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ORIGINAL ARTICLE

Reducing Anhedonia in Major Depressive Disorder with Future Event Specificity Training (FEST): A Randomized Controlled Trial

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Abstract

Background Improving future thinking, such as characteristics of specificity, detail, and use of mental imagery, may be one means to reduce anhedonia, particularly in a Major Depressive Episode (MDE) in which future thinking is impaired. The current study aimed to test this using a validated program, Future Event Specificity Training (FEST).

Methods Participants ($N = 177$; 80.8% women; M age = 43.7, $SD = 11.8$) with a current depressive episode with anhedonia and high symptom severity were randomized to FEST or no FEST. Future thinking, anhedonia-related variables, and other clinical outcomes were assessed at baseline, one- and three-month follow-up.

Results Relative to the control group, FEST was associated with significantly improved future thinking characteristics, a reduced likelihood of anhedonia (35.1% vs. 61.1%, $p = .015$), improvements on other anhedonia-related variables such as anticipatory ($d = 0.63$, $p = .004$) and anticipated pleasure for future events ($d = 0.77$, $p < .001$), and desirable clinical outcomes such as less people meeting criteria for an MDE (37.8% vs. 64.8%, $p = .011$), higher behavioural activation ($d = 0.71$, $p = .001$) and improved global functioning ($d = 0.52$, $p = .017$). Changes in future thinking were found to mediate the effect of FEST on anhedonia.

Conclusion The quality of future thinking can be enhanced in Major Depression, and this leads to a substantially reduced likelihood of anhedonia, other significant clinical effects, and functional gains.

Keywords Future thinking · Depression · Mental imagery · Specificity · Anhedonia · Anticipatory pleasure

Targeting cardinal symptoms that are less likely to improve in currently available treatments is one strategic way to improve outcomes in depression (Holmes et al., 2018). One such significant symptom is anhedonia, which is common in depression (Shankman et al., 2014) and refers to a difficulty in experiencing pleasure and interest, and general down-regulation of positive affect. Without perceiving reward or pleasure, people can become demotivated, withdrawn, and hopeless. Indeed, anhedonia has significant impact on quality of life and day-to-day functioning (Vinckier et al., 2017), including work, education, socialising and leisure, and increases suicidality independently of other symptoms (Ducasse et al., 2018). Unfortunately, current treatments may not alleviate target positive affect as successfully as other aspects of depression (Dunn et al., 2020), and untreated anhedonia uniquely predicts poorer prognosis in Major Depression (McMakin et al., 2012; Uher et al., 2012). Anhedonia therefore poses a pernicious threat to wellbeing by having unique impacts on functioning, being treatment-resistant, and increasing relapse risk. To break through the impasse of suboptimal treatment, new and effective ways of targeting and alleviating anhedonia are indicated.

One potentially effective way of treating anhedonia is through enhancing the ability to imagine future events. Effortful future thinking incorporating detailed and vivid mental imagery can help us to realistically simulate and 'pre-experience' events, giving rise to anticipatory emotions

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that motivate us to engage in rewarding, meaningful behaviours that maintain good mental health (Ji et al., 2021; Renner et al., 2019; Schacter et al., 2017). Consistent with established deficits in autobiographical memory recall (Barry et al., 2021), major depressive episodes are associated with difficulty imagining future events in ways that are specific, detailed, and accompanied by emotionally evocative mental imagery (Gamble et al., 2019; Hallford et al., 2018; MacLeod et al., 1997; MacLeod & Salaminiou, 2001; Morina et al., 2011). Crucially, these characteristics have been linked to reduced anticipation of pleasure in depression when thinking about future events (Hallford et al., 2020; Hallford, Sharma, et al., 2020; Hallford & Sharma 2019). This lack of anticipation of pleasure is a key dimension of anhedonia, and a proximal influence on motivation and intention to engage in rewarding and goal-directed behaviour (Ji et al., 2021; Renner et al., 2019; Sherdell et al., 2012). Difficulty anticipating positive events, in conjunction with a reduced experience of reward, may give rise to other factors maintaining dysfunction, such as hopelessness about having positive experiences and outcomes for oneself in the future (MacLeod et al., 2005; O'Connor et al., 2000). Indeed, people with major depression have more relatively low expectations that personally relevant positive events are plausible or likely to occur (Hallford et al., 2020; Korn et al., 2014; Miranda & Mennin, 2017) and lower expectations that they will be enjoyable or rewarding (Hoerger et al., 2012; Marroquín & Nolen-Hoeksema, 2015).

