensity interventions can be delivered individually, in groups, or using computerised methods. High-intensity interventions outlined by NICE (2009a) are CBT, interpersonal therapy (IPT), more extended BA, and behavioural couples' therapy (BCT). Again, these can be delivered individually, in groups or using computerised

methods. All of these methods may be delivered with or without the supplementation of antidepressant medication. The interventions outlined for depression as a result of long-term physical health conditions are very similar (NICE, 2009b).

Rationale for Review

Psychological therapies are important for neurorehabilitation, as they address the emotional and psychological difficulties presented as a result of neurological and psychosocial impairment following ABI (Dams-O'Connor & Gordon, 2010). However, the most recent literature review into psychological therapies for depression in ABI (Stalder-Lüthy et al., 2013) has investigated a range of psychological therapies, including those that do not feature in NICE (2009a) guidance, nor are they typically available NHS services. It has also been eight years since this review was performed, meaning newer studies are available for review. A much more recent review by Gomez-de-Regil et al. (2019) investigates psychological therapies for TBI only, and also does not focus on 'evidence-based' therapies.

Investigating evidence-based psychological therapies for depression provides a more robust overview of the efficacy of depression treatment following ABI, as these interventions are more replicable, controlled and manualised. As they are readily available on the NHS, this also provides a chance to consider whether individuals with ABI could access generic mental health services with fewer limitations or whether NICE guidance (2009a) should be reviewed accordingly to acknowledge the need for different types of therapy for ABI survivors.

Review Question

Do NICE-recommended 'evidence-based' psychological therapies for the treatment of depression in adults with ABI result in a reduction in symptoms of depression?

Method

Eligibility Criteria

Characteristics of the studies are based on the PICO (population, intervention, comparison and outcome) criteria as displayed in Table 1. Eligible study designs for review include: (1) randomised controlled trials, (2) intervention control comparison studies, and (3) single-case experimental design studies.

Table 1

Inclusion and exclusion criteria for systematic literature review eligibility.

Criteria	Inclusion	Exclusion
Population	Adults aged 18-65 years Any acquired brain injury Mean time since injury > 6 months	Children or adolescents < 18 Older adults > 65 No acquired brain injury Mean time since injury < 6 months
Intervention	Evidence-based psychological therapy according to NICE guidance Intervention contains techniques focused on depression	Psychological therapies not outlined in NICE guidance Intervention does not contain techniques focused on depression
Comparison	Control group with no intervention or other intervention Baseline (for single-case design)	No comparison
Outcome	Questionnaire evaluating symptoms of depression	No questionnaire evaluating symptoms of depression

Search Strategy

Publications were searched using MEDLINE, PsycINFO, Embase, and CINAHL, with a published date range of between October 2009 (when NICE guidance was released) and April 2021 (date of search). Supplementary searches on

the citation indexes, Web of Science and Scopus, were also performed. Reference lists of included studies were checked for relevant papers, which were reviewed using inclusion criteria. Grey literature was considered but inaccessible due to limited resources, and was therefore not searched.

Search Terminology

There were three main search criteria to consider in the search terminology: (1) psychological therapies, (2) depression, and (3) acquired brain injury. Table 2 outlines the search terminology for each of these concepts. Search strings were adjusted according to each database's Boolean operator procedure. Words in each search criteria were separated with the word "OR", whilst each search criteria was separated with the word "AND". As some articles reporting psychological therapies do not explicitly name the intervention in the title or abstract, the search terms were conducted in 'all fields'.

Table 2

Search terms for the systematic literature review.

Psychological therapy	Depression	Acquired brain injury
"Psychotherap*"	"Depress*"	"Brain injur*"
"Cognitive behavio?ral therapy"	"Low mood"	"Acquired brain injur*"
"Cognitive behavio?r therapy"	"Mood disorder"	"Traumatic brain injur*"
"Interpersonal therapy"		"Brain damage*"
"Behavio?ral activation"		"Head injur*"
"Behavio?ral couples therapy"		"Stroke"
"BA"		"Brain tumo?r"
"CBT"		"Hypoxi*"
"IPT"		"Encephal*"
"BCT"		"Meningit*"
		"Central nervous system infection"
		"CNS infection"
		"ABI"
		"TBI"

Screening Procedures and Inclusion Criteria

Studies reporting the effects on depression of a combination of psychological therapies and medication for depression were included. Studies with participants with all severities of ABI were included. For feasibility purposes, international research was included as long as they were reported in English. Studies that were 'abstract only' or were not fully published in a peer-reviewed journal were excluded.

Studies were screened using the following inclusion criteria: (a) the intervention focused on psychological distress, (b) routine outcome measures for depression were used, (c) the mean time since injury for the sample was over 6 months, (d) the intervention provided is in NICE (2009a) guidance for depression treatment, (e) participants were aged between 18-65 years when treatment was provided, (f) the study design is a randomised-controlled trial, a control comparison trial, or a single case design, and (g) the article was published in a peer-reviewed journal.

Six of the 61 articles in the full-text phase were randomly selected for blind rating by another researcher using the PICOS criteria. Disagreements were conferred and clarified, leading to 100% inter-rater reliability for inclusion and exclusion.

Evaluation Criteria

To evaluate quality, manage the risk of bias and assess the validity of records deemed eligible, the Consolidated Standards of Reporting Trials (CONSORT), as adjusted by Ross et al. (2011) and Krasny-Pacini et al. (2014) were used as appraisal criteria, as they indicate ABI-specific considerations. The strength of the studies using these criteria will be discussed. The appraisal criteria are outlined in Figure 1.

Once the scores had been totalled, the percentage of criteria met was compared against Ross et al. (2011) and Krasny-Pacini et al.'s (2014) thresholds of quality; articles meeting 50% or lower were regarded as "lower" quality, articles meeting 50-74% were deemed to be of "moderate" quality, and those meeting above 75% were considered to be of "high" quality. "High" quality papers are less likely to be at risk of bias (Moher et al., 2009).

Three of the total five articles included in the full review phase were selected at random for blind rating using the modified CONSORT appraisal criteria, including two group designs and one single-case design. Inter-rater reliability was calculated at 98.8%.

Planned Method of Analysis

The primary outcome of the reviewed studies was the mean difference in reported depression symptoms between the intervention and control groups at the post-treatment phase of the study, adjusted for baseline differences. Effect sizes (ESs) are reported as calculated by the original authors. If ES was not calculated by the author, the current reviewer used Hedge's *g* (Hedges & Vevea, 1998) to calculate ESs based on reported data. Hedge's *g* is gauged with thresholds for 'very small' ($g < 0.2$), 'small' ($0.2 < g < 0.5$), 'medium' ($0.5 < g < 0.8$) and 'large' ($g > 0.8$) effects, as outlined by Cohen (1988) and expanded on by Sawilowsky (2009). Hedge's *g* has been used for previous systematic reviews on depression in the general population (Newby et al., 2015) and in ABI rehabilitation (Krasny-Pacini et al., 2014; Mahan et al., 2017), making it an appropriate measure for this review. Changes in depression scores from pre-treatment to post-treatment for the intervention group are also discussed.

Score 1 if criteria met, 0 if not met or unable to determine:

(1) Were specific hypotheses and/or objectives stated?
(2) Were the settings and locations where data was collected stated?
(3) Is the method of randomization appropriate?
(4) Was the total sample size >20 participants?
(5) Was the total sample size >40 participants?
(6) Were at least some of the measures standardised assessment tools?
(7) Were the measures appropriate for age group?
(8) Did the article specify the severity of the brain injury for participants with acquired brain injury and was the method of diagnosis appropriate (e.g. by a medical professional, Glasgow Coma Scale)?
(9) Did the injury occur at least 6 months ago (to ensure the results were not a reflection of the recovery process)?
(10) Were follow-up data collected after post-intervention data (i.e. to see if effects were maintained post intervention)?
(11) If not, was intent-to-treat analysis used? (Award 1 point if a point is granted on the above item).
(12) Were those assessing the outcomes blind to the group?
(13) Was the intervention described in detail (i.e. how it was administered, etc.) or was there reference to a manual?
(14) Were the characteristics of participants clearly described (e.g. demographic information such as age, sex)?
(15) Did the results relate to the initial hypotheses?
(16) Was statistical analysis appropriate?
(17) Were data adequately described (mean, range etc.)?
(18) Were effect sizes calculated?
(19) Were effect sizes moderate or better (for studies with small sample sizes n<10)?
(20) Was there sufficient information to calculate effect size (i.e. mean and SD)?
(21) Was age taken into account as a possible confounding factor?

Applicable to group comparison studies only:

(22) Was a power calculation used or sample size justified?
(23) Were inclusion/exclusion criteria clearly stated?
(24) Control or comparison group used?
(25) Were participants randomly allocated to groups?
(26) Were all participants included in the analysis?
(27) Was intention-to-treat analysis used if randomised? (0 for non-randomised)

Applicable to single case studies only:

(22) Was there a clearly defined target behaviour that reflected the cognitive function the intervention aimed at improving?
(23) Were sufficient baseline assessments conducted to ensure stability prior to intervention?
(24) Was there sufficient sampling during intervention to differentiate a treatment response from fluctuations in behaviour that may have occurred at baseline?
(25) Was replication performed? (Study on two patients at least)
(26) Was inter-rater reliability of the target behaviour used in baseline and intervention assessed?
(27) Did the design allow examination of cause and effect?

Total quality rating: ___/27

Figure 1. Modified CONSORT tool as per Ross et al. (2011) and Krasny-Pacini et al.'s (2014) proposed criteria.

Results

Study Selection

The primary author conducted screening for eligible records. After removing duplicate articles, the search yielded 1,145 studies. The studies were firstly reviewed by their title and abstract using the inclusion criteria. Following a review of titles and abstracts, 1,084 studies were removed, leaving 61 items for full-text review. A total 56 studies were excluded after full-text review as they did not meet inclusion criteria. The most common reasons were that participants did not meet the age range criteria and the investigated intervention was not 'evidence-based'. A flow diagram representing the systematic review process is shown in Figure 2. A summary of each study included in the literature review is outlined in Table 3.

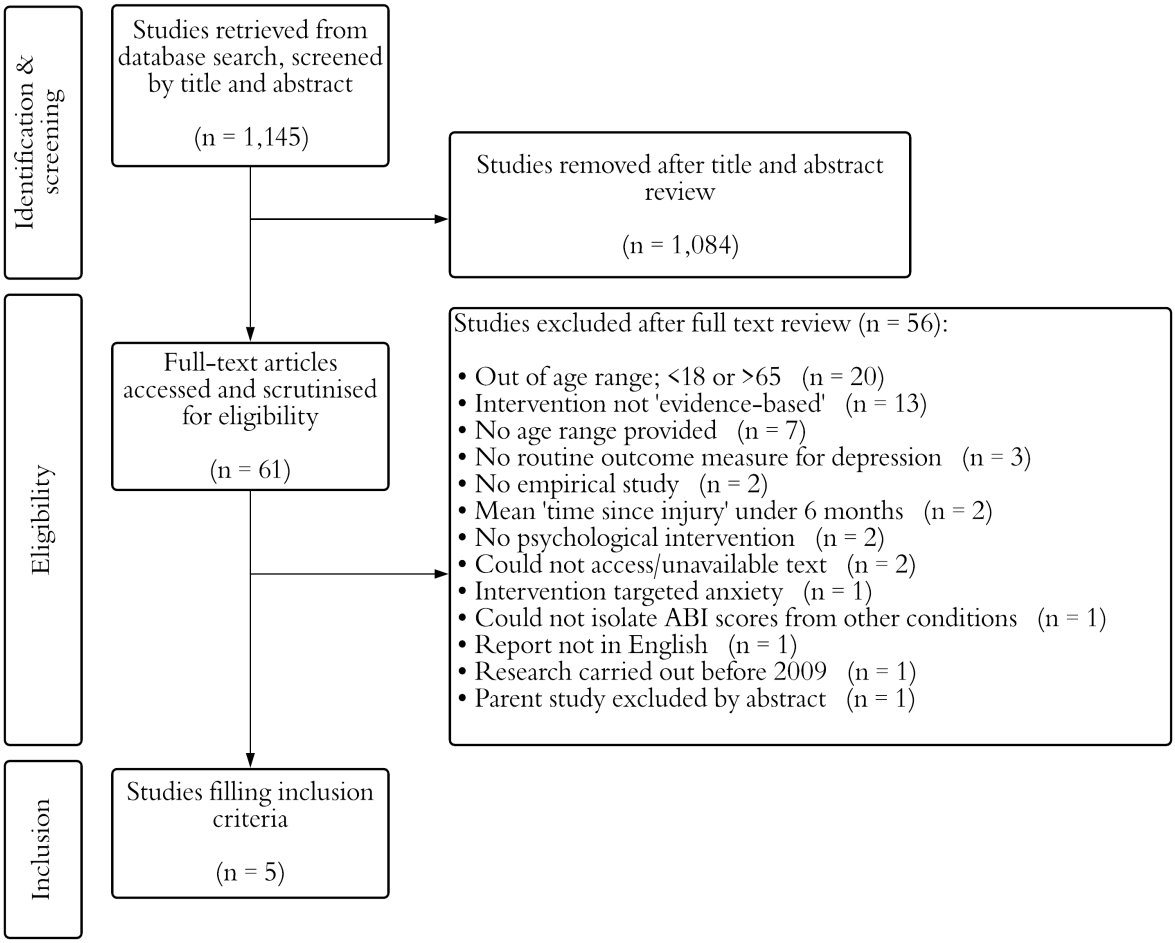

Figure 2. PRISMA flow diagram representing the identification, screening and inclusion process of articles for review.

Table 3

Summary of studies that met review inclusion criteria.

Study author/ country/ number	Quality rating (%)	Study design	Sample				Intervention/format/ no. of sessions and duration/length of intervention/clinician/ adjustments for ABI	Effect size/ 95% CI	Main strengths/ weaknesses	Main findings pertinent to depression outcomes
			No. of ppts.	Mean age of ppts. (years)	Mean time since injury (years)	Primary diagnosis/ severity/target problem/outcome measure				
Ashman et al. (2014) USA 1	High (81.5%)	RCT	IG = 22 CG = 21	IG = 47.5 CG = 48.1	IG = 7.8 CG = 13.2	TBI 'Mild' to 'severe' 'Depression' BDI-II	CBT vs SPT Individual 16 50-min sessions 12 weeks 'Fellows in clinical neuropsychology and rehabilitation psychology' Adjustments for memory and organisation	Author's calculation for CBT vs SPT: 'Large' $\eta^2 = 0.17$	Good quality control of interventions and highly trained therapists. Within-group variability of severity and time since injury was large. Some violations of treatment protocol reported; though, not large differences between groups.	Ppts. receiving CBT and SPT demonstrated significant improvements in depressive outcomes. After treatment, 35% of participants in the CBT group no longer met criteria for 'depression', compared with 17% of SPT group. Difference in 'recovery' rates between groups were not statistically significant.
Brenner et al. (2018) USA 2	High (88.9%)	RCT	IG = 15 CG = 20	IG = 47.7 CG = 54.6	No mean reported, but all cases > 1 year	TBI 'Moderate' to 'severe' 'Hopelessness' BDI-II	CBT vs WLC Group 10 2-hour sessions 10 weeks 'Therapist' Adjustments for fatigue, pace, and concentration	Reviewer's calculation for CBT vs WLC: 'Medium' $g = 0.55$	All participants at least 1 year post-injury. Sample injury characteristics were relatively less heterogeneous. Main target problem was 'hopelessness' meaning variability in baseline 'depression' scores.	BDI-II scores significantly improved for those who received the CBT-based intervention. BDI-II scores improved by 8.7 points more in the CBT group compared with control. 'Hopelessness' scores improved significantly in the CBT-based group.

Gertler & Tate (2019) Australia 3	Moderate (66.6%)	SCED	3	32.6	9.4	ABI 'Mild TBI', 'Extremely severe TBI' and 'series of strokes' 'Depression' DASS-21 Depression	BA Individual 10 30-90 min sessions 10-14 weeks 'Therapist' Adjustments not reported	Reviewer's calculation for pre-post: 'Large' g = 0.80	Participants showed either exact similarities or very distant differences in demographic characteristics, meaning results are not representative. Lack of follow-up meant that maintenance of behaviour could not be investigated. Some reporting of procedures (e.g. randomisation) missing.	Positive effects in measures of depression were found between baseline and treatment end, with two participants showing reliable change. Authors suggest extended treatment contact to improve results.
Potter et al. (2016) UK 4	High (92.6%)	RCT	IG = 25 CG = 20	IG = 40.1 CG = 43.1	IG = 3.5 CG = 2.8	TBI 'Mild' to 'moderate' 'PCS symptoms' HADS-D	CBT vs WLC Individual 12 1-hour sessions 12 weeks Clinical neuropsychologist No adjustments made	Author's calculations for CBT vs WLC: 'Small' *Partial* η^2 = 0.021 'Small' g = 0.28	Non-significance could be due to floor effects as <50% of individuals scored above the clinical threshold on the HADS-D at baseline. Individualised treatment, which was less manualised, means deviance from typical CBT procedures may have affected results. Variation in time taken to complete CBT treatment.	No significant improvement in HADS-D scores for the CBT-based condition. No difference in depression outcomes across CBT and WLC groups. Improvement in QoL for the CBT group.

Simpson et al. (2011) Australia 5	Moderate (74.1%)	RCT	IG = 8 CG = 9	IG = 39.4 CG = 44.1	IG = 6.3 CG = 7.6	TBI Not stated 'Hopelessness' HADS-D	CBT vs WLC Group 10 2-hour sessions 10 weeks 'Therapist' Adjustments for fatigue, pace, and concentration	Reviewer's calculation for CBT vs WLC: 'Very small' *g* = -0.16	Completion of the questionnaires by the therapist whilst with the patient could have contributed to response bias. Small sample makes results less generalisable and could reduce power and validity of results.	No significant changes in HADS-D scores between time points for the CBT group. No difference in post-treatment depression scores between CBT and WLC. 'Hopelessness' scores improved significantly in CBT group.

Note. In-text references to study numbers relate to the numbers in the first column of the table.
Study design: RCT = randomised controlled trial; SCED = single-case experimental design; Sample: ppts. = participants; IG = intervention group; CG = control group; Primary diagnosis: TBI = traumatic brain injury; ABI = acquired brain injury; Target problem: PCS = post-concussional syndrome; Outcome measure: BDI-II = Beck Depression Inventory II; HADS-D = Hospital Anxiety and Depression Scale Depression Subscale; DASS-21 = Depression, Anxiety and Stress Scale; Intervention: CBT = cognitive behavioural therapy; SPT = supportive psychotherapy; WLC = wait-list control; TAU = 'treatment as usual'; BA = behavioural activation; Effect size: CI = confidence interval; *g* = Hedge's g; *Partial* η^2 = partial eta squared; Main findings: QoL = quality of life.

Study Characteristics

The main characteristics and findings of the studies are given. All studies were performed in Westernised, 'developed' countries. Two studies (1 and 2) were undertaken in the USA, two studies (3 and 5) in Australia, and one study (4) in the UK. Four studies (1, 2, 4 and 5) were randomised controlled trials (RCTs) that investigated a CBT-based intervention, whilst study 3 investigated BA in a single-case experimental design (SCED). Three of the RCT studies (2, 4 and 5) compared CBT to wait-list controls (WLC). Study 1 compared CBT to supportive psychotherapy (SPT). Three studies (1, 2 and 4) achieved 'high' quality ratings according to Ross et al. (2011) and Krasny-Pacini's (2014) rating criteria based on CONSORT; two studies (3 and 5) achieved 'moderate' ratings. Two studies (1 and 3) showed 'large' ESs, whilst study 2 showed a 'medium' ES, study 4 showed 'small' ESs, and study 5 showed a 'very small' ES.

Nature of Participant Injuries

Out of the five studies, four of them (1, 2, 4 and 5) only recruited participants who had experienced TBI; out of study 3's three participants, two had experienced TBI and one had experienced a series of strokes at the age of 1 year. It is of note, then, that the current study provides more of an insight into outcomes of 'evidence-based' therapies for TBI survivors rather than ABI survivors as a whole. Furthermore, the characteristics of the studies' participants are consistent with TBI being one of the most common causes of ABI (Menon & Bryant, 2019).

A total three studies (2, 3 and 4) explicitly outlined that all participants received psychological treatment at least six months following injury. Of these studies, at post-treatment, study 2 demonstrated significant change in depression scores, study 3 reported reliable change and study 4 reported no significant change

compared to baseline. Two studies (1 and 5) did not outline that participants received psychological treatment more than six months following injury but the mean time since injury for each study was over six months. The higher quality study of the two (study 1) reported significant results, whereas study 5 (moderate quality) did not.

Outcome Measures

All five studies used self-reported measures in evaluating the severity of symptoms of depression. Whilst it is suggested that self-report and clinician-reported outcome measures can be used within clinical trials, there are differences in outcome sensitivity and each type of measure should be used dependent on what is being investigated (Cuijpers et al., 2010). However, some argue that there is little difference between self-report and clinician-reported measures (Uher et al., 2012). Typically, self-report questionnaires are used more frequently in psychotherapy-based studies, whilst clinician-reported questionnaires are used in more pharmacological-based studies (Uher et al., 2012).