Recently, in a community sample we validated a brief intervention designed to improve the aforementioned characteristics of future thinking associated with the ability to anticipate and experience pleasure (Hallford, Yeow, et al., 2020). This intervention, called Future Event Specificity Training (FEST), involves two group-based sessions of training to improve the simulation of specific (i.e., spatiotemporally located) future events, as well as associated detail and the use of mental imagery. The use of the term 'specificity' in the title is a reference to Memory Specificity Training (MeST), from which FEST was inspired (Raes et al., 2009). However, specificity is only one focus of FEST. Participants are guided within specific future thinking to generate rich detail, as well as to use mental imagery and accentuate feelings that are associated with imagined future events. The results from an initial community sample study showed large, controlled effects on future thinking specificity, detail, and imagery at follow-up (Hallford, Yeow, et al., 2020). Further, it increased the anticipation of pleasure from future events, and the feeling of pleasure when thinking about future events (anticipatory pleasure). Participants also reported more perceived control over the events and appraised them as more likely to occur in the future. These effects even generalised to positive future events that were not personally generated. This study established the feasibility, acceptability, and potential outcomes of FEST for training in future thinking. It also provided further evidence that when future events are simulated in ways that are specific, rich in detail, and draw on mental imagery, they are appraised as being more realistic and within one's control.

Based on this initial trial of FEST and increasing evidence that programs that focus on improving specificity, detail, and imagery in autobiographical thinking can have clinically meaningful impacts on depressive symptoms (Barry et al., 2019; Blackwell et al., 2015; Hallford et al. 2021; Lang et al., 2012; Pile et al., 2021), we proposed to examine the effects of FEST in Major Depression. Several recent studies have evaluated effects of future thinking training in similar, overlapping ways. For example, Pile et al., (2021) examined an intervention package containing components of positive future imagery training combined with other memory retrieval and rescripting exercises among adolescents with elevated depressive symptoms. Small to moderate, but non-significant, changes in future thinking detail were found. There were effects on depressive symptoms, but as the package had multiple components, and no clear effect on future thinking, the clinical outcomes cannot be clearly attributed to future thinking. Blackwell et al., (2015) examined the effects of computer-assisted repeated positive mental imagery in adults with Major Depression. There were no effects on the vividness of positive future imagery, nor in overall depressive symptoms. However, exploratory analyses indicated there were changes in anhedonia, with high levels of vividness in mental imagery associated with changes in depressive symptoms. Hallford et al., (2020) reported on a randomized start-point case series trial in adults with Major Depressive Disorder showing that brief future thinking activities through the day can increase detail and imagery, as well as anticipatory pleasure. An earlier study combining components of training in past and future thinking in people with schizophrenia showed increases in future thinking specificity, although notably no effect on depressive symptoms (Blairy et al., 2008). The components of this training related to future thinking were repurposed and expanded in a subsequent study, again in people with schizophrenia (Chen et al., 2020). The aforementioned findings were replicated, with an increase in future thinking specificity, but no changes in self-reported depressive symptoms. Finally, recent studies in non-clinical samples have shown that using guided mental imagery for future events increases anticipatory pleasure, anticipated pleasure, and anticipated reward for those events (Hallford et al. 2020; Ji et al., 2021; Renner et al., 2019). Other recent trials have focused on positive affect in depression, but without targeting or assessing future thinking as a mechanism (Craske et al., 2019; Kryza-Lacombe et al., 2021).