Two studies (1 and 2) used the Beck Depression Inventory II (BDI-II; Beck et al., 1996), two studies (4 and 5) used the Hospital Anxiety and Depression Scale Depression Subscale (HADS-D; Zigmond & Snaith, 1983), and one study (3) used the Depression, Anxiety and Stress Scale (DASS-21; Lovibond & Lovibond, 1995). Every study's depression outcome measure has achieved at least 'good' to 'excellent' internal consistency ($.82 \leq \alpha \leq .88$) when tested in ABI populations. The BDI-II, used in studies 1 and 2, and the HADS-D, used in studies 4 and 5, both achieved 'excellent' internal consistency ($\alpha \geq .9$). The DASS-21, used in study 3, achieved 'good' internal consistency. The psychometric properties for each outcome measure are outlined in Table 4.

Table 4

Summary of routine outcome measures used in reviewed studies, their psychometrics in a typical population, and the internal consistency score when used with a population with ABI.

Routine measure	Author(s)	Used in study	Type of questionnaire/no. of items	Internal consistency[a]	Test-retest reliability[b]	Internal consistency for ABI[a]
Beck Depression Inventory (2nd ed.) (BDI-II)	Beck et al. (1996)	1 2	Self-report 21	α = .91 – .93 (Beck et al., 1996)	*r* = .93 (Beck et al., 1996)	α = .92 (Green et al., 2001)
Depression, Anxiety and Stress Scale (DASS-21)	Lovibond & Lovibond (1995)	3	Self-report 21	α = .88 (Ownsworth et al., 2008)	*r* = .78 (Ownsworth et al., 2008)	α = .82 – .90 (Randall et al., 2017)
Hospital Anxiety and Depression Scale – Depression Subscale (HADS-D)	Zigmond & Snaith (1983)	4 5	Self-report 7	α = .90 (Moorey et al., 1991)	*r* = .92 (Zigmond & Snaith, 1983)	α = .88 (Whelan-Goodinson et al., 2009)

[a] Cronbach's alpha (α)
[b] Intraclass correlation coefficient (*r*)

Some depression questionnaires include symptoms of ‘depression’ that might overlap with ABI sequalae (Dyer et al., 2016). However, all the questionnaires in the reviewed studies have been tested for internal consistency in the ABI population, and have still shown slightly lower but satisfactory results. Therefore, it can be considered that all studies have used appropriate questionnaires to measure depression symptoms.

Effect Sizes

All ES calculations were performed on group differences post-treatment when adjusted for baseline differences. Only studies 1 and 4 provided their own ES calculations. Study 1 used ‘eta squared’ as their ES measure, resulting in a ‘large’ ES ($\eta^2 > 0.14$; Fisher, 1928). Study 4 reported a ‘small’ ES using ‘partial eta squared’ ($0.06 >$ partial $\eta^2 > 0.01$; Fisher, 1928) and a ‘small’ ES using Hedge’s *g.* Studies 2, 3 and 5 did not report ESs. Therefore, Hedge’s *g* calculations were performed by the reviewer (Cohen, 1988; Sawilowsky, 2009).

Study 1 showed no significant differences between post-treatment CBT and SPT group depression scores, despite its ‘large’ ES. Study 2 showed a significant difference in post-treatment CBT and WLC scores with a ‘medium’ effect. Despite no significance between groups in study 1, both study 1 and study 2 showed a significant difference between pre- and post-treatment depression scores in the intervention arm. Both of these studies demonstrated ‘high’ quality ratings.

The other two group studies (4 and 5) did not demonstrate significant differences in outcomes from pre- to post-treatment in the CBT group, nor were there differences between CBT and WLC group scores post-treatment. Studies 4 and 5 demonstrated ‘small’ and ‘very small’ ESs respectively. It is important to note that, whilst of ‘high’ quality, study 4 was prone to ‘floor effects’ for its depression

outcomes, as less than 50% of participants showed clinically significant depression scores at baseline. Study 5 achieved a ‘moderate’ quality rating, had a small sample size, and was prone to response bias. It is notable that both of these non-significant studies with ‘very small’ and ‘small’ ESs demonstrated these methodological weaknesses, which may have compromised their results and ESs. This is considered further in the discussion of this review.

Two out of three participants in study 3 demonstrated ‘reliable change’ for depression scores from baseline to post-treatment, with an overall ‘large’ effect across all participants.

Cognitive Behavioural Therapy

Studies 1, 2, 4 and 5 investigated CBT for several presenting difficulties, including ‘depression’, ‘hopelessness’ and ‘post-concussion syndrome’ (PCS), following ABI. Study 4 investigated PCS, which include ‘anxiety disorders’ and ‘post-traumatic stress disorder’. All four studies used important aspects of CBT treatment for depression, discussed below. Study 1, using individualised CBT, and study 2, using group CBT, showed significant pre- to post-treatment results, whilst only study 2 demonstrated significant post-treatment differences compared with a control group.

Individual CBT

Two studies using CBT (1 and 4) delivered the intervention on a one-to-one, face-to-face basis. Treatment protocols differed across studies 1 and 4, with different session lengths (study 1: 50 mins vs. study 4: 60 mins) and number of sessions (study 1: 16 sessions vs. study 4: 12 sessions).

Both studies referred to their treatment protocols and included basic CBT principles. Study 1 implemented adjustments to address ABI sequalae impairments, including embedding compensatory strategies, such as memory supports and

organisational strategies. Study 4 did not make any adjustments specifically for ABI but used a ‘formulation-driven’ approach. Only study 1 targeted depression as the main ‘problem’ for treatment direction. Study 4 targeted PCS, which encompasses depression, anxiety and post-traumatic stress disorder.

Both studies reported the use of CBT socialisation and psychoeducation, brief principles of BA, cognitive restructuring, problem-solving, relapse prevention and goal orientation; these would all be used in CBT for depression. However, study 4 reported that as CBT was delivered to fit the individual and was less manualised, outcomes may have been affected. Alongside the lack of ABI-specific adjustments, there might be further reasons why study 4 showed no significant difference in pre-post scores, whilst study 1 did.

Group CBT

Two studies (2 and 5) delivered CBT in face-to-face groups. Both studies used the ‘Window to Hope’ (WtoH) protocol, which focuses mainly on hopelessness but uses principles of CBT for depression, including socialisation to CBT, brief principles of BA, cognitive restructuring, problem-solving, relapse prevention and goal orientation. Both studies delivered 10 2-hour sessions over the space of 10 weeks. As typical in the WtoH protocol, both studies automatically included adjustments to specifically accommodate for ABI sequalae, including implementing 15-minute breaks in sessions and putting participants in smaller groups.

In study 2, all participants met criteria for ‘depression’ before receiving treatment. Study 5 did not report the percentage of participants who met ‘depression’ criteria. As the two studies showed differing results (study 2: significant effects of treatment on depression vs. study 5: no significant effects of treatment on depression), it is inconclusive whether the WtoH protocol is effective in treating

depression following ABI. Notable differences in the quality of the studies (study 2: high vs. study 5: moderate) and their sample sizes (study 2: n = 35 vs. study 5: n = 17) might have been responsible for differences. No other methodological differences between studies were observed, except for ROMs, which both show high internal consistency for ABI.

Behavioural Activation

Study 3 investigated BA for depression following ABI using a SCED methodology with three participants. Treatment was delivered in a one-to-one, face-to-face format over 10 sessions between 30 and 90 minutes in length. Treatment for one participant lasted for 10 weeks; though, two participants had sessions over 14 weeks. It was not clear whether more sessions were offered or whether sessions were spaced across the 14 weeks. It is also not clear whether ABI-specific adjustments were offered to participants. The intervention contained typical content for BA provision: mood and activity psychoeducation, recording current patterns of activity, identifying problems with activities and how they link to mood, and introducing new, valued activities. However, the intervention focused on participation as the main problem, whilst symptoms of depression was a secondary outcome. The study reported ‘positive effects’ in measures of depression between baseline and post-treatment, with two participants achieving reliable change in depression measures from baseline to post-treatment. The study also achieved a ‘large’ ES.

Discussion

The studies outlined in this review demonstrate mixed results regarding the effectiveness of ‘evidence-based’ psychological therapies for depression following ABI. Based on this review, there is no conclusive evidence for the effectiveness of ‘evidence-based’ psychological therapies for treating depression in adults who have

experienced ABI. One out of two individual CBT-based interventions provided promising pre- to post-treatment results (study 1), which is encouraging given the study with no significant change in outcomes was vulnerable to floor effects. However, study 1's SPT treatment group also resulted in improved outcomes, meaning it is not clear whether there are any CBT-specific gains compared to other treatments, and, as there is no WLC arm, it is difficult to say whether or not treatment gains would have happened anyway. One out of two group CBT-based interventions provided significant results, which is also hopeful when we consider its larger sample size and higher quality rating in comparison with the non-significant study. The results of the study implementing BA were encouraging; though, it is a single-case design that did not focus specifically on depression, and had a small sample with similar characteristics.

There were several aspects of the included studies that could have been improved to give a more reliable picture of the effectiveness of CBT for depression following ABI. It is therefore appropriate to consider the results of the reviewed studies with some caution.

Critique of Included Studies

All of the group studies were RCTs, which have historically been considered the 'gold standard' of research (Jones & Podolsky, 2015). However, Cartwright (2007) argues that results of RCTs still rely on deductive reasoning, which are prone to assumptions that may not be externally valid. Three of the RCTs in this review investigated wait-list comparisons, which may exaggerate estimates of the effect of the tested intervention (Cunningham et al., 2013). Furthermore, in particular, study 5 had no more than 17 participants, which makes it of weaker quality; the study did not reach its own power calculation threshold of 16 participants per group. The

implications of this are that the study's reported significance and ES are likely to be less valid.

In terms of quality ratings, most of the studies lost points due to omitting finer details on gathering and reporting data, such as stating the setting and location of data collection, blindness to outcome data, and reporting ESs. The difference between 'high' and 'moderate' quality studies mainly came down to the reporting on participants and how they were used in analysis; namely the reporting of injury severity, including all participants in analysis, and accounting for age as a confounding variable. Despite this, all the studies used appropriate research methods and statistical analysis, and four out of five of them provided specific reference to guidance and protocols regarding the intervention they were delivering. As all the studies achieved at least a 'moderate' quality rating, it can be suggested that the risk of bias across the studies was low and the results were valid.

All five studies used appropriate measures for depression, with high internal consistency ratings for the ABI population. All studies provided enough data from these results for ES calculations. However, it is important to consider that study 4 investigated CBT for PCS symptoms, which include 'depression', 'anxiety', and other psychological diagnoses such as 'post-traumatic stress disorder'. Despite using an outcome measure that investigates symptoms of 'depression', the authors reported 'floor effects', demonstrating how investigating wide-ranging sequalae of ABI within one study may not yield results that are suitable for reviews into specific difficulties. The study was still included as it met inclusion criteria; however, the small ES and lack of significance in this study could render the results of this study less representative of the effectiveness of 'evidence-based' therapies for ABI.

Critique of Review

To the author's knowledge, this is the first review to look into solely 'evidence-based' therapies for the treatment of depression in adults with ABI, as outlined by NICE guidance (2009a). This is especially important in the context of current NHS service provision, which is heavily influenced by NICE guidance (2009a). Therefore, this review provides an opportunity to consider how well these treatments could be applied to individuals who are experiencing depression as a result of ABI. Another strength of this review is that it was open to including both single-case and group studies. Including single-case studies provides a rich insight into what kinds of presentation as a result of ABI sequalae are more or less responsive to psychological therapy, as more of an in-depth focus of treatment cause and effect is achievable (Lobo et al., 2017). These studies are also pertinent to clinical practice and should be considered in such reviews (Tate et al., 2008).

With that in mind, one of the most notable outcomes of the review is that all studies meeting inclusion criteria evaluated CBT-based interventions, including group CBT, individual CBT, and BA. This is not surprising, given that CBT is the most researched psychological intervention for depression treatment, mainly due to its ease of systematic implementation (David et al., 2018). This observation has highlighted how other 'evidence-based' therapies outlined by NICE (2009a), such as BCT and IPT, are often overshadowed. Had the review included non-evidence-based therapies, another 13 studies might have been eligible for review; however, many of these therapies are not available in the NHS for depression. Furthermore, reviews on all psychological interventions for depression following ABI (Stalder-Lüthy et al., 2013) and TBI (Gómez-de-Regil et al., 2019) have already been performed.

The current review is quite stringent in its inclusion criteria in relation to the length of time since injury when psychological therapy was introduced. This meant that some studies that would have otherwise been appropriate for the review were excluded. However, Krasny-Pacini et al. (2014) outline that psychological therapy should be offered at least six months after injury to account for the effects of ABI and allow enough time for typical expected recovery. There are some studies whereby psychological therapy was delivered after professional consideration of 'readiness' for therapy was made sooner than six months. Future reviews could investigate the impact of time since injury further, by including studies that start treatment before six months post-injury and by performing a meta-analysis with time since injury as a moderator.

Implications for Research

Stalder-Lüthy et al. (2013) called for more research to further our understanding of the role of psychological interventions for depression in ABI. Even though it has been eight years since this review, the amount of research in the field is still relatively limited. However, there has been an increased focus on treatment specifically for 'depression', with an increase in screening for depressive symptoms and the use of outcome measures for depression. This is a positive start for future research.

Most of the studies are RCTs with 'high' quality ratings; however, all of the reviewed studies had small sample sizes and could have improved their reporting. This is an important consideration for future studies. The most noticeable lack of information in the more widely available literature outside of the included studies was mainly time since injury and age of participants. Whilst mean time since injury was reported in many instances, providing a range too could provide better insight and

meet more inclusion criteria. This information is particularly important in ABI research as time since injury and age at injury and at treatment are likely to moderate the outcome of psychological therapies for depression following ABI.

As already discussed, the most striking outcome of this review is the proportion of CBT-based interventions for treating ‘depression’ in individuals who have experienced ABI. Whilst this is rooted primarily in NICE guidance’s (2009a) partiality to CBT-based therapies, other ‘evidence-based’ therapies, such as BCT and IPT, are overlooked. These therapies should be explored further; they might support individuals who have experienced ABI and depression to maintain and possibly improve relationships, particularly when we consider the population’s difficulties with spousal satisfaction, social relationships, and participation (Burridge et al., 2007; Jones et al., 2012; Nestvold & Stavem, 2009). A high proportion of CBT-based interventions can also be observed in previous reviews on ABI and TBI (Gomez-de-Regil et al., 2019; Stalder-Lüthy et al., 2013). This must be taken into consideration for research into depression following ABI to get a more rounded picture of what psychological treatment is likely to be effective.

Implications for Theory

Evidence-based therapies, particularly CBT-based interventions, are notably structured and can follow manualised protocols. All of the studies in the review outlined their protocols and demonstrated a good mix of cognitive and behavioural techniques, apart from study 3, which was purely behavioural. Behavioural techniques in CBT, and particularly in BA, focus mainly on recognising ‘problematic’ patterns that might instigate and perpetuate depressive symptoms, so that the individual may learn ways of managing avoidance and introducing activities in their lives that promote a sense of enjoyment, closeness and achievement (Veale, 2008).

This makes sense for depression in the context of ABI, considering the increased risk of difficulties with planning and maintaining activities, social participation and quality of life (Hart & Evans, 2006; Nestvold & Stavem, 2009). With this in mind, the current review demonstrates that behavioural approaches might be useful for those experiencing depression after ABI, as a recognition of problematic patterns followed by an increase in activity levels could result in the alleviation of low mood (Jacobson et al., 1996; Lewinsohn, 1974).

Cognitive theory also suggests that 'maladaptive information processing' plays a part in maintaining low mood (Beck et al., 1979) and ABI survivors are prone to 'attributional biases' and 'maladaptive social information processing' (Neumann et al., 2017). As CBT works on challenging these biases and assumptions, more 'balanced' and 'realistic' views can be formed, leading to an improvement in mood (Neumann et al., 2017).

Implications for Clinical Practice

The prevalence of ABI in the UK is rising (Headway, 2018), as is the number of individuals surviving ABI due to an increased understanding of how to treat it both acutely and chronically (Headway, 2018). A large proportion of ABI survivors will experience long-term disabilities as a result of their ABI and might find particular difficulties with everyday functioning even long after their injury (Andelic et al., 2018). Attempts to understand and treat depression as a result of ABI have been relatively less abundant compared with physical rehabilitation (Al Sayegh et al., 2010) but recently, the understanding that depression might impede recovery from ABI has highlighted the issue (Lewis & Horn, 2017).

Evidence-based therapies, as the most widely available psychological interventions in the NHS and the UK, may therefore play an important role in

managing overall rehabilitation outcomes. The outcomes of this review suggest that individualised, CBT-based approaches, including BA, may be beneficial for supporting individuals with depression following ABI. It could be suggested that general services might be more welcoming of referrals for depression from an ABI population. However, there are reasonable adjustments that were explored in the reviewed studies, particularly outlined in those that showed significant results, such as mid-session breaks, adapted materials and smaller group sizes (in the case of group CBT); thus, it will be important for therapists to receive training on the diverse consequences of ABI on cognition, emotion, behaviour, communication and social functioning that a survivor would present with (Gallagher et al., 2019).

Given that primary care services that deliver CBT-based interventions have recently integrated long-term conditions into their delivery model (Royal College of Psychiatrists, 2015), there could be scope for further training and support for practitioners to work with ABI survivors too. This would require further research into how primary care services can introduce this into their practice using consultancy or supervision from a clinical psychologist or a professional with a robust understanding of ABI. This should be feasible given the similarities in competences required, as outlined by Roth & Pilling (n.d.), in their consultation on ‘persistent physical health conditions’ and how these have been managed in primary care.

Conclusion

This review has summarised and evaluated the findings of studies that investigate ‘evidence-based’ psychological therapies for depression in adults who have experienced an ABI a mean time of six months ago. The results were mixed and could not provide conclusive evidence for the effectiveness of such interventions for this population. However, it is notable that studies with ‘high’ quality ratings and

few methodological weaknesses provided promising between-group results and pre- to post-treatment results. This suggests that CBT-based interventions could be beneficial for individuals who have experienced depression as a result of ABI; however, more research with larger sample sizes and better quality of reporting is needed before stronger conclusions can be made.

The current review suggests that ‘evidence-based’ psychological therapies could be effective for ABI survivors, based on the theoretical underpinnings of CBT-based interventions and how they align with the emotional, functional and psychological outcomes of ABI. The review also suggests that with further research, individuals with depression after ABI might be able to receive support from typical primary care services in the UK if a similar model to long-term condition integration is followed. The most important takeaway from the review, however, is that more research into the treatment of depression after ABI, in the context of the availability of psychological therapies in the UK and the NHS, is needed.

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Appendix A: Instructions for Authors – Neuropsychological Rehabilitation

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SCHOOL OF PSYCHOLOGY

DOCTORATE IN CLINICAL PSYCHOLOGY

EMPIRICAL PAPER

Evaluating Brief Behavioural Activation for depression in adolescents with acquired brain injury using a single-case experimental design

Trainee Name:	**Conor O'Brien**
Primary Research Supervisor:	**Professor Anna Adlam** Associate Professor and Clinical Psychologist, Child and Adolescent Neuropsychology
Secondary Research Supervisor:	**Dr Jennifer Limond** Senior Lecturer and Consultant Clinical Neuropsychologist, Child and Adolescent Neuropsychology
Field Collaborators:	**Dr Laura Pass and Professor Shirley Reynolds** University of East Anglia and University of Reading
Target Journal:	Neuropsychological Rehabilitation
Word Count:	7,990 (excluding abstract, table of contents, list of figures, references, footnotes, appendices)

Submitted in partial fulfilment of requirements for the Doctorate Degree in Clinical Psychology, University of Exeter

Abstract

Background: Adolescents with acquired brain injury (ABI) commonly experience depression due to difficulties with participation, quality of life (QoL), and performing usual activities. Brief Behavioural Activation (BBA) is a successful, values-based intervention for managing depression in typical adolescents and is investigated using a single-case experimental design with adolescents experiencing depression following ABI.

Methods: Five adolescents aged 14-17 years with mild to severe ABI of various aetiologies completed a 6-week course of BBA following at least 2 weeks of baseline measurements. The primary outcome measures were mean daily activity scores out of 10 for 'achievement', 'closeness' and 'enjoyment' (MACES). After baseline MACES collection, activities aligning with participants' values were introduced or targeted during the intervention and further MACES were collected. Depression, QoL, and participation scores at post-treatment and follow-up were compared to baseline.

Results: No overall statistical changes in mean activity scores for all participants were found. Though, each participant showed significant change in one area and some changes using visual inspection. All participants reported significant reliable change in depression scores at their follow-up sessions, with three showing clinically significant change. Three participants reported reliable change in QoL. All parents reported reliable change in participants' depression and QoL scores.