The Current Study

The current study was a pre-registered, randomized-controlled trial design that aimed to provide a comprehensive test of whether future thinking characteristics can be enhanced in people experiencing a Major Depressive Episode, and if this produces effects on anhedonia. People with a current depressive episode, and who also endorsed experiencing anhedonia as part of this diagnosis, were randomized to receive FEST or a no FEST control group. In this evaluation, we assessed the variables that FEST sought to train, which included specificity, detail, and imagery of future events, as well as fluency in generating future events (i.e., how many events people could generate in a given time period). We also assessed whether training in future thinking specificity would have crossover effects onto the ability to retrieve specific autobiographical memories. In relation to anhedonia, we assessed whether people continued to meet the DSM-5 Major Depressive Episode (MDE) criterion for anhedonia (American Psychiatric Association, 2013) following FEST, as well as changes in trait measures of anticipatory pleasure and consummatory pleasure (i.e., experiencing in-the-moment pleasure), and reported state anticipated and anticipatory pleasure when generating personally-relevant future events. Broader clinical outcomes were also assessed in the form of how many people met criteria for an MDE, symptom severity, behavioural activation and global assessment of functioning (GAF). The use of cognitive reappraisal was also assessed as an outcome measure. It was reasoned that, if there was improvement in future thinking, this may provide further psychological resources with which people could use to regulate their emotional states (e.g., to look forward to things, or imagine a future state that might evoke a difference and less negative emotional state). It was hypothesised that, relative to a control group, FEST would enhance future thinking characteristics, have effects on anhedonia-related variables (lower rates of anhedonia, increased anticipatory, anticipated and consummatory pleasure), and have effects on clinical outcomes (higher remission, lower symptoms, higher behavioural activation and functioning).

Methods

The study was approved by the University Human Research Ethics Committee, and in accordance with the provisions of the World Medical Association Declaration of Helsinki as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. All methodology was pre-registered on 20/7/2020 with the Australian New Zealand Clinical Trials Registry (ACTRN12620000754943). Journal Article Reporting Standards for Quantitative Research in Psychology were followed (Appelbaum et al., 2018), as were CONSORT guidelines for randomized controlled experiments (Schulz et al., 2010).

Study Design

A pre-registered online, randomized-controlled trial design was used with a two (condition: FEST vs. no FEST) x three (time-points: baseline, one-month, three-month follow-up) factorial-design. Participants were allocated with 1:1 randomization by computer.

Future Event Specificity Training (FEST): The training program was group-based, conducted over videoconferencing software, and comprised two sessions, each of 90min duration. A total of 14 groups were run, ranging in size from 3 to 8 participants. The sessions were conducted by two researchers, both with a bachelor's degree and honours in psychology, and one with experience delivering FEST in the initial validation study of FEST. They were supervised by the first author, a registered clinical psychologist. The training was adapted for use in a clinical depression population from the previous manualised version used in a community sample (Hallford, Yeow, et al., 2020). Both manuals are open access and available online (https://osf.io/mq6y3/). The corresponding author of this study can be contacted for latest information on implementation.

The first session involved psychoeducation about future thinking and its functions, the interplay of depressive psychopathology and future thinking, and distinguishing between general and specific episodic future thinking (EFT). The facilitators provided examples of generating specific, detailed, and imagery-rich episodic future thoughts in response to cue words. Participants then practised this exercise using positively and neutrally-valenced cue words to generate future events that either would happen or could reasonably happen. They were asked to generate details relevant to the future event (e.g., sensorial and scene details, actions, people, thoughts, feelings etc.), using mental imagery and imagining events from a first-person perspective to increase the sense of pre-experiencing (D'Argembeau & van der Linden, 2012). The future thoughts that were generated were discussed in the group, with facilitators and other group members providing feedback. Once specific future thoughts were generated, participants were given more time to elaborate on them with further episodic detail. It was impressed upon participants that future thoughts need not necessarily involve a high-arousal type of positive emotion, like joy or excitement, but could also be low-arousal, like calmness or contentment. At the end of the session, participants were given a homework task consisting of practice

cue words and providing a daily future thought of something that would or could happen the following day.

The second session commenced with a review of session one and of the homework task. Some further psychoeducation was provided on general and specific future thinking and prospective emotions and their function (with a focus on anticipated and anticipatory pleasure). Participants then practised generating two distinct episodic future thoughts to single cue words in order to improve divergent thinking in relation to future events. Throughout they were encouraged to focus on the emotions they expected to experience in those imagined future events. The participants were encouraged to complete another homework task that was comparable to the first but required participants to generate two specific episodic future thoughts per word. The program finished with a discussion about how bringing future thinking under conscious control more often might be helpful in their lives, such as in planning, goal setting, and building motivation.

Participants and Recruitment

Recruitment occurred from July-December 2020 via advertising on Facebook and ceased when the required sample size had been reached. The inclusion criteria, assessed through self-report, were: (i) 18–65 years of age; (ii) residing in Australia; (iii) English-speaking; (iv) current diagnosis of a Major Depressive Episode using the Electronic Psychological Assessment System (e-PASS, see below; Nguyen et al., 2015), and must meet the anhedonia criterion as indicated by endorsement of "more days than not" or "every day" on the anhedonia item (*Over the last TWO WEEKS or more, please indicate how often you felt much less interested in or much less able to enjoy most activities*); and (v) internet access on their laptop or desk computer. The exclusion criteria, also assessed through self-report, were neurodevelopmental disorders (intellectual disability or autism spectrum disorder specifically). No other mental health disorders were excluded. Participants were asked whether they were receiving mental health support at each time-point.

Measures

MDE Diagnosis MDE diagnostic status was assessed using the Electronic Psychological Assessment System (e-PASS; Nguyen et al., 2015). The e-PASS is an online, self-report clinical assessment system with 11 questions corresponding to the frequency of MDE symptoms over the last two weeks concordant with the Diagnostic and Statistical Manual of Mental Health Disorders, 5th edition (DSM-5)(American Psychiatric Association, 2013). Items are answered using a scale from 0 (*not at all*) to 4 (*every day*), with one item for severity using a scale from 0 (*no interference/distress*) to 8 (*extremely significant interference/distress*). In concordance with DSM criteria, an algorithm is used to score the e-PASS whereby if five symptoms occur either *more days than not* or *every day*, at least one of these is mood or anhedonia, and participants score ≥ 3 for interference/distress they are categorized as experiencing an MDE. An e-PASS diagnosis corresponds well with the Mini-International Neuropsychiatric Interview (MINI; Sheehan et al., 1998; Nguyen et al., 2015). To assess this in the current study, participants who screened as eligible and could be contacted by phone were assessed for a current MDE using the MINI. In total, 207 of the 215 participants that were interviewed met criteria on the MINI. This concordance of 96.2% with the MINI for MDE diagnosis indicates the e-PASS has strong criterion validity in this sample as a diagnostic tool, which is also consistent with high concordance reported in a previous study in youth with Major Depression (91.9%; Hallford, Austin, Takano, Fuller-Tyszkiewicz, et al., 2021).

Future Thinking Characteristics The Episodic Future Thinking Test (Hallford, Takano, et al., 2020) assessed the effects of FEST on future thinking characteristics of specificity, detail, and the use of mental imagery. Participants were presented with 10 cue words; five positively-valenced and five neutrally-valenced, in alternating order. For each cue word, participants were asked to describe an event or activity related to or inspired by the cue word that was either planned to happen, or hypothetically could happen, in their future. They were instructed that this was to be something specific that would occur in the space of one day, and something they would be personally involved in. No time limit was given. Participants were asked to provide as many details as possible and provide a different event/activity for each cue word. Two examples of specific EFTs were provided for the words *pleasure* and *table* on a separate webpage to the instructions. Three sets of cues were used in total to facilitate counterbalancing across the time-points. Twenty of these were taken from the original EFT-T word sets (see Hallford et al., 2019), and an additional 10 were added using the same method of balancing the frequency of word use, emotional valence, and intensity as in the original item selection. Two co-authors (*removed*.) coded a subset of 15% (280 total) of cue word responses as either 1 (specific; a unique event occurring within the space of a day) or 0 (non-specific; events extending over more than a day, recurring events, semantic associates) while blinded to condition and inter-rater reliability was found to be acceptable (Cohen's kappa = 0.90). The remaining responses were coded by author (*removed*) while blinded to condition. Inspection of the written responses indicated that they were sensical in nature, and there were no repeated responses. Omissions