Discussion: Despite no significant changes in MACES, increased participant insight linking valued activities, mood and positive reinforcement may have positively impacted on participants' depression and QoL outcomes. Rationale is presented for charities and services providing low-intensity interventions to consider trialling BBA

for adolescents with depression following ABI. Future research suggestions are discussed.

Keywords: acquired brain injury, adolescents, depression, Brief Behavioural Activation

Introduction

Acquired Brain Injury in Adolescents and Depression

Children and young people (CYP) with acquired brain injury (ABI) commonly experience depression, with reported prevalence rates of 20-25% (Hendry et al., 2020; Schachar et al., 2015). The cognitive and behavioural impact of the ABI, psychological adjustment difficulties, and a reduced quality of life (QoL) compared with peers make CYP with ABI more at risk of developing depression than otherwise healthy adolescents (Connell et al., 2018).

Following injury, neurological changes, such as damage to neuronal pathways and lesions, can cause difficulties with apathy, emotional regelation, and initiating activities (Fayed et al, 2019). Damage to the hypothalamic-pituitary-adrenal axis is a common complication following ABI; the neurological changes and likelihood of cascade effects, such as lower stress tolerance, can often result in depression (Tapp et al., 2019).

Psychosocial changes, such as adjustment to ABI sequalae, can also make depression more likely in ABI survivors (Farner et al., 2010). CYP with ABI experience lower rates of social participation (Bedell & Dumas, 2004), which could be attributed to fatigue (Cantor et al., 2008). Others discuss difficulties with goal-attainment and self-regulation (Hart & Evans, 2006). Rosema et al. (2012) suggest that ABI in childhood can disrupt the integrated neural network that governs social skills, leading to atypical social development. The Socio-Cognitive Integration of Abilities Model (SOCIAL; Beauchamp & Anderson, 2010), which focuses on CYP with ABI in particular, suggests that peer relationships might be adversely affected by reduced social competence. Taking this a step further, a recent study (Ankrett, 2020) suggested that emotional difficulties such as anxiety, hopelessness and

shame following ABI might impact upon social competence and motivation for social participation. These psychosocial difficulties increase the likelihood of depression (Nestvold & Stavem, 2009).

Psychological support is a key part of suggested rehabilitation models, particularly for CYP with ABI (Limond et al., 2014). The effectiveness of psychological interventions, such as cognitive behavioural therapy (CBT), has been explored for treating depression in adults with ABI, with positive results (Stalder-Lüthy et al., 2013). In a very recent meta-analysis, CBT-based interventions adapted for CYP have been cited as effective for treating depression in adolescents with traumatic brain injury (TBI) across five reported studies (Gomez-de-Regil et al., 2019); though, there is limited research on psychological therapies in CYP with ABI of non-traumatic aetiologies.

There is already a significant challenge to delivering psychology services in the context of limited National Health Service (NHS) resources in the UK (Gilburt, 2018). Whilst primary care services have been and are improving rates of 'access' to therapies for depression over the last few years (NHS England, 2019), the primary care workforce does not have specialist training in working with CYP with ABI and this population is often excluded from services.

Behavioural Activation for Depression in Adolescents

Theoretical Underpinnings of Behavioural Activation

Interventions focused on behavioural change, known as behavioural activation (BA) were first developed for adolescents in the 1990s (Lewinsohn et al., 1990). BA is based on behavioural theories of depression, whereby depression results from 'problematic' or reduced activity patterns, leading to low mood and further reduced activity levels (Jacobson et al., 1996; Lewinsohn, 1974). This results

from a reduction of positive reinforcement, triggered by loss of relationships or a loss in achievement or increased failure, coupled with an increase in negative reinforcement, through avoidance (Clark & Oates, 1995; Goodyer et al., 2000). The principles of BA encourage adolescents to identify 'problematic' activity patterns and increase their engagement in enjoyable activities and social interaction, leading to better mood (Lewinsohn et al., 1990).

Behavioural Activation in Practice

BA can be performed by a 'junior therapist' (such as psychological wellbeing practitioners in primary care) compared with other, more expensive psychological therapies (Richards et al., 2016), at no detriment to treatment outcomes (Ekers et al., 2008). This renders it cost-effective, less invasive, easier to deliver, and more efficient than other psychological therapies. Research in a non-ABI adult population has shown that BA is no less effective than CBT in treating depression (Ekers et al., 2008; Richards et al., 2016).

BA has been adapted into Brief BA (BBA), a more clinically suitable and efficient intervention for adolescents, which is brief and accessible, with excellent rates of adherence and good outcomes for patients (Pass et al., 2018). BBA is also highly acceptable to adolescents (Pass et al., 2018); acceptability is often an overlooked aspect of an intervention in research (Sekhon et al., 2017), despite its direct influence on outcomes and treatment adherence (Calvert & Johnston, 1990).

Brief Behavioural Activation for Depression in Adolescents with ABI

Clinical Rationale

There is no available research into the efficacy of BA for depression in CYP with ABI. However, recent research into BA for depression in adults with ABI has shown promising results (Gertler & Tate, 2019). In a non-ABI population, BA is

comparable in effectiveness to CBT for treating depression in adults (Ekers et al., 2008; Richards et al., 2016). Furthermore, behavioural components of CBT are the most efficacious for treating adults with depression in the general population (Dimidjian et al., 2006). As the current study focuses on adolescents, it is important to consider a more engaging approach to providing BA (BBA; Reynolds & Pass, 2021).

CYP with ABI typically exhibit lower activity levels than their peers (van Markus-Doornbosch et al., 2019), mainly due to poor motivation, anhedonia, lack of initiation, and social withdrawal (Ownsworth & Oei, 2009). CYP with ABI also have difficulty with planning, initiating activities, and self-regulation (Middleton, 2001), which can affect participation (Cook et al., 2008). Parental anxiety about returning to normal activities following ABI can also lead to reduced activity levels, and, consequently, reduced participation (Renaud et al., 2018). Research into mild TBI in CYP has suggested a return to normal activity levels and participation is important for overall rehabilitation gains (van Heugten et al., 2017).

Theoretical Rationale

Like BA, BBA is based on behavioural theories of depression (Jacobson et al., 1996; Lewinsohn, 1974; Skinner, 1938), whereby increased, meaningful activity levels lead to better mood and positive reinforcement, particularly in adolescents (Lewinsohn et al., 1990). Common ABI sequalae, such as fatigue and reduced self-regulation, can result in reduced activity levels, and, consequently, difficulties with a lower sense of achievement, an increased sense of failure (Middleton, 2001), and reduced participation in social activities (Cook et al., 2008). Reynolds and Pass (2021) suggest that these difficulties in the typical adolescent population often result

in less positive reinforcement and the onset of depression (Clark & Oates, 1995; Goodyer et al, 2000).

As an activity-based intervention, BBA is likely to alleviate symptoms of depression in adolescents with ABI by supporting them to overcome the difficulties they might typically experience with planning and maintaining activities (Hart & Evans, 2006), motivating them to increase valued activities that deliver 'achievement', 'closeness', and 'enjoyment'. BBA is also values-based (Pass et al., 2018), which means it is a source of intrinsic positive reinforcement and is led by which activities the adolescent chooses. Increased positive reinforcement is likely to make the target behaviour more likely to be repeated (Skinner, 1938), leading to an improvement in mood (Reynold & Pass, 2021).

Figure 1 is a visual representation used in BBA to demonstrate how activity levels can be impacted by low mood (Reynolds & Pass, 2021). Reduced activity levels can lead to lower mood and 'getting less out of life', which reinforces a further reduction in activity. BBA aims to reverse this by introducing and planning meaningful activities, which encourages adolescents with ABI to do more and consequently feel better.

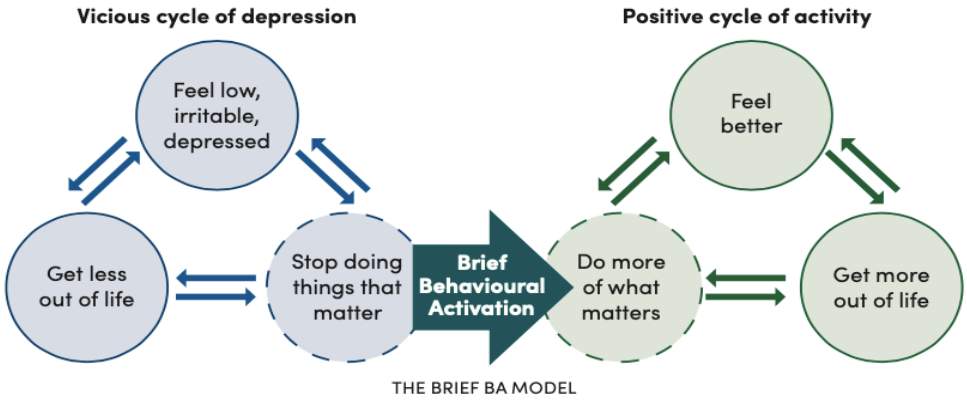

Figure 1. The 'vicious cycle of depression' and how BBA can introduce a 'positive cycle of activity'; taken from Reynolds and Pass (2021).

Single-case Experimental Design Rationale

A single-case experimental design (SCED) is a research design that provides researchers with a "flexible and viable alternative to group designs with large sample sizes" (Smith, 2012, p.1). SCEDs require few participants; even three subjects can be enough to draw conclusions (Krasny-Pacini & Evans, 2018). The SCED design was suitable for the current study due to the lack of existing research that has investigated any type of BA for depression in adolescents with ABI.

Multiple Baseline Design

A multiple baseline design (MBD) was used in this study. MBDs are used in psychological research when the outcomes of an intervention are unlikely to return to normal after completion, and the staggered design reduces the likelihood of confounding or extraneous effects that are not related to the intervention; thus increasing external validity (Morgan & Morgan, 2009).

Experimental Hypotheses

The main aim of the study is to investigate the efficacy of BBA for treating depression in adolescents with ABI. This study investigated five hypotheses:

1) BBA will increase the mean levels of achievement, closeness and enjoyment of daily activities reported by participants;
2) BBA will reduce the reported symptoms of depression in adolescents with ABI;
3) BBA will lead to higher participation levels in adolescents with ABI;
4) BBA will lead to better QoL in adolescents with ABI;
5) BBA will be an acceptable intervention for adolescents with ABI.

Method

The study took place during the COVID-19 pandemic in 2020-21. The intervention period was during the third national lockdown in the UK. COVID-19 lockdowns caused an increase in depression prevalence and depression symptoms in the UK population of CYP (Shum et al., 2021).

Power Analysis

Pass et al. (2018) cite a large effect size ($d > 0.80$) in their study delivering BBA for depression to adolescents. Though, effect sizes are expected to be smaller in this sample due to the cognitive, emotional, physical and social impairments associated with ABI. To produce adequate power (> .80) and detect a large effect size ($d \geq 0.80$; Pass et al., 2018), Ferron and Sentovich (2002) recommend collecting at least 20 data points per participant for as few as four participants when employing a MBD in SCED research. To increase the ability to detect a smaller effect size, this study was planned to collect 36 data points for up to 10 participants by encouraging participants to provide at least four data points per week. Up to 63 data points were possible due to nine weeks of daily data collection.

Design

A MBD with randomised intervention start points was completed over a nine-week period, which comprised a minimum two weeks of baseline and a minimum six weeks of intervention; the transition phase was one week long. Each participant was randomly allocated to one of the four different tracks, which determined when they started the intervention during the transition phase. Four tracks were chosen to feasibly allow for randomisation of start points over the space of a week in the context of limited time and resources. Figure 2 represents how the tracks' transition

times were staggered, and how this fitted in with the nine-week data collection period.

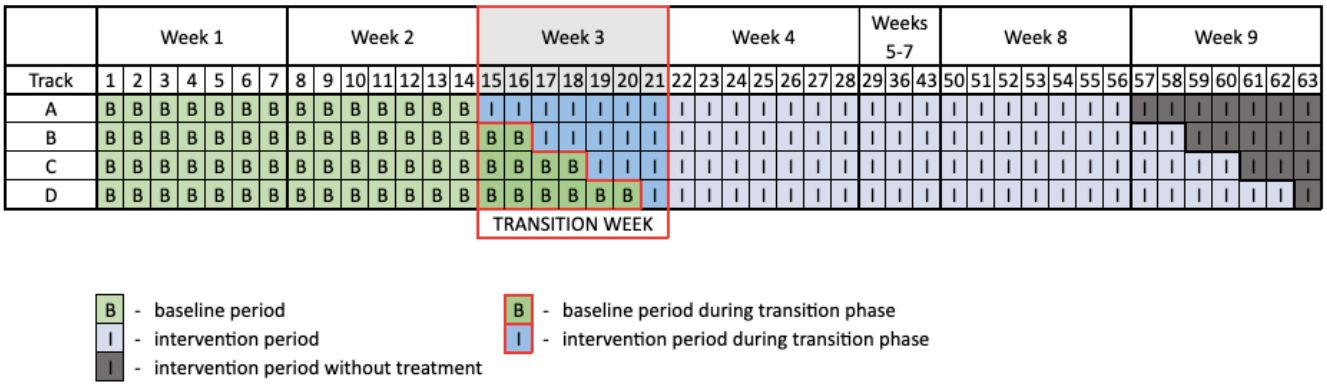

Figure 2. A diagram representing the timeline of events for each track during the data collection period.

Participants

Recruitment

Recruitment took place from March 2020 to January 2021, during the COVID-19 pandemic. A total 14 potential participants from across the UK were recruited through the University of Exeter's Child and Adolescent Neuropsychology participant volunteer panel and through various charities for ABI and neurorehabilitation in CYP. Six participants discontinued contact before screening. Following screening, eight participants were offered BBA. Three participants dropped out during the baseline period; one due to discontinued contact and two due to apprehension about committing the appropriate time for the intervention. Five participants received BBA and completed the study.

Eligibility Criteria

All participants were required to be aged 12-18 years, meet the clinical threshold for symptoms of depression (T score = 65+) according to the Revised Children's Anxiety and Depression Scale's (RCADS) Major Depression Disorder Subscale (MDD) child and/or parent form (Chorpita et al., 2000) and have a history

of ABI. All medically stable ABI survivors were eligible, allowing an investigation into whether BBA is acceptable and efficacious for depression across all presenting ABI severities. Those with profound impairment, who would not otherwise be able to engage in talking therapy, were excluded.

Participant Characteristics

Basic demographic variables, such as age, gender, and ethnicity were recorded. Specific details about the participants' ABI were gathered, including nature and severity of injury, age of participant at time of injury/illness and time since injury. Socioeconomic status was defined using the Index of Multiple Deprivation, based on the current postcode of the participants' home address (IMD; Ministry of Housing, Communities & Local Government, 2019).

Intervention

Brief Behavioural Activation for Depression

BBA (Pass et al., 2018) comprises eight hourly individual treatment sessions. Parents were invited to be involved for part of sessions 1, 6 and 8. BBA is a structured intervention and was delivered according to a treatment protocol, as outlined in Appendix A.

As the efficacy of BBA was being investigated, the researcher adhered to the BBA protocol where possible. Only one minor adjustment to the protocol was required to make the protocol more amenable for the sample; a five-minute break in the middle of the session, for which participants could opt for if necessary. No other specific adjustments outside of what would account for typical differences in the adolescent population were needed. Otherwise, due to a need to increase accessibility for a dispersed population, and COVID-19 restrictions, the intervention was delivered using live online video software. Live online video provision of

paediatric neuropsychology in the UK has so far been feasible (Bennett et al., 2021). Supplementary phone calls were provided by research interns to support activity recording.

Protocol Adherence. Treatment adherence checklists, provided by Reynolds and Pass (2021), were used by the main researcher during sessions. Checklists are unique to each session and were ticked off as each checkpoint was reached during the session (Appendix B). Out of the total 40 sessions of BBA delivered, full adherence to the checklist was achieved on 37 occasions (92.5% adherence). Any deviance from the checklist was accounted for as a change in the agenda due to what the participant wanted to bring to the session. Independent review of session recordings was not possible due to difficulties retrieving saved recordings.

Clinicians, Training and Supervision. Only the principal researcher delivered BBA. Training on BBA was provided to the researcher by Dr Laura Pass, outlined in Appendix C. The principal researcher and author is a trainee clinical psychologist, who has robust experience in delivering BA to adults in primary care, and experience of providing psychological therapy to adolescents and neuropsychological support to adults with ABI. The data collection protocol is outlined in Appendix D.

Materials

Participant information sheets, a risk contact form, and consent forms can be found in Appendices E-J.

Measures

The details and psychometric properties of the current study's questionnaires are summarised in Appendix K. Primary routine outcome measures (ROMs) were completed daily using Qualtrics. Secondary ROMs were sent via e-mail to

participants, at baseline (T1), immediately post-treatment (T2) and four weeks post-treatment follow-up (T3), to be completed and sent back to the researcher.

Primary Outcome Measure

Achievement, Closeness and Enjoyment. Consistent with typical BA procedures, participants completed a daily activity log (Appendix L), where the participant recorded what activities they completed during each day. The participants were asked to rate each activity for its level of 'achievement', 'closeness' and 'enjoyment' out of 10. Qualtrics, an electronic data collection module, was used to collect these data from participants. Research interns calculated a mean daily score for each of 'achievement', 'closeness', and 'enjoyment' ratings completed.

Secondary Outcome Measures

Depressive Symptoms. The RCADS MDD Subscale (Appendix M; Chorpita et al., 2000) includes a child version and a parent version, which were both used to test Hypothesis 2. The RCADS has high internal consistency (Donnelly et al., 2019), and is highly reliable and valid (Ebesutani et al., 2011). The RCADS has age and gender 'T-score' norms for all subscales (Chorpita et al., 2015), which means it can also be used at screening and for measuring clinically significant change using clinical thresholds. Higher MDD scores indicate more severe depression symptoms.

Social Participation. The Child and Adolescent Scale of Participation (CASP; Bedell, 2004) measures an adolescent with ABI's level of participation at school, home, and community activities, which could be impeded by their ABI, and is a valid measure of participation (Bedell, 2009). Higher CASP scores indicate higher levels of participation. The child-report CASP measure was used to test Hypothesis 3. The full scale is outlined in Appendix N.

Quality of Life. The Paediatric Quality of Life Inventory (PedsQL; Appendix O; Varni et al., 1999) was created as a way of measuring the QoL in children who are experiencing long-term health conditions, including neurological conditions, and the parent and child core questionnaires were used to test Hypothesis 4. Higher PedsQL scores indicate a better QoL. The PedsQL has repeatedly been deemed to be a valid and responsive measure (Desai et al., 2014).

Study Acceptability. This was administered at T3 only. The Treatment Acceptability Questionnaire (TAQ; Appendix P; Hunsley, 1992) consists of six items that are rated on a 7-point Likert scale and is used to measure study acceptability (Hypothesis 5). Acceptability using the TAQ can be calculated as a total percentage of the maximum score, with a higher percentage indicating higher study acceptability. The TAQ also allows for the collection of qualitative data.

Procedure

Recruited participants who consented were screened for eligibility over live online video. Those who met eligibility criteria and consented to treatment were offered BBA and were invited to an online video briefing session with the researcher, which aided participants' understanding of the intervention, the ROMs, and session layout. The baseline activity diary and how to record activity ratings (MACES) on Qualtrics were presented and explained using 'screen share'. The activity diary was sent via e-mail after the appointment. Data from secondary questionnaires were collected and recorded.

Participants recorded their activities for two weeks on Qualtrics. Participants were randomly allocated to an intervention start point during week three. Activity recordings were collected until the end of week nine. Participants received six weeks of BBA as per the BBA protocol. Immediately, at the end of treatment, secondary

ROMs were collected again. A follow-up session to collect secondary ROMs was arranged with participants four weeks after they completed BBA. Participants were also debriefed and future considerations for support were discussed.

Data Analysis Strategy

Hypothesis 1

Visual analysis (VA) and statistical analysis was performed, as recommended by Bulté and Onghena (2008). All analyses were performed using the R statistical software programme. The functions adhered to for analysis were compiled by Bulté and Onghena (2008, 2009, 2013).

VA of the MACES data was performed by the lead author and discussed with the supervisors. The median was used as the figure of central tendency for visual comparison, as this is less prone to outliers, which are expected to be common in daily activity scores. Trend analysis was performed using the 'split-middle' technique, as recommended by Bulté and Onghena (2008). As this technique is insensitive to outliers, substituted phase medians in place of missing data were removed for this analysis.

Following VA, Bulté and Onghena (2008) recommend performing randomisation tests (RT); this allowed comparison of the difference in mean scores between phases for 'achievement', 'closeness' and 'enjoyment'. RTs explore the likelihood of the data occurring across all possible assignment outcomes. RTs are helpful when data shows variability during the baseline phase, as it is not based on assumptions of homogeneity and other random sampling assumptions (Bulté & Onghena, 2008; Heyvaert & Onghena, 2014).