or expressed failures to generate future events to a cue word were marked as non-specific (e.g., "I couldn't think of anything"). Scores were summed for each participant to generate an overall EFT specificity score, and the internal reliability was acceptable (MacDonald's ω = 0.77). After providing each future event, participants rated its phenomenological characteristics on response scales from 1 (*Not at All*) to 9 (*Very Much So*), which were averaged across the events. These assessed the perceived detail ("How vivid and detailed is your thought of this event/activity?", ω = 0.71), use of mental imagery ("How much did you find yourself thinking in pictures/mental images about this activity?", ω = 0.81), perceived control ("How easy would it be to do this event/activity?", ω = 0.86), and perceived likelihood of occurrence ("How likely is it that this event/activity will happen?", ω = 0.74).

To assess the fluency of thinking of future events, the Future Thinking Task (FTT) was used (MacLeod et al., 1993). This FTT version required participants to think of positive future experiences, things they were looking forward to, in three time periods (next week, next year and next 5–10 years). The time periods were presented one at a time in that order. Participants had one minute on the web page to generate as many responses as possible. Two authors (*removed*) counted the number of valid future events in a subset of 33% of participants responses (169 items) while blinded to condition. Inter-rater reliability was found to be acceptable (intra-class correlation coefficient = 0.89), whereby author *removed* coded the remaining responses blind to condition. Previous studies looking at the different time periods have almost always found no differential effects relating to time periods (MacLeod et al., 1997). Therefore, the total number of responses given in each of the three time periods were averaged together (minus any repeated responses across time periods) providing final scores of future thinking fluency for positive events (ω = 0.77).

Memory specificity was assessed using the Autobiographical Memory Test (AMT; Williams & Broadbent 1986). As per the traditional AMT instructions, a definition of a specific autobiographical memory was given along with some examples of specific memories. Ten cue words were then presented: five positively and five negatively-valenced, one at a time, alternating in emotional valence. No time limit was given for responses. Three sets of cues were used for counterbalancing, taken from previous trials of computerized memory specificity training (c-MeST; Hallford, Austin, Takano, Fuller-Tyszkiewicz, et al., 2021). Two authors (*removed*)coded a subset of 15% (280 total) of responses from participants as either 1 (specific) or 0 (non-specific) while blinded to condition and inter-rater reliability was found to be acceptable (Cohen's kappa = 0.88). The number of specific responses at each time-point were summed (range 0–10). In the current study the internal reliability for specificity scores was acceptable (MacDonald's ω = 0.73).

Anhedonia-Related Variables

Consistent with the inclusion criteria and diagnostic criteria for anhedonia (DSM-5; APA, 2013), the e-PASS was used to assess whether people met diagnostic threshold for anhedonia. Responses of "more days than not" or "every day" met criteria for anhedonia in response to the question "Over the last two weeks or more, please indicate how often you felt much less interested in or much less able to enjoy most activities". Proportions were calculated in each group.

To assess trait anticipatory and consummatory pleasure, the Temporal Experience of Pleasure Scales (TEPS: Gard et al., 2006) were used. The TEPs comprises 18 self-report items referring to pleasure in looking forward to future experiences (anticipatory pleasure) and in-the-moment pleasure of experiences (consummatory pleasure) using responses scales from 0 (*Very false for me*) to 6 (*Very true for me*). The two-factor structure of the TEPS has been validated for online use in populations with Major Depression (Hallford & Austin, 2021), and consistent with these findings one reverse-scored item from the anticipatory subscale was removed. The scores for items in each subscale were averaged to create an overall score. The internal reliability in the current study was acceptable (anticipatory pleasure: ω = 0.83, consummatory pleasure: ω = 80).