The current study had 57,624 possible randomisation distributions; the author chose to run 1,000 randomisation distributions using a Monte Carlo simulation (Bulté

& Onghena, 2008; Morley, 2017), as this number is no greater than the possible distributions and higher numbers might not demonstrate superior accuracy despite their increased administrative burden (Heijungs, 2020). In the current study, instead of using the psychology accepted standard alpha of .05, the *p*-value can be compared with an alpha value of 0.1429 for each individual case and for overall tests, as this is the lowest possible *p*-value obtainable with a phase change of seven days, calculated by dividing 1 by the number of phase change days (i.e. 1/7 = 0.1429; Morley, 2017). RTs were performed according to the assumption that there were a minimum of 14 data points per phase (seven data points per week for two weeks).

Effect sizes for each participant were calculated using the non-overlap of all pairs (NAP; Parker & Vannest, 2009), allowing for exploration of the magnitude of the effect and uses all the available data. Overall effect size analysis was also performed separately for ‘achievement’, ‘closeness’ and ‘enjoyment’. NAPs were calculated using an online calculator created by Vannest et al. (2016). Parker and Vannest (2009) suggest tentative NAP ranges for a ‘weak’ effect (0 – .65), a ‘medium’ effect (.66 – .92), and a ‘large’ effect (.93 – 1).

Hypotheses 2-4

The Leeds Reliable Change Index (RCI; Morley & Dowzer, 2014) was used to measure reliable change in secondary ROMs across all three timepoints. Each participant’s RCI was calculated by dividing the change in the participant’s score across two timepoints by the standard error of the difference of the participants as a whole. Significant reliable change is dependent on the internal consistency of the measure. CASP parent data could not be analysed due to an error in storing the data.

Hypothesis 5

The TAQ provides a descriptive satisfaction level, where the percentage of the highest possible TAQ score was calculated for each participant as a measure of total study acceptability. As the sample size was small, each participant's response was recorded.

Overall Intervention Effects

Effect sizes for all participants as a whole were calculated for all secondary ROMs. The small sample size will have increased the chance of large differences in standard deviations between each phase, so Glass's delta (Δ; Hedges, 1981) was used to measure effect size, as this calculates effect size using only the baseline scores' standard deviations. Effect size thresholds for Glass's delta are outlined by Cohen (1988) as 'very small' ($\Delta < .2$) 'small' ($0.2 < \Delta < 0.5$), 'medium' ($0.5 < \Delta < 0.8$), 'large' ($0.8 < \Delta < 1.20$) and 'very large' ($\Delta > 1.30$).

Results

Five participants completed the nine-week data collection period; including at least two weeks of baseline data. All participants had missing data points; two participants (1 and 3) were excluded from the primary analysis of Hypothesis 1 due to having over 50% of missing data. Of the three participants achieving over 50% of data, Participant 5 had three missing data points whilst the other two (Participants 2 and 4) had 24 missing data points each out of the total maximum of 63 data points (seven data points per week for nine weeks).

The primary reasons for missing data were forgetting, fatigue, and tedium. For VA and NAP calculations (RTs could be calculated with missing data) of the MACES ratings, any missing data were retrospectively managed using median substitution, where the median for each intervention phase was calculated and put in place of

missing data dependent on the phase. All participants who completed the intervention were still put forward for analysis of secondary measures (Hypotheses 2-5), as data from these outcomes following BBA were still of interest.

Participants

Table 1 outlines participant characteristics, including brief information about their ABI.

Table 1

A summary of each participant's demographic characteristics at the time of screening.

Ppt. no.	Age[a] (years)	Gender	Ethnicity[b]	IMD decile[c]	Lives with	Screening RCADS MDD T-score	Type of ABI[d]	ABI severity[d]	Time since ABI (years)[a]	Notable impairments[d]
1	14	F	'White European'	9	Mother	C = 89[†] P = 78[†]	General encephalomyelitis leading to a coma; congenital brain injury under investigation	Participant unsure	10	Conceptual reasoning Fatigue Participation Physical difficulties Processing speed Visual problems
2	15	F	'White British'	9[*]	Mother Father Sister Sister	C = 92[†] P = 93[†]	8cm subdural abscess pressing on right frontal lobe	Participant unsure	2.5	Attention Emotional regulation Fatigue Impulsivity Initiation Keeping routine Memory Noise sensitivity Processing speed
3	14	M	'British Asian'	3	Mother Father Brother Brother	C = 76[†] P = 99[†]	Tumour on posterior fossa on two separate occasions; surgery, radiotherapy and chemotherapy on both occasions	'Severe'	1st: 7 2nd: 2	Cognitive inflexibility Flat affect Keeping routine Noise sensitivity Processing speed Short-term memory Visual problems Balance difficulties

4	15	F	'White British'	9	Mother	C = 59 P = 87†	6cm atypical teratoid tumour on left frontal and temporal lobes; multiple surgeries, radiotherapy and chemotherapy	'Mild'	4	Appetite Attention Fatigue Noise sensitivity Processing speed Short-term memory Sleep
5	16	F	'Mixed White and Black Caribbean'	10	Mother	C = 58 P = 82†	Traumatic brain injury and contrecoup; hit head-on by heavy object	Participant unsure	15	Contextual reasoning Fatigue Flat affect Literal thinking Noise sensitivity Processing speed Short-term memory

Key: Ppt. no. = participant number; M = male; F = female; C = child version; P = parent version; RCADS MDD = Revised Child Anxiety and Depression Scale Depression Subscale; ABI = acquired brain injury.

[a] Values accurate at the start of the intervention.

[b] Ethnicity as reported by the participant with the support of their parent.

[c] Index of Multiple Deprivation (IMD; Ministry of Housing, Communities & Local Government, 2019) overall decile at home postcode; socioeconomic status.

[d] All data as reported by participants and their parents at screening, based on experience/reported information given by professionals.

[*] Postcode in Scotland; Scottish IMD (Scottish Government, 2021) was used.

[†] Clinically significant score according to Chorpita et al. (2000).

Hypothesis 1

Visual Analysis

Due to over 50% of missing MACES data from Participants 1 and 3, only Participants 2, 4 and 5 could be included in VA. The MACES data for VA of central tendency are displayed in Figures 3-5, separated by the three target areas: achievement, closeness and enjoyment. The corresponding data for VA of trends are displayed in Figures 6-8.

Participant 2. Compared to baseline, Participant 2 showed a very slight increase in median 'achievement' and 'enjoyment' scores, with very little change in her median 'closeness' scores during the intervention. Participant 2 reported predominantly low 'achievement' scores, particularly in the intervention phase. Trend analysis showed gradually increasing 'achievement' and very slightly increasing 'closeness' scores over time during the intervention phase. Though, 'enjoyment' scores were slightly decreasing, and showed more polar variance during the intervention phase.

Participant 5. Compared to baseline, Participant 5 showed a marked increase in median 'achievement' scores and a small increase in 'enjoyment' scores, with very little change in her median 'closeness' scores during the intervention. Participant 5 showed very stable 'enjoyment' scores during the intervention period, and attributed this to 'good mood'. Participant 5's trend data showed slightly increasing 'enjoyment' scores and markedly increasing 'achievement' and 'closeness' scores during the intervention phase.

Participant 4. Participant 4 started the intervention phase four days after Participants 2 and 5, and showed the most stable scores overall. Compared to baseline, Participant 4 showed an increase in median 'achievement' and 'enjoyment'

scores, with very little visible change in her median ‘closeness’ scores during the intervention. Participant 4’s trend data demonstrated a slightly decreasing ‘achievement’ scores and markedly decreasing ‘closeness’ and ‘enjoyment’ scores over time during the intervention phase; all of which started at a high score.

Randomisation and Effect Size Tests

Table 2 shows the mean scores, NAP effect sizes, and significance of each participants’ mean scores for each phase for ‘achievement’, ‘closeness’ and ‘enjoyment’.

Overall Results. Findings from NAP analysis showed that, compared to baseline, the overall effect size for ‘achievement’ was in the ‘medium’ range, ‘closeness’ was in the ‘small’ range and ‘enjoyment’ was in the ‘medium’ range. Compared to baseline, there were no statistically significant overall changes in the intervention phase.

Individual Results. Compared to the baseline phase, Participant 2 showed a significant, medium change in ‘enjoyment’ scores, Participant 4 showed a significant but small change in ‘closeness’ scores, and Participant 5 showed a significant, medium change in ‘enjoyment’ scores during the intervention phase. Participants 4 and 5 showed medium changes in ‘achievement’ scores during the intervention phase compared to baseline but these were not statistically significant.

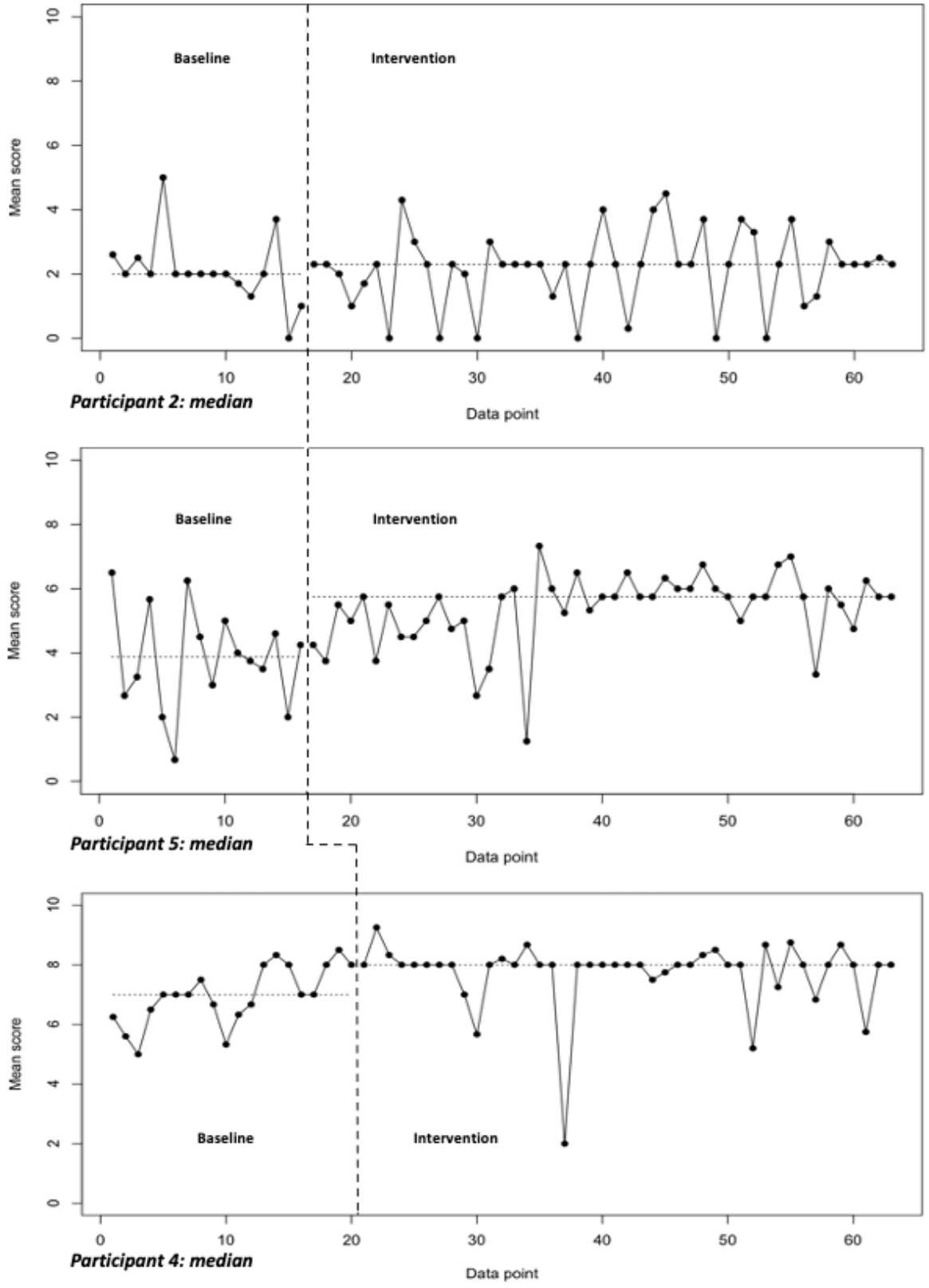

Figure 3. The median of each participant's daily mean 'achievement' scores for each phase.

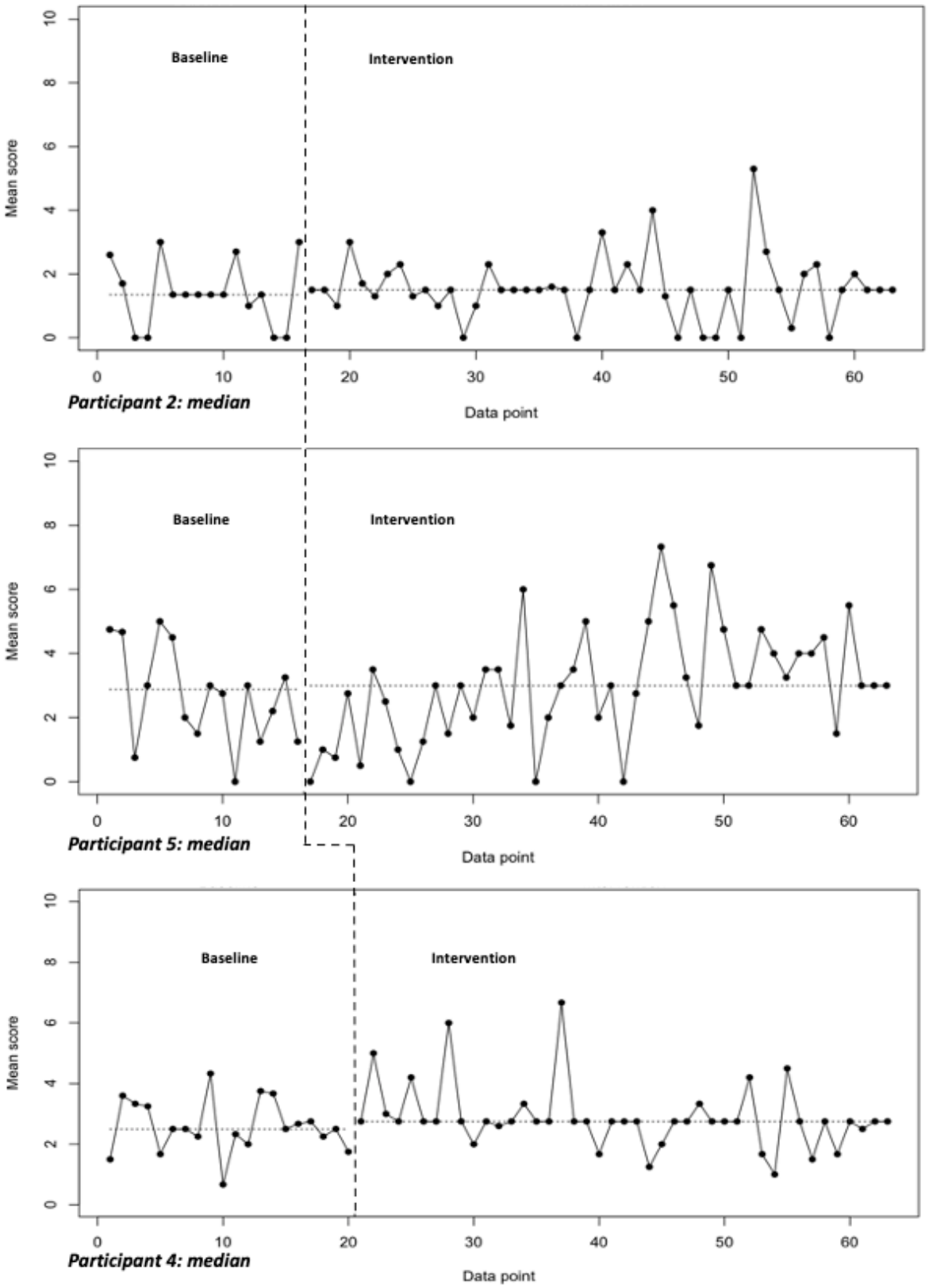

Figure 4. The median of each participant's daily mean 'closeness' scores for each phase.

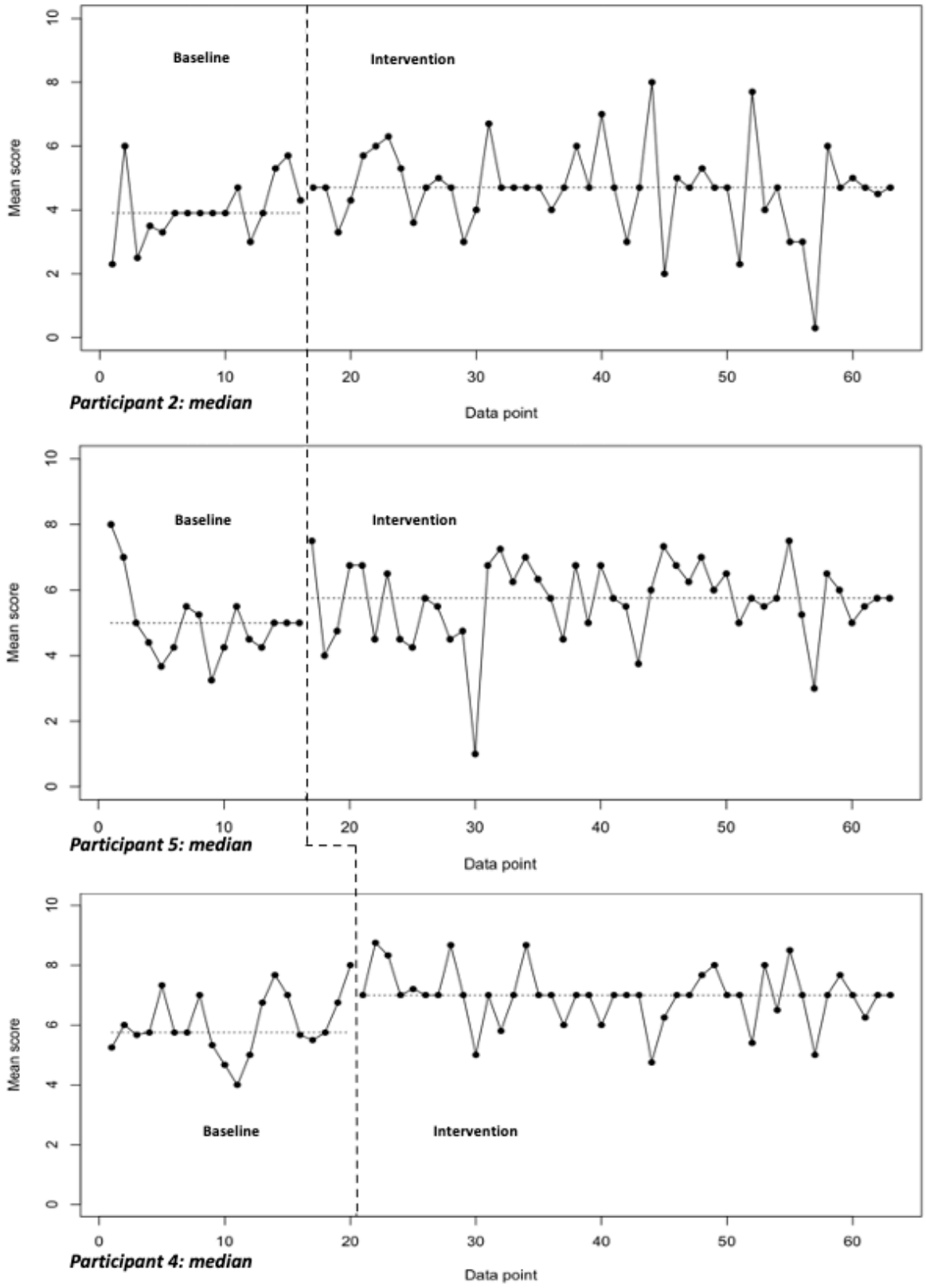

Figure 5. The median of each participant's daily mean 'enjoyment' scores for each phase.

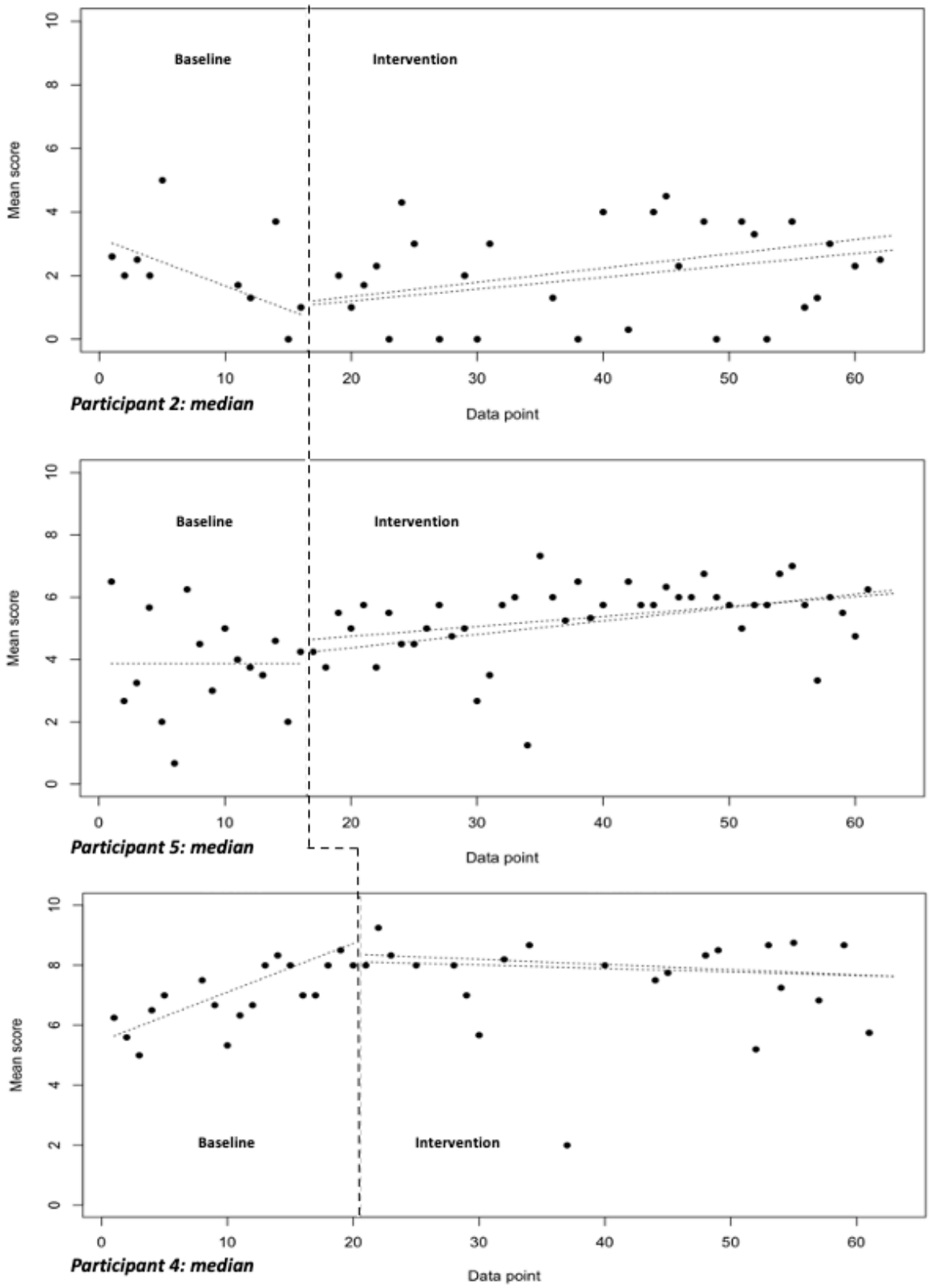

Figure 6. The trend of each participant's daily mean 'achievement' scores for each phase.

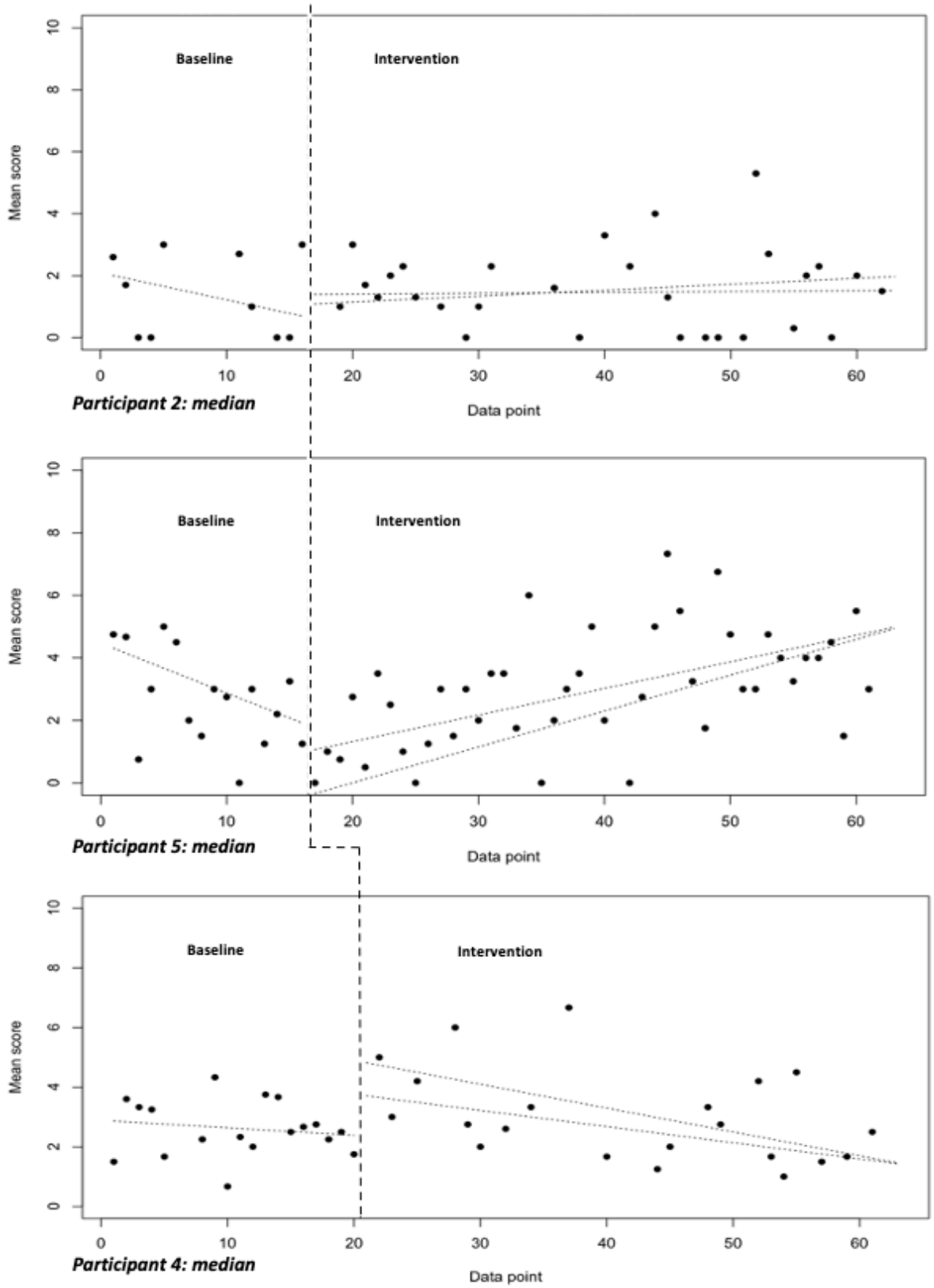

Figure 7. The trend of each participant's daily mean 'closeness' scores for each phase.

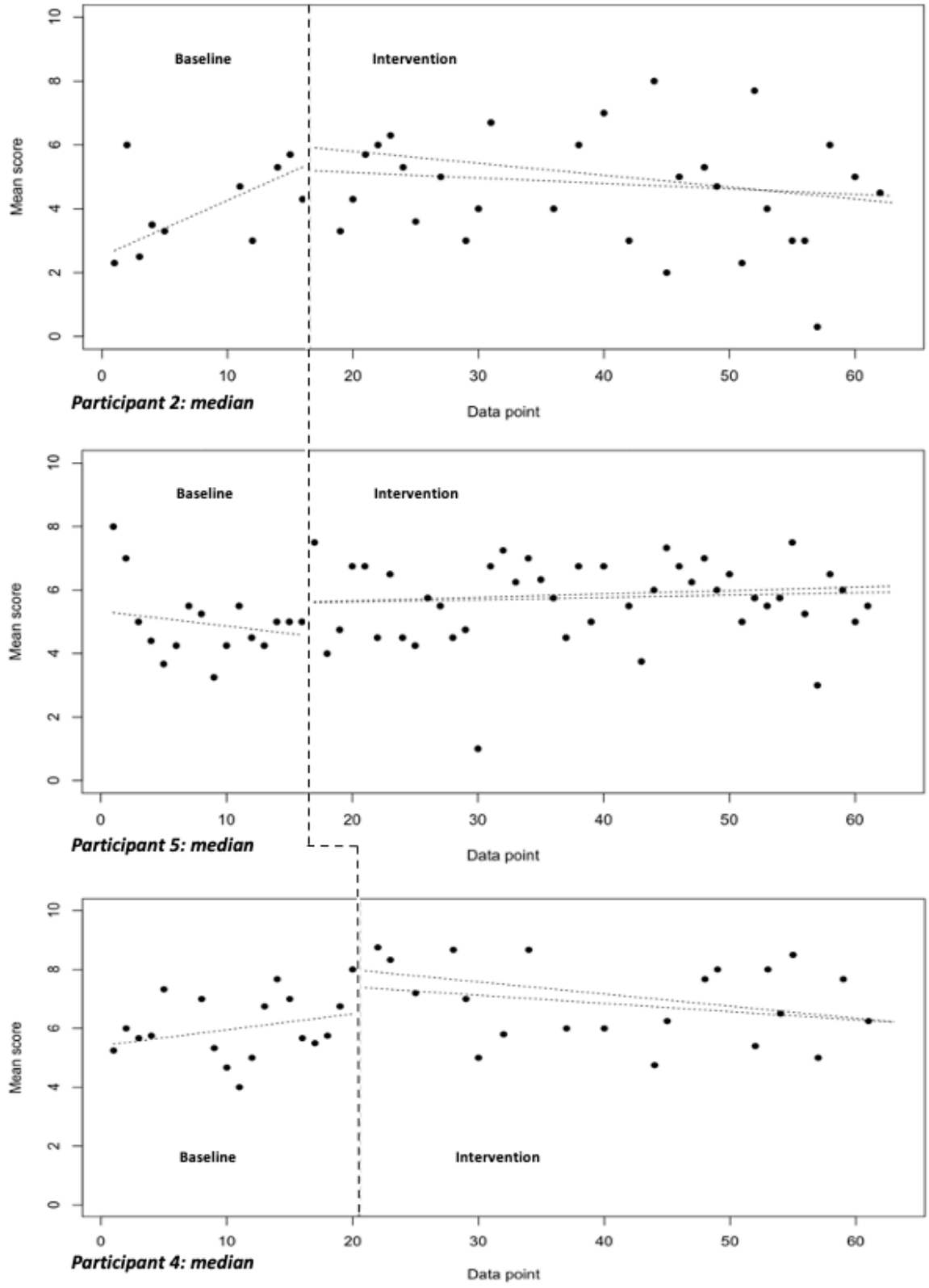

Figure 8. The trend of each participant's daily mean 'enjoyment' scores for each phase.

Table 2

Mean 'achievement', 'closeness' and 'enjoyment' scores, effect sizes and randomisation tests for each participant and the overall totals, means and figures across participants.

Achievement

	Phase duration (days)		Mean score (SD)				
Ppt.	Baseline	Intervention	Baseline	Intervention	NAP	*p*-value	Sig.?*
2	16	47	2.18 (1.40)	2.08 (1.50)	0.606	0.946	No
4	20	43	6.98 (1.04)	7.47 (1.62)	0.745	0.275	No
5	16	47	3.85 (1.59)	5.34 (1.18)	0.787	0.192	No
Overall	52	137	4.75 (2.38)	4.84 (2.45)	0.714	0.719	No

Closeness

	Phase duration (days)		Mean score (SD)				
Ppt.	Baseline	Intervention	Baseline	Intervention	NAP	*p*-value	Sig.?*
2	16	47	1.40 (1.35)	1.57 (1.32)	0.583	0.262	No
4	20	43	2.60 (0.93)	3.03 (1.56)	0.615	0.052	Yes
5	16	47	2.68 (1.52)	2.97 (1.83)	0.551	0.938	No
Overall	52	137	2.36 (1.34)	2.55 (1.74)	0.584	0.419	No

Enjoyment

	Phase duration (days)		Mean score (SD)				
Ppt.	Baseline	Intervention	Baseline	Intervention	NAP[a]	*p*-value	Sig.?*
2	16	47	4.06 (1.33)	4.62 (1.77)	0.692	0.2	Yes
4	20	43	6.06 (1.08)	6.92 (1.34)	0.755	0.214	No
5	16	47	4.99 (1.17)	5.66 (1.30)	0.711	0.095	Yes
Overall	52	137	5.22 (1.40)	5.62 (1.67)	0.721	0.858	No

Key: Ppt. = participant; SD = standard deviation; NAP = non-overlap of all pairs.
[a] NAP ranges: 0-.65 = 'weak'; .66-.92 = 'medium'; .93-1 = 'large' (Parker & Vannest, 2009).
*As compared to allocated 0.1429 significance alpha value.

Hypotheses 2-4

Individual Results

Descriptive statistics for all secondary measures for all participants are shown in Table 3. Reliable change and clinically significant change (CSC) at timepoints compared to baseline are also reported. Compared to baseline, Participants 1, 3 and

4 reported CSC in MDD child scores at post-treatment, and whilst Participants 1 and 4 maintained CSC, all participants reported reliable change by follow-up. In parent MDD scores, compared to baseline, Participants 1, 4 and 5 showed CSC and all participants showed reliable change by follow-up. Compared to baseline, Participants 2 and 3 showed reliable change in child PedsQL scores at at least one timepoint, whilst all participants' parent PedsQL scores showed reliable change by follow-up. No other statistically significant changes were noted.

Overall Results

Effect sizes for overall scores were calculated for each secondary ROM using Glass's delta (Δ; Hedges, 1981) and are shown in Table 4 for baseline to post-treatment and Table 5 for baseline to follow-up. Effect sizes for RCADS MDD child scores at post-treatment and follow-up compared to baseline, RCADS MDD parent scores at post-treatment and follow-up compared to baseline, and PedsQL parent scores at post-treatment and follow-up compared to baseline were 'very large'. Effect sizes for PedsQL child scores at post-treatment and follow-up compared to baseline, and CASP scores at follow-up compared to baseline were small. The effect size for CASP child scores at post-treatment compared to baseline was very small.

Table 3

Secondary ROM scores for each participant at baseline, post-treatment and follow-up, and whether differences indicate reliable change and clinically significant change.

Routine outcome measure	Timepoint		
	Baseline (T1)	Post-treatment (T2)	Follow-up (T3)
RCADS MDD child (T-score)			
Participant 1	17 (75)	10* (56)†	7* (48)†
Participant 2	23 (92)	19 (81)	15* (70)
Participant 3	19 (84)	6* (48)†	14* (70)
Participant 4	13 (65)	10 (56)†	7* (48)†
Participant 5	12 (56)	3* (36)	1* (31)
RCADS MDD parent (T-score)			
Participant 1	14 (81)	11* (72)	7* (59)†
Participant 2	18 (93)	14* (81)	16* (87)
Participant 3	16 (89)	13* (80)	11* (73)
Participant 4	16 (87)	8* (62)†	8* (62)†
Participant 5	13 (76)	9* (63)†	7* (57)†
PedsQL child			
Participant 1	40.2	47.8	47.8
Participant 2	32.6	-	43.5*
Participant 3	44.6	55.4*	42.4
Participant 4	61.7	55.4	65.2
Participant 5	53.3	50.0	50.0
PedsQL parent			
Participant 1	21.7	-	40.2*
Participant 2	38.0	43.5	48.9*
Participant 3	42.4	62.0*	58.7*
Participant 4	44.6	65.2*	66.3*
Participant 5	28.3	51.1*	47.8*
CASP child			
Participant 1	-	67.1	76.3
Participant 2	68.8	-	77.5
Participant 3	82.9	73.8	92.1
Participant 4	85.0	88.2	88.2
Participant 5	53.8	57.5	53.8

Note. CASP parent data could not be included due to an error in storing the data.
* Reliable change since baseline
† Clinically significant change from 'caseness' to 'recovery'
- Missing data

Table 4

Mean ROM scores and standard deviations for all participants at baseline (T1) and post-treatment (T2), with calculated effect sizes using Glass's delta.

	Timepoint mean scores (SD)		
Routine outcome measure	T1	T2	ES (Δ)
RCADS MDD child (n=5)	16.8 (4.49)	9.6 (6.02)	1.60
RCADS MDD parent (n=5)	15.4 (1.95)	11.0 (2.55)	2.26
PedsQL child (n=4)	49.95 (9.54)	52.15 (3.86)	0.23
PedsQL parent (n=4)	38.33 (7.22)	55.45 (9.99)	2.37
CASP child (n=3)	73.90 (17.44)	73.17 (15.36)	-0.04

Table 5

Mean ROM scores and standard deviations for all participants at baseline (T1) and follow-up (T3), with calculated effect sizes using Glass's delta.

	Timepoint mean scores (SD)		
Routine outcome measure	T1	T3	ES (Δ)
RCADS MDD child (n=5)	16.8 (4.49)	8.8 (5.76)	1.78
RCADS MDD parent (n=5)	15.4 (1.95)	9.8 (3.83)	2.87
PedsQL child (n=5)	46.48 (11.33)	49.78 (9.16)	0.29
PedsQL parent (n=5)	35.00 (9.72)	52.38 (10.19)	1.79
CASP child (n=4)	72.63 (14.47)	77.90 (17.21)	0.36

Hypothesis 5

Quantitative Findings

The mean TAQ rating for BBA given by participants was 36.6 (SD 3.07), which was 87% of the maximum score, ranging from 76% to 95%. Participants scored highest for its ethicality and low possibility of negative side effects (91%) and lowest for intervention acceptability (80%). Participants scored 86% for psychologist

knowledge and for the potential wider effectiveness of BBA, and 89% for trust in the psychologist.

Qualitative Findings

Table 6 lists the qualitative feedback given by participants in the TAQ, separated by answers to questions about what participants 'liked' and 'did not like/improvement suggestions'.

Table 6

Feedback from each participant, grouped as 'likes', and 'did not likes/improvement suggestions'.

Ppt. no.	Likes	Did not likes/ improvement suggestions
1	"Everything was really well explained and I got to talk to someone who was also a young person about my issues."	"I think it could have gone on longer."
2	"I learned how to tell normal teenage feelings to post brain injury feelings."	NA
3	"The psychologist made sure I was comfortable speaking."	"I wouldn't want it to be online."
4	"I found it helpful to just go over everything I did and valued in the day."	NA
5	"[It was] interesting and made me think about how my mood can affect others."	NA

Key: Ppt. no. = participant number; NA = did not answer.

Discussion

The current study aimed to investigate the efficacy of BBA for treating depression in adolescents with ABI. Hypothesis 1 predicted an increase in daily mean 'achievement', 'closeness' and 'enjoyment' activity scores in the intervention

phase when compared to baseline. Overall changes in scores were not statistically significant, despite some visually noticeable improvements in mean ‘achievement’ and ‘enjoyment’ scores and an increase in effect sizes in the intervention phase compared to baseline. Hypothesis 2 was mostly supported, as reliable change in MDD child and parent scores was achieved by all participants at follow-up compared to baseline. Four out of five participants also experienced CSC in MDD child and/or parent scores at at least one timepoint relative to baseline. Hypothesis 3 was not supported, as no reliable change in participation was demonstrated by any participants. Hypothesis 4 was partially supported; relative to baseline, reliable change in QoL was reported by all participants’ parents at at least one timepoint and by two out of five participants at at least one timepoint. Hypothesis 5 was supported, as all participants deemed BBA highly acceptable. All measures were likely to have been influenced by social restrictions put in place by the UK Government in response to the COVID-19 pandemic; participation (Hypothesis 4), as a measure driven by social interaction, was most likely affected, particularly as some questions in the CASP ask about ‘connectedness’.

Despite an overall lack of significance for Hypothesis 1, results suggested that some participants found some activity types more amenable than others. Participants may have differed on their ‘achievement’, ‘closeness’ and ‘enjoyment’ ratings for the same activities, whilst different activities might have elicited different ratings in the same participant. Notably, ‘enjoyment’ scores were considerably higher for Participants 2 and 5 across both phases when compared with ‘achievement’ and ‘closeness’, which might suggest that enjoyment is either easier to define or seek.

In the visual trend analysis, Participant 2 showed increasing MACES scores in ‘achievement’ and ‘closeness’. Participant 5 showed increasing MACES scores in

achievement, ‘closeness’ and ‘enjoyment’. This suggests that as the intervention was gaining momentum, Participants 2 and 5 were performing activities that gave them more achievement, closeness and enjoyment. Had the intervention gone on for longer with more sessions, this might have resulted in increased MACES and possibly MDD, PedsQL and CASP gains, if MACES were the mechanism of change in BBA. Participant 5’s higher MACES data input (60/63 timepoints) might have given a more reliable picture of how MACES were affected during the intervention phase.

Contrarily, Participant 4 showed decreasing scores for all three activity types during the intervention phase, despite a large immediate difference in mean MACES scores at the start of the intervention phase compared to baseline. Participant 4 regularly experienced difficulties with fatigue, which might have resulted in difficulties maintaining the activities with higher MACES that she immediately implemented at the beginning of the intervention. Perhaps an introduction of protected breaks in Participant 4’s schedule to adjust for this might have mitigated a decrease in scores over time.

Activity logs are a key component of BBA, and the extent of missing data for Participants 1 and 3 (>60%) demonstrates how difficult some adolescents with ABI might find completing these tasks. Participant 3 gave continuously low scores across all activity types, whilst Participant 1 gave either very low or very high scores to activities. This might allude to difficulties with activity appraisal, limited insight, and proneness to ‘black-and-white’ thinking; therefore, greater support with tracking and reflecting on activities might be required for adolescents with ABI. However, limited insight does not necessarily mean participants’ depression scores will not reduce (Krasny-Pacini et al., 2014). Participants 1 and 3 both showed CSC at post-intervention compared to baseline in MDD scores; yet Participant 3 could not

maintain this improvement after the intervention had finished, which might indicate having the space to reflect on activities and mood with a therapist is helpful but difficult when done independently, especially when MACES scores are low. Limited insight in participants may have been demonstrated on secondary ROMs too; parents in the current study were much more likely to report improvement compared to baseline at all timepoints in MDD and PedsQL scores.

When seen for their follow-up session, most participants suggested to the therapist that their ABI might have impacted their ability to keep a routine and track their daily activities, mainly due to difficulties with self-regulation and short-term memory; aligning with findings from Cantor et al. (2008) and Hart and Evans (2006). All participants and their parents also commented on how different their outcomes might have been had it not been for COVID-19 restrictions. For example, Participant 3 was unable to do his favourite activities: shopping and seeing his cousins. Repeating the current study in a post-COVID era might produce different results and is encouraged.

Hypothesis 2 predicted a reduction in the reported symptoms of depression in participants following BBA. The hypothesis was mostly supported by the MDD results. The evidence supporting the influence of activity levels on depression in this study is inconclusive. Only Participants 2, 4, and 5 could undergo visual and RT analysis for significant changes in MACES and there was a lack of significant change in MACES at post-treatment compared to baseline. Nevertheless, the mechanisms of increasing positive reinforcement, reducing negative reinforcement, and increased awareness of activities and their impact of mood (Reynolds & Pass, 2021) might well have had a significant impact on outcomes, as these were the main focus in sessions. When the previously discussed difficulties with insight in adolescents with

ABI are considered, perhaps MACES might not fully reflect increases in positive reinforcement and reductions in negative reinforcement. It could also be argued that participants benefited from having the space to discuss with a therapist how their mood and activity levels are linked. Watson et al. (2021) found that young people reported connecting with values and self-monitoring as playing an important role in managing anhedonia. This is further supported by participants' feedback in Table 6 of the current study.

Hypotheses 3 and 4 predicted an improvement in the participation and QoL of participants following BBA. Compared to baseline, participation scores showed no change for all participants and child QoL scores were variable at all timepoints; it is likely that QoL and participation scores were significantly impacted by the restrictions imposed by the UK Government in response to the COVID-19 pandemic. However, it is notable that parents' QoL scores showed reliable change for all participants and a very large effect size, which raises questions about participants' insight into their own QoL and what they value as determinants of QoL compared with their parents.

Study Limitations

The current study's MACES had a lot of missing data. Whilst activity monitoring is a key part of BBA, its use as an outcome measure may have been burdensome for participants. In sessions, participants sometimes reported filling in fewer activities to reduce the administrative burden or did not fill it in due to fatigue, forgetfulness or tedium; despite this, participants did not provide this as negative feedback in the TAQ. The daily monitoring of activities may also have resulted in fewer study participants, as many might have been put-off by the amount of data entry required.

It would have been difficult to investigate changes in MACES without recording daily activities; thus, to mitigate forgetfulness and fatigue, automatic daily reminders, increased contact with research interns through more regular supplementary phone calls, or encouraging specific rewards, particularly from parents, might have made data input more frequent. As activity monitoring is a key concept of BBA, these initiatives might have resulted in increased primary and secondary gains for participants too.

The study was delivered using live online video due to the COVID-19 pandemic. Whilst this improved the ability to recruit potential participants and deliver the intervention to a population whose services are hard-to-reach, this may disadvantage many adolescents from lower socioeconomic backgrounds, who may not have easy access to the Internet or the required software. It is notable that four out of five of the current study's participants were from the three highest IMD deciles. Using live online video for the intervention might have been exclusionary and results may not be representative of the wider population of adolescents with depression following ABI.

Due to an admin error, the parental version of the CASP was not collected. In line with Hypothesis 3's results, which demonstrated reliable change in PedsQL scores reported by parents but not by the participants, a similar effect might have been observed for the CASP had the data been collected.

Study Strengths and Future Directions

This is the first study to investigate the efficacy of BBA for treating depression in adolescents with ABI. The SCED methodology was the most appropriate method, as it provides a robust insight into how the intervention can be applied in clinical settings for less common presentations (Morley, 2017). This is particularly

appropriate given the availability of BBA across England and its cost-effectiveness (Pass et al., 2018; Richards et al., 2016). The study adhered closely to the protocol that would typically be delivered in NHS services, meaning the study allows for a close exploration of how adolescents with ABI respond to typical care for adolescents with depression. Future research could build on the current study by similarly investigating BBA for a wider range of neurological conditions, or perhaps consider a more powerful, controlled trial with a larger number of adolescent participants with depression following ABI. Once COVID-19 restrictions are lifted, a repeat of this study might produce different results, as adolescents will be able to continue with their usual activities.

The study's use of live online video meant the intervention could be rolled out to a population that typically does not have access to many services at all, regardless of socioeconomic status. This meant the current study could be delivered from a small hamlet in mid-Devon to as far as south-west Scotland. The successful delivery and acceptability of this intervention adds to current research into the feasibility of online neuropsychology service delivery (Bennett et al., 2021); future studies or established therapy providers could consider live online delivery of interventions for adolescents with ABI, whose services are typically hard-to-reach. Though, considerations must be made to ensure inclusivity for those from lower socioeconomic backgrounds too.

Theoretical Implications

The findings of the current study support the behavioural theoretical underpinnings of depression (Jacobson et al., 1996; Lewinsohn, 1974; Skinner, 1938) and BBA (Reynolds & Pass, 2021) in the context of adolescents with ABI. By encouraging participants to recognise 'problematic' patterns, which may have been

as a result of ABI sequelae (Cook et al., 2008; Renaud et al., 2018; van Markus-Doornbosch et al., 2019), participants were able to make changes to their daily lives by introducing or focusing on valued activities that provided positive reinforcement (Clarke & Oates, 1995; Goodyer et al., 2000). Future research could investigate the behavioural mechanisms targeted by BBA in a controlled trial, possibly investigating MACES as a mediator for treatment gains in depression in adolescents with ABI.

Clinical Implications

Adolescents with ABI should be routinely screened for depression following recovery from ABI, due to high prevalence rates (Hendry et al., 2020; Schachar et al., 2015). They should also be able to access mainstream low-intensity interventions such as BBA with minor adjustments recommended by the author, such as more sessions, frequent check-in phone calls, and brief mid-session breaks. As discussed, the findings suggest that having the space to reflect on and discuss emotions, mood and how they impact on activity levels may be a potentially useful intervention in itself (Table 6; Watson et al., 2021). More research is needed before drawing more definitive conclusions.

For now, services and charities for ABI might consider trialling BBA in their own services, with robust service evaluation to explore its efficacy, acceptability and feasibility in their specific settings. As the prevalence of depression in CYP with ABI is high (Hendry et al., 2020; Schachar et al., 2015) and BBA is a relatively cost-effective therapy compared to most other therapies, this might be a worthwhile investment for ABI services and charities. The demonstrated improvements in QoL as reported by participants' parents might also mean BBA could be useful even if depression is not necessarily the target problem, as it mainly focuses on regulation and valued activities.

Conclusion

The current study has provided support for BBA as a suitable and acceptable intervention for adolescents with depression following ABI. MACES findings were mixed, with significant individual improvements in either ‘closeness’ or ‘enjoyment’ for three participants who were suitable for analysis. However, the overall study findings suggest that focusing on valued activities, increasing positive reinforcement and reducing negative reinforcement, and how these mechanisms link to mood had a positive effect on every participant’s depression scores and parent-reported QoL. Given the likely impact of the COVID-19 pandemic on the outcomes of this study, these results are promising and should be investigated further in research and clinical practice.

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Appendices

Appendix A: Brief Behavioural Activation Protocol

Table 1

Structured session overview of BBA for adolescent depression, taken from Pass, Lejuez, & Reynolds (2018).

Session	Young person content	Parent content	Homework
1	Introduction to BBA approach and rationale, session workbook.	Attend part of session (rationale, structure of BBA), parent workbook.	Activity log.
2	Review of BBA approach, review of activity log, session workbook.	Parent workbook.	Activity log.
3	Review of activity log, introduction to values, session workbook.	Parent workbook.	Activity log, values.
4-5	Review of values, plan valued activities across life areas, session workbook.	Parent workbook.	Valued activities.
6	Review of progress, introduction to problem-solving and contracting, session workbook.	Attend part of session (review, problem-solving, contracts), parent workbook.	Valued activities.
7	Review of progress, identification of activities to continue working towards, session workbook.	Parent workbook.	Valued activities.
8	Review of progress, relapse prevention, session workbook, relapse prevention handout.	Attend part of session (review, relapse prevention), parent workbook.	
Review	Review of progress, plan for further input/discharge.	Attend part of review.	

Table 2

Overview of delivery media for each point of contact for participants.

Week	Form of contact	Medium
1	Introduction to study Provision of all study materials Supplementary data support	Live online video E-mail/post Telephone
2	Supplementary data support	Telephone
3	BBA sessions (x2) Supplementary data support	Live online video Telephone
4	BBA sessions (x2) Supplementary data support	Live online video Telephone
5	BBA session Supplementary data support	Live online video Telephone
6	BBA session Supplementary data support	Live online video Telephone
7	BBA session Supplementary data support	Live online video Telephone
8	BBA session (final) Supplementary data support	Live online video Telephone
9	Supplementary data support	Telephone
13*	Follow-up session Debrief forms	Live online video E-mail/post

Note. Week 13 will not be included in data collection.

Appendix B: Brief Behavioural Activation Checklist Example

Brief BA Session 1 Checklist

ID/Client initials:

Date:

Brief BA Session 1 Checklist	
Complete?	**Task**
	Introductions (introduce self, ask young person preferred name, outline session and length, agree how to split time with young person and parent but also with young person alone)
	Explain audio/video recording and complete consent form(s) as applicable
	Turn audio/video recorder on
	Explain confidentiality, limits to this (if risk of harm to young person or others)
	Anything in particular to make time for today? Details:
	Explain use of ROMs and how they inform therapy
	Complete ROMs: • Young person symptom questionnaire (e.g. RCADS Depression Subscale + Risk Q, or full RCADS if not done recently) • Young person functioning/quality of life questionnaire (e.g. ORS) • Parent report of young person symptom questionnaire (e.g. RCADS Depression Subscale + Risk Q, or full RCADS if not done recently) • Parent report of young person functioning/quality of life questionnaire (e.g. ORS)
	Risk discussion and check on changes since assessment
	Safety plan review
	Introduce Brief BA
	Overview of depression: explore current symptoms
	Ask about possible triggers
	Explain Brief BA maintenance cycle
	Set goals and rate them on 0–10 scale (or if already completed, review and rate)
	Introduce activity log
	Fill in activity log for day before
	Agree homework: complete activity log, read worksheets
	Photocopy completed young person's session worksheets
	Give young person session worksheets to take away
	Give parent session worksheets to take away
	Confirm next session date, time, location
	Young person session feedback questionnaire (e.g. SRS)
	Parent session feedback questionnaire (e.g. SRS)

After Session 1	
Complete?	**Task**
	Upload audio/video recording and delete from device
	Score young person and parent ROMs (if not done in session)
	Outcome electronic diary appointment (if applicable)
	Electronic or paper session record: ROMs, risk, attendees, content, homework, next appointment
	Upload completed session worksheets and ROMs to electronic records (if applicable)
	Diary appointment for next session
	Prepare to discuss in supervision
	Book room for next session

Appendix C: Brief Behavioural Activation Training Statement

The author and main researcher of the current study, who was also the therapist who delivered Brief Behavioural Activation (BBA), attended training on Brief Behavioural Activation for a full day on Thursday 14th November 2019 as part of the PGCert Low Intensity Cognitive Behavioural Therapy for Children, Young People and Families at the University of Exeter. This training day was taught by Dr Laura Pass, one of the joint creators of BBA. The author received a satisfactory sign-off by Dr Laura Pass upon the completion of training.

Appendix D: Data Collection Protocol Statement

Primary routine outcome measures (Mean Achievement, Closeness and Enjoyment Scores; MACES) were collected by research interns, Horatio Price and Janelle Lin, who had received safeguarding, risk management and data collection training. At the time, Horatio was completing a Master's degree in psychology at the University of Bath and Janelle was completing an undergraduate in psychology at the University of Exeter. The author and main researcher supervised data collection and supplementary phone calls to participants but was not involved with recording MACES data.

In line with guidance from the Association of Clinical Psychologists UK (Snell & Ramsden, 2020) on the exploitation of unpaid psychology staff, the research interns were routinely surveyed for satisfaction with their involvement and their time commitment was checked to ensure they did not spend more than three hours per week working on their responsibilities in the study. Both interns reported satisfactory involvement.

Reference:

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Appendix E: Participant Information Sheets

Younger Adolescent Participant Information Sheet (12-15)

Name of department:
Clinical Education Development and Research (CEDAR)

Title of the study:
Evaluating Brief Behavioural Activation for depression in adolescents with acquired brain injury: A Single-case Experimental Design study

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What is the study trying to do?

We are trying to see if a type of therapy called 'Behavioural Activation' is helpful for young people who have been feeling depressed because of their brain injury. We want to see if Behavioural Activation makes you feel more like doing things with other people and to see if it helps you feel happier about life.

How can we find this out?

We will be checking to see how much you enjoy activities that you decide with your therapist by asking you to 'score' them every now and then. We will see if these scores get better once you have had some therapy. If your scores are better after therapy, this should mean that you feel better than you usually do.

What is 'Behavioural Activation'?

Behavioural Activation is a type of treatment that helps people to learn ways of planning and doing activities they enjoy. Sometimes, when we are feeling down, we might not be able to do these activities as much as we would like because we just don't feel like it. Behavioural activation will help you to feel more able to do these activities, so you start to feel happier.

If you want to learn more, you can speak to your parent or ask the researcher for some more information over the telephone.

How long does the study last?
The study will last for 9 weeks from the beginning to the end. We will have one session 4 weeks after therapy to check up and see how things have been.

What happens during the study?
At the start of the study, we will ask you to give us some scores for the activities you usually do. This will be over 2 weeks or more and you will not be having therapy during this time. You will meet with the therapist before you start doing this so he can tell you what you need to do and answer your questions.

During the 3rd week, the therapist (who is also the researcher) will start doing therapy with you. You will be told when you start therapy when you meet with the therapist. We have to make sure everyone's first session of therapy is mixed up to make sure we do the study properly.

Once you have started therapy, you will receive 8 sessions over 6 weeks. During the first 2 weeks, you will have 2 sessions per week. During the last 4 weeks, you will have 1 session per week.

What happens at the end of the study?
After therapy, you will carry on doing the things you have learnt without the therapist. The therapist will see you 4 weeks after you have finished to see how you are and whether you are feeling better. The therapist will also give you some questions to answer.

What questions will I have to answer?
The main thing that you have to do during the study is give 'scores' to your activities. You will have to do this at least 4 times a week on mixed days. We would be really happy if you managed to do this every day! You can do this on your smartphone or on the computer.

There are 3 other sets of questions you will need to do 4 times. One looks at your mood, one looks at how much you do things with other people, and one looks at how much you enjoy your life.

Your parents will be doing these questions too, so they can help you if you get stuck. The therapist will also make sure you know what you are doing when you meet him for the first time. He will also call you during the week to make sure you are doing the questions properly.

At the end of the study, the therapist will ask you questions about how you found the therapy. This is a chance to let the researcher know what was good and what could have been better.

What will this study help to do?
Most importantly, we hope the therapy will help you to feel happier, enjoy life more, and start doing more things with other people.

If the study goes well, we might be able to help other people like you. We can start training people to do this kind of therapy so it can be done in more places across the country. Your help in this study could mean that you help hundreds, maybe thousands of others like you!

Will therapy work for me?
At the moment, we are not sure; that is why we are doing this study. So far, we know that this therapy helps young people with depression but we are not sure about teenagers with low mood because of brain injury. We will be doing the same things in this study that has helped teenagers with depression who have not had a brain injury. So, hopefully, it could help you.

How will information about me be used and kept?
The researcher will be keeping some personal information about you to make sure they do the study properly. We will keep this information safe on a computer that nobody else can use. We will make sure this computer is in a safe place at the University of Exeter. The researcher will also keep some information on a memory stick with a password, which will be kept safe and hidden at the researcher's home. Only the

researcher, and their supervisor can see this information. Anything you write down on paper, or any information given to us on paper, will be kept in a locked filing cabinet at the University of Exeter.

One month after you see the therapist for the last time, the personal information will be taken away, which means nobody can see it. But the 'scores' you give will be kept in a safe online place forever. Nobody will know these are your scores and nobody will know that you took part in this study. But anyone will be able to see the scores that you have given if they want to learn more about the study. If we do not think the study is right for you and you do not take part, any information you have given to the researcher will be destroyed no more than a week after you have given us this information.

This study might be shared with other people around the world in something called a 'journal', which is what other people doing studies or learning about studies might read. Nobody will ever know you took part and they will not know that the scores they see in the study are yours. We share studies so that other researchers can use this information to do more studies.

Will anyone find out about things I've said?
The therapist will try not to share most things you tell him. But there may be a time where he worries that you are not safe or need some more help. If this happens, he might have to tell other people that he is worried so you can get the help you need. The researcher will try to make sure you know if he is going to share any information you have given him.

A notice for your parent(s)
The University of Exeter processes personal data for the purposes of carrying out research in the public interest. The University will endeavour to be transparent about its processing of your personal data and this information sheet should provide a clear explanation of this. If you do have any queries about the University's processing of your personal data that cannot be resolved by the research team, further information may be obtained from the University's Data Protection

Officer by emailing dataprotection@exeter.ac.uk or by visiting the data protection webpage at www.exeter.ac.uk/dataprotection.

I would like to take part in the study! What do I do?

If you would like to take part in the study, you will first need to go through 'screening'. Screening is where we check if the study is right for you. Before you go through screening, you or your parent(s) must let the researcher know that you are happy to take part by filling out a form together.

When we do 'screening', we will ask your parents for some information about your brain injury. You will also be given questions to answer about your mood. If we think the study is right for you, we will tell you that you can take part within a week. You can then decide whether you would like to have some therapy to help with your mood. If we do not think the study is right for you, we will tell you within a week. Nothing bad will happen if you do not want to take part.

If you do want to take part, you or your parents will be asked to sign another form together. You must sign this form if you want to take part.

If you would like some more information about 'screening', please ask the researcher.

What if I do not want to do the study or carry on with therapy anymore?

If you do not want to do the study, you do not have to. If you start the study and do not want to do therapy anymore at any point, you also do not have to continue. You can either tell your parent(s)/guardian to tell the researcher or the supervisor, or you can tell the researcher yourself. You will not be punished and you will not be stopped from having any other therapy again. You can tell the researcher or the supervisor by e-mailing them at the e-mail addresses below.

If you want, you can also ask the researcher to get rid of the information you have given to them. You will only be able to do this for up to a month after your final follow-up session has happened. This is because the personal information you give to us will be gone after a month, which means we will not know which 'scores' from the questions are yours. The researcher must follow instructions from the University of Exeter, which means other people make sure he is doing things properly and fairly.

I have questions about this study – who do I contact?
You can contact the main researcher, Conor O'Brien (Trainee Clinical Psychologist) at any time before, during, and after the study by e-mailing: co359@exeter.ac.uk

If you have any concerns or complaints about the researcher, or do not want to carry on with the study, you can contact the main researcher's supervisor, Dr Anna Adlam (Chartered Clinical Psychologist & Deputy Director of Research for Clinical Psychology training), by e-mailing: a.r.adlam@exeter.ac.uk

For any further information about the university's ethical procedures and policies, or to raise any concerns or complaints about the research, please contact Dr Nick Moberly, the Chair of Psychology Ethics, by e-mailing: n.j.moberly@ex.ac.uk

Thank you for your time and for seeing if you would like to take part in the study!

Conor O'Brien
Trainee Clinical Psychologist, University of Exeter, under the supervision of:
Professor Anna Adlam
Chartered Clinical Psychologist/Associate Professor
Deputy Director of Research, DClinPsy, University of Exeter

Participant Information Sheet for Parent and Older Adolescent (16+)

Name of department:
Clinical Education Development and Research (CEDAR)

Title of the study:
Evaluating Brief Behavioural Activation for depression in adolescents with acquired brain injury: A Single-case Experimental Design study

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What is the aim of the study?
The main aim of the study is to evaluate the effectiveness of Brief Behavioural Activation (BA) for treating symptoms of depression in adolescents with acquired brain injury (ABI). We are also looking to evaluate whether BA can improve:

- The participation levels of adolescents with ABI;
- The quality of life (QoL) of adolescents with ABI.

How will this be measured?
The study will try to see if you respond well to BA by looking carefully at the scores of several questionnaires, known as routine outcome measures (ROMs). ROM scores before you receive BA will be compared with ROM scores after you have received BA. If you respond well to BA, we should notice a 'significant' difference in scores, and you should notice that you are feeling better than normal.

What is BA?
BA is a behavioural intervention that is shown to be effective for adults, adolescents and children in supporting them with their low mood. Research suggests that structured and meaningful activities can help with low mood. The main purpose of BA is to help the individual to start doing activities that are meaningful to them. The therapist will do this by identifying the individual's current activity pattern, considering how this affects the individual's mood, encouraging the individual to introduce a more structured or new routine, and seeing the individual through to doing this independently in their own lives.

If you would like to learn more, please see the 'Brief BA Study Information' sheet.

How long does the study last?
The study will last for 9 weeks from the beginning to the end. There will be a one-off follow-up session 4 weeks after you have completed BA.

What happens in the 9-week study period?
At the beginning of the study, there is a minimum 2-week period where you will be asked to do some tasks without receiving any BA. You will meet with the researcher before this period starts in an introductory session, so he can talk about the tasks that you will be doing and answer any questions you might have.

During the 3rd week, you will be asked to begin BA at a random point. You will be told in advance when you will start BA. The reason why we start at random times is to make sure we know we are doing the study properly.

Once you have started BA, you will receive 8 sessions over 6 weeks. During the first 2 weeks, you will have 2 sessions per week. During the last 4 weeks, you will have 1 session per week.

What happens at the end of the study?
After you have completed your treatment, you will be left to continue with your life normally. The main researcher will set up a follow-up session, which will be done 4 weeks after you are finished. This is for the research team to check how you are and whether you have been feeling better. They will also give you some questionnaires to complete.

What questionnaires will I have to do?
There will be 1 main questionnaire, called the Mean Daily Achievement, Closeness and Enjoyment Scale (MACES), which you will complete every day of the week for the whole study. This can be done using a smartphone or a web browser to make it easier. Don't worry - it only takes a minute to complete!

There will be 3 other questionnaires that you will be completing 4 times during the study. These are to help the researcher to learn a bit more about how BA helps. They are:

- Revised Children's Anxiety and Depression Scale (RCADS)
    - Depression Subscale
- Child and Adolescent Scale of Participation (CASP)
- Paediatric Quality of Life Inventory (PedsQL)

Your parents will also need to complete these questionnaires. They will be asked slightly different questions from you but the reasons for the questionnaires are the same.

Information about all the questionnaires will be given to you in the introductory session. The researcher will call you during the week to check if you have had any problems with completing the MACES questionnaire.

At the end of the study, you will be given a Treatment Acceptability Questionnaire (TAQ), which gives you a chance to tell the researcher about anything you found helpful or not so helpful during BA.

What will this study help to do?
Most importantly, we are hoping that BA will help you to have less symptoms of depression, improve your QoL, and help you to feel more able to participate at home, school and in other situations.

This study will also help us to see if BA is a good enough therapy to be researched further. If we can research it further, we might be able to offer more adolescents with ABI some support for their symptoms of depression. Because BA is much easier and cheaper to do than other therapies, there is a chance that it could be used in the NHS in the future for more people. Your help in this study could mean that you help hundreds, maybe thousands of others like you!

Will BA work for me?
At the moment, we are not sure; that is why we are doing this study. Recent research has shown that BA has been effective for adolescents with depression in general. We are going to be using the same schedule and techniques as this study in the hope that it will be effective for adolescents with ABI too.

How will my data be used and kept?
The data the researcher collects from you must be kept by the researcher in order to do the study. Some of the information you give us will be 'identifiable', which means we can link it to you and we know whose data it is. This is important because the researcher needs to know how you are getting on and will need to contact you from time to time! This data will be kept safe on a computer with a strong password, which is kept in a safe place at the University of Exeter. This data will also be stored on a safe online storage facility and a memory stick, which also have passwords. The memory stick will be kept in a safe place at the researcher's home. The researcher and their supervisor are the only people who can see this information and know the passwords. Any information that is given to the researcher on paper will be kept in a locked filing cabinet at the University of Exeter.

Once we have collected all the information we need by the end of the study's follow-up session, the data will be 'anonymised' within 1 month. Any identifiable data will be destroyed by this point. This means that the data will be disconnected

from you because we do not need to know which information is yours anymore. The anonymised data will be kept in the same way that your identifiable data was kept. It will also be kept forever in an online 'repository', which is a place for others to see anonymous information if they need to learn more about the study. If we do not think the study is right for you and you do not take part, any information you have given to the researcher will be destroyed within a week of data collection.

It is likely that the study will be 'published'. This means that the study will be written-up and shared online and in academic journals. The data will stay anonymous and cannot be linked to you in any way. This is so that other researchers can use this information to do more studies.

Will anyone find out about things I've said?
We will keep everything you tell us as confidential as possible. However, sometimes we might be concerned about your safety or the safety of others. If that is the case, we might have to share information to make sure you get the support you need. The researcher will try to make sure you know beforehand if he decides to share any confidential information.

A notice for your parent(s)
The University of Exeter processes personal data for the purposes of carrying out research in the public interest. The University will endeavour to be transparent about its processing of your personal data and this information sheet should provide a clear explanation of this. If you do have any queries about the University's processing of your personal data that cannot be resolved by the research team, further information may be obtained from the University's Data Protection Officer by emailing dataprotection@exeter.ac.uk or by visiting the data protection webpage at www.exeter.ac.uk/dataprotection.

I would like to take part in the study! What do I do?
If you would like to take part in the study, you will first need to go through 'screening'. Screening is where we check if you are suitable for the study. Before you go through screening, you or your parents must give consent using the Informed Consent for Screening Form.

For the screening procedure, you will be asked for evidence of your ABI. You will then be given the full RCADS questionnaire to complete. If you have an ABI and your RCADS score is above 65, you will be able to take part in the study. If your score is too low, then you cannot take part.

If you are invited to take part, you or your parents will be asked for consent to receive BA using the Participant Consent form if you are over 16, or the Child

Assent and Parental Consent Form if you are under 16. The relevant form must be signed before you can receive BA.

If you would like some more information about the 'screening procedure', please ask the researcher.

What if I do not want to do the study or carry on with BA anymore?
If you do not want to do the study, you do not have to. If you start the study and do not want to do BA anymore at any point, you also do not have to continue. You can either tell your parent(s)/guardian to tell the researcher or the supervisor, or you can tell the researcher yourself. You will not be punished nor stopped from having any other treatment again. You can tell the researcher or the supervisor by e-mailing them at the e-mail addresses below.

If you want, you can also remove your data from the study. You will only be able to do this for up to a month after your final follow-up session is completed. This is because your data will be anonymised after this point and the researcher will not know what data is yours.

The researcher is 'bound' by ethical guidelines outlined by the University of Exeter, which means they have to follow a very strict policy to make sure you are being treated fairly.

I have questions about this study – who do I contact?
You can contact the main researcher, Conor O'Brien (Trainee Clinical Psychologist) at any time before, during, and after the study by e-mailing: co359@exeter.ac.uk

If you have any concerns or complaints about the researcher, or wish to withdraw without speaking to the researcher, you may contact the main researcher's supervisor, Dr Anna Adlam (Chartered Clinical Psychologist & Deputy Director of Research for Clinical Psychology training), by e-mailing: a.r.adlam@exeter.ac.uk

For any further information about the university's ethical procedures and policies, or to raise any concerns or complaints about the research, please contact Dr Nick Moberly, the Chair of Psychology Ethics, by e-mailing: n.j.moberly@ex.ac.uk

Thank you for your time and for considering taking part in this study.

Conor O'Brien
Trainee Clinical Psychologist, University of Exeter, under the supervision of:

Dr Anna Adlam
Chartered Clinical Psychologist/Associate Professor
Deputy Director of Research, DClinPsy, University of Exeter

Appendix F: Consent/Assent to Screening Forms

Evaluating Brief Behavioural Activation for depression in adolescents with acquired brain injury: A single-case design protocol

SCREENING ASSENT FORM FOR YOUNG PEOPLE (aged 12-15)

To be completed alongside the Screening Consent Form for Parents

Chief Investigator: Conor O'Brien, Trainee Clinical Psychologist, University of Exeter, UK
Research Supervisor: Professor Anna Adlam, University of Exeter, UK

1. I have read the information sheet made on June 2020 and know what will happen in the study.
2. I have had the chance to ask questions about this screening session and the questions I have asked have been answered properly.
3. I understand that I am choosing to do the study for myself and I can stop the study whenever I want to without worrying about being treated unfairly.
4. I understand that the information I give to the researcher will be kept safe and will not be shared with anyone other than researchers in the study team.
5. I understand that information that can be linked to me will be deleted within a week if the study is not right for me.
6. I am happy for the research team to keep my contact details so I can be told about the results of the study.
7. I understand that the study might not be right for me and that I might not need to have the treatment.
8. I am happy to do the screening session to see if the study is right for me.

I agree to points 1-8 above.*	☐
I agree that my contact information can be kept safe and be used by researchers from the University of Exeter to contact me about future research projects.	☐
Participant first name*	Click here to enter text.
Participant surname*	Click here to enter text.
Name of parent/guardian*	Click here to enter text.
Date form completed	Click here to enter text.

Evaluating Brief Behavioural Activation for depression in adolescents with acquired brain injury: A single-case design protocol

SCREENING CONSENT FORM FOR ADULTS

To be completed alongside the Screening Assent Form for Young People (aged 12-15)

Chief Investigator: Conor O'Brien, Trainee Clinical Psychologist, University of Exeter, UK
Research Supervisor: Professor Anna Adlam, University of Exeter, UK

1. I confirm that I have read the information sheet dated June 2020 and understand what is expected of my child in this study.
2. I confirm that I have had opportunities to ask questions about this screening procedure and that these have been answered sufficiently.
3. I understand that my child is participating on a voluntary basis and is free to withdraw at any time without consequence.
4. I understand that the information about my child will be kept confidential and may only be viewed by members of the research team.
5. I understand that all collected information about my child will be anonymised and that there will be no identifiable information published following this study.
6. I understand that any identifiable data will be destroyed within a week if my child's participation in the study is not suitable.
7. I agree that my contact details can be kept securely for the research team to contact me and my child about the findings of the study.
8. I understand that the screening procedure may deem my child unsuitable for the study and they therefore might not receive the intervention.
9. I give my consent for my child to participate in the screening procedure for this study.

I agree to points 1-9 above.*	☐
I agree that my contact information can be kept safe and be used by researchers from the University of Exeter to contact me about future research projects.	☐
Participant first name*	Click here to enter text.
Participant surname*	Click here to enter text.
Name of parent/guardian*	Click here to enter text.
Date form completed	Click here to enter text.

Evaluating Brief Behavioural Activation for depression in adolescents with acquired brain injury: A single-case design protocol

SCREENING CONSENT FORM FOR YOUNG PEOPLE (aged 16-18)

Chief Investigator: Conor O'Brien, Trainee Clinical Psychologist, University of Exeter, UK
Research Supervisor: Professor Anna Adlam, University of Exeter, UK

1. I have read the information sheet made in June 2020 and know what will happen in the study.
2. I have had the chance to ask questions about this screening session and the questions I have asked have been answered properly.
3. I understand that I am choosing to do the study for myself and I can stop the study whenever I want to without worrying about being treated unfairly.
4. I understand that the information I give to the researcher will be kept safe and will not be shared with anyone other than researchers in the study team.
5. I understand that identifying information will be deleted within a week if the study is not suitable for me.
6. I agree to the research team keeping my contact details so I can be told about the results of the study.
7. I understand that the study might not be suitable for me, in which case, I will not need to receive the treatment.
8. I agree to participate in the screening session to see if the study is suitable for me.

I agree to points 1-8 above.*	☐
I agree that my contact information can be used by researchers from the University of Exeter to contact me about future research projects.	☐
Participant first name*	Click here to enter text.
Participant surname*	Click here to enter text.
Date form completed	Click here to enter text.

Appendix G: Consent/Assent to Intervention Forms

Evaluating Brief Behavioural Activation for depression in adolescents with acquired brain injury: A single-case design protocol

INTERVENTION ASSENT FORM FOR YOUNG PEOPLE (aged 12-15)

To be completed alongside the Intervention Consent Form for Parents

Chief Investigator: Conor O'Brien, Trainee Clinical Psychologist, University of Exeter, UK
Research Supervisor: Professor Anna Adlam, University of Exeter, UK

Key words
Contact information: information we can contact you with.
Health information: information about your health that is used for the study.
Personal information: information that is linked to your health information.

1. I have read the information sheet made in Sept 2020 (v2) and know what will happen in the study.
2. I have had the chance to ask questions about the treatment and the questions I have asked have been answered properly.
3. I understand that I am choosing to do the treatment for myself and I can stop the study whenever I want to without worrying about being treated unfairly.
4. I understand that the **contact** information I give to the researcher will be kept safe and will not be shared with anyone other than researchers in the study team.
5. I understand that **personal** information given to the researcher will be deleted a month after my last session with the researcher.
6. I understand that once my **personal** information is deleted, the researchers will not know which **health** information is mine and thus they cannot delete it if I ask them to.
7. I understand that the **health** information I give the researcher will not be linked to my **personal** information once the study is published.
8. I agree to the research team keeping my **contact** details so I can be told results of the study.
9. I agree to take part in the study and have the treatment.

I agree to points 1-9 above.*	☐
I agree that my contact information can be kept safe and be used by researchers from the University of Exeter to contact me about future research projects.	☐
Participant first name*	Click here to enter text.
Participant surname*	Click here to enter text.
Name of parent/guardian*	Click here to enter text.
Date form completed	Click here to enter text.

Evaluating Brief Behavioural Activation for depression in adolescents with acquired brain injury: A single-case design protocol

INTERVENTION CONSENT FORM FOR PARENTS

To be completed alongside the Intervention Assent Form for Young People (aged 12-15)

Chief Investigator: Conor O'Brien, Trainee Clinical Psychologist, University of Exeter, UK
Research Supervisor: Professor Anna Adlam, University of Exeter, UK

Key words
Contact information: details used to contact you and/or your child.
Health information: details about your child's health that are used for the study.
Identifiable personal information: personal details linked to your child's data which is used to identify your child's health information.

1. I confirm that I have read the information sheet dated September 2020 and understand what is expected of my child in this study.
2. I confirm that I have had opportunities to ask questions about this intervention and that these have been answered sufficiently.
3. I understand that my child is participating on a voluntary basis and is free to withdraw at any time without consequence.
4. I understand that the **identifiable personal** and **contact** information about my child will be kept confidential and may only be viewed by members of the research team.
5. I understand that all collected **health** information about my child will be anonymised and that there will be no **identifiable personal** information published following this study.
6. I understand that any **identifiable personal** data linked to my child's **health** data will be destroyed within a month of my child's final follow-up session, making it unidentifiable.
7. I understand that once this **identifiable personal** data is deleted, the researcher cannot delete my child's **health** information as they will not be able to identify my child's data.
8. I agree that my **contact** details can be kept securely for the research team to contact me and my child about the findings of the study.
9. I give my consent for my child to receive the intervention in this study.

I agree to points 1-9 above.*	☐
I agree that my contact information can be kept safe and be used by researchers from the University of Exeter to contact me about future research projects.	☐
Participant first name*	Click here to enter text.
Participant surname*	Click here to enter text.
Name of parent/guardian*	Click here to enter text.

Evaluating Brief Behavioural Activation for depression in adolescents with acquired brain injury: A single-case design protocol

INTERVENTION CONSENT FORM FOR YOUNG PEOPLE (aged 16-18)

Chief Investigator: Conor O'Brien, Trainee Clinical Psychologist, University of Exeter, UK
Research Supervisor: Professor Anna Adlam, University of Exeter, UK

Key words
Contact information: details used to contact you.
Health information: details about your health that are used for the study.
Identifying personal information: personal details linked to your data which is used to identify your health information.

1. I have read the information sheet made in September 2020 (v2) and know what will happen in the study.
2. I have had the chance to ask questions about the treatment and the questions I have asked have been answered properly.
3. I understand that I am choosing to do the treatment for myself and I can stop the study whenever I want to without worrying about being treated unfairly.
4. I understand that the **contact** information I give to the researcher will be kept safe and will not be shared with anyone other than researchers in the study team.
5. I understand that **identifying personal** information will be deleted within a month of completing the follow-up session.
6. I understand that once the **identifying personal** information is deleted, I cannot withdraw my **health** information from the study, as the researcher will not know which is mine.
7. I understand that the **health** information I give the researcher will not be linked to my **identifying personal** information once the study is published.
8. I agree to the research team keeping my **contact** details so I can be told about the results of the study.
9. I agree to receive the intervention.

I agree to points 1-9 above.*	☐
I agree that my contact information can be kept safe and be used by researchers from the University of Exeter to contact me about future research projects.	☐
Participant first name*	Click here to enter text.
Participant surname*	Click here to enter text.
Name of parent/guardian*	Click here to enter text.
Date form completed	Click here to enter text.

Appendix H: Risk Protocol and Contacts Sheet

MOOD DISORDERS CENTRE – UNIVERSITY OF EXETER
PROTOCOL FOR ASSESSING AND REPORTING RISK

The following principles and procedures govern risk assessment and reporting in the Mood Disorders Centre (MDC). The MDC does not manage risk. The protocol will be used for the "Evaluating Brief Behavioural Activation for depression in adolescents with acquired brain injury: A single-case experimental protocol" study.

General principles

MDC clinical academic faculty are responsible for risk assessment in their research programmes. This includes ensuring that staff, students and interns working with them receive adequate induction and training prior to participant contact in which risk could be disclosed and ongoing supervision during their research work.

Many of the research projects in the MDC will include supplementary and more detailed protocols for risk assessment.

General procedures

Background training materials are available on the shared directory. All staff should attend training in the use of this protocol as soon as is reasonably possible and attend training normally at least annually. If they undertake any work where risk may be an issue prior to receiving formal training, it is the PI's responsibility to ensure that they have reviewed all the materials and have received bespoke training.

Whenever any significant risk is identified a risk assessment should be completed and (counter-) signed by the responsible member of staff. If at all possible this should be done at the time of the assessment, or as soon afterwards as possible. This record should be kept on file in line with the Centre's or study's data storage procedures.

Any significant, but not imminent risk should be reported to the person's GP and, if appropriate, other health care professionals, as soon as is reasonably possible.

For research outside of the local area, PIs / supervisors should familiarise themselves with the local providers' risk procedures, and researchers should hold the relevant contact details needed in the case of immediate risk.

When clinical academic staff are away from the Centre they should ensure appropriate cover is arranged for any risk issues that might arise in their absence.

When conducting telephone interviews in which risk may be disclosed, the interviewer should establish the telephone number and location of the participant at the start of the call, and clarify the boundaries of confidentiality (as per trial / clinic protocol).

Urgent Help Information Sheet for Devon

Accident and Emergency/Urgent Care

If you feel like seriously hurting or killing yourself and you are struggling to manage these feelings, please go to your nearest A&E as soon as possible or call 999 and ask for the ambulance service.

EXETER / EAST DEVON	NORTH DEVON	PLYMOUTH / WEST DEVON
Royal Devon and Exeter Hospital Barrack Road Exeter EX2 5DW	North Devon District Hospital Raleigh Park Barnstaple EX31 4JB	University Hospitals Plymouth Crownhill Plymouth PL6 8DH

The Samaritans

The Samaritans are people who can speak to you about your feelings, especially if they are difficult. Calls are free from landlines and mobile phones. Nobody will know that you have called this number.

Telephone: 116 123

Childline

Childline help children and young people who feel unsafe and need help. They can also give you some counselling support if you're feeling low or anxious.

Telephone: 0800 1111 (from 9am – midnight every day)

NHS 111 service

You can call 111 when you need help if it's not a 999 emergency. NHS 111 is available 24 hours a day, 365 days a year. Calls are free from landlines and mobile phones.

Telephone: 111

Single Point of Access Devon

A support line for children if you need some help for your feelings as soon as possible. This team will ask you some questions about your feelings and see if they can help you.

Telephone: 03300 245 321

Exploring Risk in Research Interviews

THOUGHTS

"I see that you've said here (indicate question/response) that… Can you tell me a bit more about that?"
"I'm sorry that you've been feeling like this, that sounds very difficult. When people are feeling sad a lot, they can often have these kinds of thoughts and feelings. Sometimes though, that can make us think that they may need some extra support and so I'd like to ask a little bit more about the thoughts and feelings you've been having so I can check whether you're getting the right support."

PLANS

1 You told me that you wish you were dead. Have you thought about how you would kill yourself? Can you tell me about that? Yes / No

If **yes –** details

2 Do you have any plans to kill yourself? What are your plans? (note if time/place planned as well as method) Yes / No

If **yes –** details

ACTIONS

3 Have you done anything to get ready to kill yourself? What have you done? Yes / No

If **yes –** details

4 Have you ever tried to kill yourself before? Can you tell me when that was, and what happened? Yes / No

If **yes –** details

PREVENTION

5 Are there any things or people that stop you from killing yourself? Can you tell me more about that/them? Yes / No

If **yes –** details

6 Do you think there's a danger that you will take your own life?

Yes / No

Details:

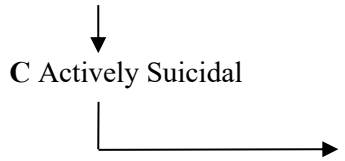
FOLLOW-UP FROM PREVIOUS CONTACT

7 **If Action B was enacted at previous assessment and level B risk is identified at current assessment**: Last time I saw you, we talked about these thoughts and feelings, and we talked about your paediatrician/GP seeing you to talk about this with you. Have they done this yet? Can you tell me what happened? Yes / No

See risk table overleaf for appropriate actions

Researcher Risk Protocol To be used following any indication of risk from questionnaire items, responses to interview questions or any other sources. Look at answers from the sheet to determine the level of risk, A B or C:

Actions by Researcher	***Tell Participant***
All answers 'no' apart from Q5 'yes':	
A	*I'm sorry that you've been having these thoughts about wishing you were dead, that must be really upsetting for you. From what you've told me, I think you are saying that these bad feelings wouldn't make you hurt yourself. Do you think I have got this right? (if they say yes) I think it would be a good idea for you to talk to parent/GP/paediatrician/clinical psychologist about this so they know how you've been feeling. Would you be able to do that do you think?* ***(as per trial protocol)****.*
'Yes' for any **one** of Qs 1-4; plus 'yes' for Q5 and 'no' for Q6	
B1	*It sounds like things are really hard for you at the moment and I think it would be helpful if you spoke to paediatrician/GP/clinical psychologist about the feelings you've been telling me about. I think it's important that your GP/paediatrician/clinical psychologist knows that you've been having these difficult thoughts, and so I'm going to send them a letter to let them know that we talked about this today. I also think it would be a good idea for you/parent/guardian to make a time for you to go and see them to talk to them about this. (****as per trial protocol).*
'Yes' for any **one** of Qs 1-4; plus 'yes' for Q5 and 'no' for Q6 **and** 'no' to Q7	*I think it's important that your GP/paediatrician/clinical psychologist knows how difficult things are for you at the moment. I'm going to give them a phone call to let them know that I'm worried about how you've been feeling and suggest that they see you to talk about this. I'm also going to suggest to parent/guardian that they make an appointment for you to go and see GP/paediatrician/clinical psychologist to talk about these feelings* ***(as per trial protocol****).N.B: telephone call to GP/paediatrician/clinical psychologist to be followed up by letter. The letter should include the statement "*the clinical management of this patient remains your responsibility, but it is part of our protocol to inform you of any risks disclosed to ourselves so that you can take account of them in your care plan.*"*
B2	
Scoring 'no' to Q5 or 'yes' to Q6	*I am very worried about your safety at the moment, and I would like you to talk to a clinician*



right now. I am going to make some phone calls now to your GP/paediatrician/clinical psychologist/Care Co-ordinator / Crisis Management team/the emergency services to let them know how you are feeling and to arrange for you to have help straight away.

Action to take in the case of immediate risk:
Participant needs immediate help – **do not leave them alone, or if on telephone, do not hang up**. Follow your trial's chain of supervisory clinical contact in order to involve supervisory clinician right away. Then either yourself or the supervisory clinician* should follow the chain of contact below:
1. GP / out of hours GP; if not
2.Crisis team; if not
3. Call ambulance; if this does not result in ambulance attending 4..Clinician accompanies to A&E (by taxi rather than private car)

**Individual projects should determine in advance whether clinician or researcher (with clinician support) enacts steps 1-4*

Appendix 1 Risk Report

Patient name: _____ DOB: _____

Suicide risk information:

Include whether the participant has reported any of the following:

- *History of previous suicide attempts*
- *Current suicidal ideation*
- *Relevant inventory scores (e.g., BDI item 9)*
- *Suicide plans / preparations*
- *Protective factors*
- *Regular contact with GP?*

Date reported: ___/___/___

Additional notes / actions taken:

*As part of the MDC risk protocol, suicide risk is **managed** by the patient's GP.*

Date action taken: ___/___/___

Researcher / assessor: _____ Signed: _____ Date: ___/___/___

Supervisor: _____ Signed: _____ Date: ___/___/___

Appendix I: Study Instructions Sheet

Study Instructions Sheet (12-15)

Name of department:
Clinical Education Development and Research (CEDAR)

Title of the study:
Evaluating Brief Behavioural Activation for depression in adolescents with acquired brain injury: A Single-case Experimental Design protocol

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During the introductory session

1) Please look at the Daily Activity Diary. The researcher will explain how to fill this out. If you forget, please see the instructions at the end of this document.
2) The researcher will talk you through how to use Qualtrics to upload your information.
3) You will have Brief Behavioural Activation explained to you.
4) Please feel free to ask any questions!

After the introductory session

1) Your therapist will tell you when it's time to start recording your activities using Qualtrics (you can see how to use this in the 'How to use Qualtrics' section below). Click here to upload your first daily activity log data!
2) Please remember to record your activities and the achievement, closeness and enjoyment scores every day up to your first session of Brief BA!
3) You will be reminded to put this data into your Qualtrics app because you will get a link every day in your email.
4) You will also be asked to fill out the following questionnaires:
    a. RCADS Depression Subscale
    b. CASP
    c. PedsQL

Preparing for your first session of BA

1) Please make sure you have your new Daily Activity Diary ready.
2) Remember to be in a place where you can use online live video and make sure it's nice and quiet!

Between each session

1) Make sure you do the homework that the researcher sets you.
2) Remember to keep filling in the Daily Activity Diary and put in your scores when you are asked. Click here to upload your daily activity log data!

Preparing for every BA session

1) Get the materials your therapist has asked you to prepare for the session ready, either on the computer or printed out.
2) Please make sure you have done your homework!

Preparing for your last session

1) Please make sure you have filled out the following questionnaires:
    a. RCADS Depression Subscale
    b. CASP
    c. PedsQL
    d. TAQ

During your last session

1) You will make a 'future plan' with your researcher. Please keep this somewhere safe and easy to remember!
2) You will arrange a follow-up session with your researcher.
3) You will be told how much longer you will need to complete your Daily Activity Diary for.

Preparing for your follow-up session

1) Please make sure you have filled out these questionnaires:
    a. RCADS Depression Subscale
    b. CASP
    c. PedsQL
2) Think about what you have learnt from BA and what you would like the researcher to know.

During the follow-up session

1) Your researcher will look at your questionnaires with you and ask you to think about how it all went.
2) Your researcher will recap on your 'future plan'.
3) Your researcher will let you know what happens next and what you can do if you need further support for your difficulties.

After the follow-up session

1) You will receive a 'Debrief Form', which tells you what has happened in the study, where you can find further reading, and what to do if you need more help.
2) Congratulate yourself on your hard work!

How to use Qualtrics

Qualtrics is the software we use to collect your data. You will be sent a link to click on to fill in your 'MACES' data. You don't need to download any software to use Qualtrics.

Daily questions

You can send in your daily data at any time during the week but we recommend doing it every day to get into the habit of it. You can click here to upload your daily activity log data! The form asks for 5 main things:

1) The date you are filling in the information for;
2) Your mood on the day;
3) The time of each activity;
4) What the activity was, who you did it with, and where;
5) How much achievement, closeness and enjoyment you got out of the activity.

To answer 1 and 4, you will need to type your answers. If you find this hard, please ask your parent to help. To answer 2 and 5, you will need to use a slider. You can use this by clicking and dragging the tool to the number that best describes your level of achievement, closeness and enjoyment. To answer 3, you will be given a drop-down list of times to select from. Try to select the closest time to what you have written in your diary!

You will also be asked whether you feel the activity was 'important' to you. You can click on the 'important' button if it was.

After you have filled in 3 activities, you will notice that a button saying 'I'm done!' comes up. You can click this if there are no more activities to fill in. If you have more, do not click this button and continue as normal.

How to use online video software

Your therapist will send you invitations to your sessions through your preferred email address. The therapist will use 'Zoom', which does not require downloading. However, to make the most of its features, you can download it here: https://zoom.us/download

Zoom will tell you what you need to do next and will provide you with a tutorial. If you're unsure on how to use Zoom, you can visit their support page at https://support.zoom.us/hc/en-us or e-mail Conor O'Brien at co359@exeter.ac.uk.

If you are unsure…
Please e-mail the researcher, Conor O'Brien, at co359@exeter.ac.uk if you have any questions or need support.

If you would like to ask someone else a question, please e-mail the researcher's supervisor, Professor Anna Adlam, at a.r.adlam@exeter.ac.uk

Study Instructions Sheet (16-18 and parent)

Name of department:
Clinical Education Development and Research (CEDAR)

Title of the study:
Evaluating Brief Behavioural Activation for depression in adolescents with acquired brain injury: A Single-case Experimental Design protocol

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During the introductory session

1) Please observe the Daily Activity Diary. The researcher will explain how to fill this out. If you forget, please see the instructions at the end of this document.
2) The researcher will talk you through how to use Qualtrics to upload your data.
3) You will have Brief Behavioural Activation explained to you.
4) Please feel free to ask any questions!

After the introductory session

1) Your therapist will tell you when it's time to start recording your activities using Qualtrics (you can see how to use this in the 'How to use Qualtrics' section below). Click here to upload your first daily activity log data!
2) Please remember to record your activities and the achievement, closeness and enjoyment scores every day up to your first session of Brief BA!
3) You will be reminded to put this data into your Qualtrics app because you will get a link every day in your email.
4) You will also be asked to fill out the following questionnaires using Qualtrics:
    a. RCADS Depression Subscale
    b. CASP
    c. PedsQL

Preparing for your first session of BA

1) Please make sure you have your new Daily Activity Diary ready.
2) Remember to be in a place where you have access to online live video and make sure it's nice and quiet!

Between each session

1) Make sure you do the homework that the researcher sets you!
2) Remember to keep filling in the Daily Activity Diary and report your scores when you are asked. Click here to upload your daily activity log data!

Preparing for every BA session

1) Get the materials your therapist has asked you to prepare for the session ready, either on the computer or printed out.
2) Please make sure you have done your homework!

Preparing for your last session

1) Please make sure you have filled out the following questionnaires:
    a. RCADS Depression Subscale
    b. CASP
    c. PedsQL
    d. TAQ

During your last session

1) You will make a maintenance plan with your researcher. Please keep this somewhere safe and easy to remember!
2) You will arrange a follow-up session with your researcher.
3) You will be told how much longer you will need to complete your Daily Activity Diary for.

Preparing for your follow-up session

1) Please make sure you have filled out the following questionnaires:
    a. RCADS Depression Subscale
    b. CASP
    c. PedsQL
2) Think about what you have learnt from BA and what you would like the researcher to know.

During the follow-up session

1) Your researcher will review your questionnaires and ask for your reflections on your treatment.
2) Your researcher will recap on your maintenance plan.
3) Your researcher will let you know what happens next and what you can do if you need further support for your difficulties.

After the follow-up session

1) You will receive a Debrief Form, which explains what has happened in the study, where you can find further reading, and what to do if you need more support.
2) Congratulate yourself on your hard work!

How to use Qualtrics

Qualtrics is the software we use to collect your data. You will be sent a link to click on to fill in your 'MACES' data. You don't need to download any software to use Qualtrics.

Daily questions

You can send in your daily data at any time during the week but we recommend doing it every day to get into the habit of it. You can click here to upload your daily activity log data! The form asks for 5 main things:

1) The date you are filling in the information for;
2) Your mood on the day;
3) The time of each activity;
4) What the activity was, who you did it with, and where;
5) How much achievement, closeness and enjoyment you got out of the activity.

To answer 1 and 4, you will need to type your answers. If you find this hard, please ask your parent to help. To answer 2 and 5, you will need to use a slider. You can use this by clicking and dragging the tool to the number that best describes your level of achievement, closeness and enjoyment. To answer 3, you will be given a drop-down list of times to select from. Try to select the closest time to what you have written in your diary!

You will also be asked whether you feel the activity was 'important' to you. You can click on the 'important' button if it was.

After you have filled in 3 activities, you will notice that a button saying 'I'm done!' comes up. You can click this if there are no more activities to fill in. If you have more, do not click this button and continue as normal.

How to use online video software

Your therapist will send you invitations to your sessions through your preferred email address. The therapist will use 'Zoom', which does not require

downloading. However, to make the most of its features, you can download it here: https://zoom.us/download

Zoom will tell you what you need to do next and will provide you with a tutorial. If you're unsure on how to use Zoom, you can visit their support page at https://support.zoom.us/hc/en-us or e-mail Conor O'Brien at co359@exeter.ac.uk.

If you are unsure…
Please e-mail the researcher, Conor O'Brien, at co359@exeter.ac.uk if you have any questions or need support.

If you would like to ask someone else a question, please e-mail the researcher's supervisor, Professor Anna Adlam, at a.r.adlam@exeter.ac.uk

Appendix J: Study Debrief Sheets

Study Debrief Form

Name of department:
Clinical Education Development and Research (CEDAR)

Title of the study:
Evaluating Brief Behavioural Activation for depression in adolescents with acquired brain injury: A Single-case Experimental Design study

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Thank you for taking part in this study. We really appreciate the time and effort you have put into this research.

You have just given us important information about how BA works for adolescents with ABI who have experienced symptoms of depression. We will also be looking at whether it has improved your QoL and participation levels. This could make some important changes to what support adolescents with ABI are given in the future!

Please be reminded that the information you have given us can still be linked to you for the next calendar month, up until 15th May 2021. After this date, this 'identifiable' information about you will be destroyed and the data we have collected from you cannot be linked to you. All the information you have given to us will be kept safe on the password-protected computer and secure online drive, and will not be shared with anybody.

If you do not want us to use your information anymore, that is fine. Please e-mail the researcher, Conor O'Brien (co359@exeter.ac.uk) or their supervisor (a.r.adlam@exeter.ac.uk) if you want your data to be removed.

If you are concerned about anything in this study, and would like to check that it sticks to ethical guidelines, you can also contact the 'Chair of Ethics', Dr Nick Moberly at: n.j.moberly@exeter.ac.uk.

You have opted to hear about future studies that you might be interested in participating in. If anything comes up, we will email you. If you do not wish to be contacted, please email Conor (co359@exeter.ac.uk).

Once again, thank you for your help in this study.

Conor O'Brien
Trainee Clinical Psychologist

Professor Anna Adlam
Chartered Clinical Psychologist

Appendix K: Table of Routine Outcome Measures

Table 1

Secondary routine outcome measures used for data collection, their psychometric properties, and administration timepoints.

Routine measure	Author(s)	Administration	Internal consistency[a]	Test-retest reliability[b]
Mean Daily Achievement, Closeness and Enjoyment Scale (MACES)	Current author	Daily; T1 – T2	New measure – no data.	New measure – no data.
Revised Children's Anxiety and Depression Scale (RCADS) – Depression Subscale (MDD)	Chorpita et al. (2000)	T1 – T3	α = .88 (Donnelly et al., 2019)	.77 (Chorpita et al., 2000)
Child and Adolescent Scale of Participation (CASP)	Bedell (2004)	T1 – T3	Parent scale: α = .95 Youth scale: α = .87 (McDougall et al., 2013)	.94 (Bedell, 2004)
Paediatric Quality of Life Inventory (PedsQL)	Varni et al. (1999)	T1-T3	Parent scale: α = .90 Youth scale: α = .88 (Varni et al. 2001)	Parent scale: .85 Youth scale: .79 (Sherman et al. 2006)
Treatment Acceptability Questionnaire – Adolescent and Parent (TAQ)	Hunsley (1992)	T3	α = .80 (Hunsley, 1992)	.78 (Hunsley, 1992)

Key: T1 = baseline; T2 = post-treatment; T3 = follow-up.
[a] Cronbach's alpha (α)
[b] Intraclass correlation coefficient

References for table:

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Appendix L: Daily Activity Log

Brief BA activity log

Your mood can be really affected by what you do, where you spend your time, and who you spend it with. Try to record any activities you do (no matter how small or boring you think they are) in the activity log below:

Achievement: 0 = Didn't feel I achieved anything, 10 = Massive achievement!

Closeness: 0 = No closeness (on my own), 10 = Felt really close to someone

Enjoyment: 0 = Hated it! No enjoyment at all, 10 = Loved it, really enjoyed it

Day, date, time	**Activity – what I did, who with, and where** *(remember – even doing nothing is an activity!)*	**Achievement**	**Closeness**	**Enjoyment**	**Important?**
Mon 7th March 11.15 – 12.00	Went for a walk with mum in the local park	5	7	3	Y

Source: Adapted from Carol Vivyan's ACE log (www.getselfhelp.co.uk)

Daily mood rating: 0 = Really low, depressed, 10 = Really happy, upbeat

Mon	**Tues**	**Weds**	**Thurs**	**Fri**	**Sat**	**Sun**

This full worksheet was taken and adapted from Reynolds and Pass (2021)

Appendix M: Revised Child Anxiety and Depression Scale: Depression Subscale

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Appendix N: Child and Adolescent Scale of Participation

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Appendix O: Pediatric Quality of Life Inventory

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Appendix P: Treatment Acceptability Questionnaire

Treatment Acceptability Questionnaire for Brief BA

Please answer these questions that deal with your reactions to the proposed treatment. Put a cross (X) in the box that best describes your response.

1. Overall, how acceptable do you find Brief BA to be?

Not at all	Not very	Not quite	Neutral	Quite	Very	Extremely

2. How ethical do you think Brief BA is?

Not at all	Not very	Not quite	Neutral	Quite	Very	Extremely

3. How effective do you think Brief BA might be on a larger scale?

Not at all	Not very	Not quite	Neutral	Quite	Very	Extremely

4. How likely do you think it is that Brief BA may have negative side effects?

Not at all	Not very	Not quite	Neutral	Quite	Very	Extremely

5. How knowledgeable do you think the psychologist is?

Not at all	Not very	Not quite	Neutral	Quite	Very	Extremely

6. How trustworthy do you think the psychologist is?

Not at all	Not very	Not quite	Neutral	Quite	Very	Extremely

This questionnaire has been adapted from the Treatment Acceptability Questionnaire by Hunsley (1992).

Please turn over for further questions about your experience.

7. What did you like specifically about Brief BA?

_____

_____

_____

_____

8. What did you not like specifically about Brief BA?

_____

_____

_____

_____

9. Would you recommend Brief BA to a friend? (please circle)

YES NO

10. If you could change anything about Brief BA, what would it be?

_____

_____

_____

_____

Thank you for answering the questions about the acceptability of Brief BA. Please refer to the Participant Debrief Form should you have any questions about the study.

Reference:

Hunsley, J. (1992). Development of the Treatment Acceptability Questionnaire. *Journal of Psychopathology and Behavioral Assessment, 14*(1), 55-64. http://dx.doi.org/10.1007/BF00960091

Appendix Q: Ethical Approval

CLES – Psychology
Psychology
College of Life and Environmental Sciences
University of Exeter
Washington Singer Building
Perry Road
Exeter
EX4 4QG
Web: www.exeter.ac.uk

CLES – Psychology Ethics Committee

Dear Conor O Brien

Ethics application - eCLESPsy001448
Evaluating Brief Behavioural Activation for depression in adolescents with acquired brain injury: A Single-case Experimental Design study

Your project has been reviewed by the CLES – Psychology Ethics Committee and has received a Favourable opinion.

The Committee has made the following comments about your application:
Nick Moberly commented, pp Anna Adlam

- Please view your application at https://eethics.exeter.ac.uk/CLESPsy/ to see comments in full.
If you have received a Favourable with conditions, Provisional or unfavourable outcome you are required to re-submit for full review and/or confirm that committee comments have been addressed before you begin your research.

If you have any further queries, please contact your Ethics Officer.

Yours sincerely

Date: 05/10/2020

CLES – Psychology Ethics Committee

Appendix R: Instructions for Authors – Neuropsychological Rehabilitation

Instructions for authors

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As a result of the significant disruption that is being caused by the COVID-19 pandemic we understand that many authors and peer reviewers will be making adjustments to their professional and personal lives. As a result they may have difficulty in meeting the timelines associated with our peer review process. Please let the journal editorial office know if you need additional time. Our systems will continue to remind you of the original timelines but we intend to be flexible.

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Contents

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Appendix S: Statement of Dissemination

It is intended that the current study will be disseminated in the Neuropsychological Rehabilitation journal. Preparations are currently underway for presentation at the NR-SIG-WFNR's '18th Neuropsychological Rehabilitation Hybrid Conference' on 4th-5th July 2021, and the BABCP's 'EABCT 2021 Congress Belfast, Northern Ireland' conference on 8th-11th September 2021. The current study's findings may also be discussed with child brain injury charities, such as Headway, Child Brain Injury Trust, Encephalitis Society, etc.