To assess state anticipatory and anticipated pleasure, two response scales were completed following the generation of each future event on the EFT-T, one referring to anticipatory pleasure ("How pleasurable/enjoyable is it to just think about doing this event/activity?", ω = 0.75) and the other to anticipated pleasure ("How pleasurable/enjoyable do you think it will be to do this event/activity?", ω = 0.77). Anticipatory and anticipated pleasure were assessed as distinct constructs given their conceptual differences (Baumgartner et al., 2008) and empirical distinction in their associations with behavioural intentions and phenomenological characteristics of EFT (Barsics et al., 2016; Baumgartner et al., 2008). The items were taken from studies on prospective emotions in clinical (Hallford, Barry, et al., 2020; Hallford, Sharma, et al., 2020) and non-clinical samples (Hallford, Yeow, et al., 2020) where they demonstrate convergent, divergent, and construct validity.

Clinical Variables

Depressive Symptoms The Patient Health Questionnaire-9 (PHQ-9; Spitzer et al., 1999) was assessed depressive

symptom severity. It consists of nine items corresponding to DSM-5 symptom criteria for an MDE. Rating scales from 0 (*Not at all*) to 3 (*Nearly every day*) indicate frequency of symptoms in the last two weeks. Scores are summed to provide a total (range 0–27; MacDonald's ω = 0.83). The PHQ has excellent validity and reliability (Kroenke et al., 2010).

Cognitive Reappraisal: Reported use of cognitive reappraisal, reinterpreting an emotion-eliciting situation in a way that alters its meaning, was assessed using this subscale from the psychometrically robust Emotion Regulation Questionnaire (ERQ:Gross & John 2003). Six self-report items are completed, using a 0 (*Strongly Disagree*) to 7 (*Strongly Agree*) scale and averaged for an overall score. Internal reliability in this study was good (MacDonald's ω = 0.87).

Behavioural Activation The Behavioural Activation for Depression Scale (BADS; Kanter et al., 2007) was used to assess goal-directed behavioural activation and avoidance behaviours that are hypothesised to underlie depression. Participants respond to 25 items on a 0 (*Not at all*) to 6 (*Completely*) scale to indicate how the items describe their last week. The items relate to activation, rumination/avoidance, work, school, and social functioning, and were averaged to create an overall activation score. The BADS is a psychometrically robust scale in depressed samples (Fuhr et al., 2016; Kanter et al., 2007). Internal reliability in this study was good (MacDonald's ω = 0.90).

Global Assessment of Functioning (GAF): A self-report version of the Global Assessment of Functioning scale (Association, 1994) was used to assess psychological, social and occupational functioning. The self-report version has good to excellent agreement with ratings from global functioning in psychiatric samples from independent ratings through interview (Bodlund et al., 1994) and treating professionals (Ramirez et al., 2008). Participants use a slider on a scale from 0 to 100 that best describes their functioning over the last week, with each a description provided at each 10-point mark along the slider with content consistent with descriptors used in the interviewer rated GAF (e.g., 50 – 41: Serious symptoms [e.g., suicidal ideation, severe obsessions] OR any serious impairment in social, work, or school functioning [e.g., no friends, unable to keep a job]).

Participant Perceptions and Attitudes Towards the Training A series of response scales rated from 1 to 7 assessed participants' perception and attitudes towards FEST in terms of how easy they found it to understand, how helpful they thought it was, whether it was long enough, whether they would recommend it to others, and whether the facilitator feedback on future thinking was accurate and helpful. Responses indicating disagreement (1 = *Strongly Disagree*, 2 = *Disagree*, 3 = *Somewhat Disagree*) were combined to form a disagreement index, and responses indicating agreement (5 = *Somewhat Agree*, 6 = *Agree*, and 7 = *Strongly Agree*) were combined to indicate an agreement index. A response of 4 indicated neither agreement nor disagreement.

Sample Size Calculation

The sample size was calculated under the following assumptions: (1) based on our prior trial of the FEST intervention (Hallford, Yeow, et al., 2020), we expected at least moderate to large group differences (Cohen's $d = 0.70$) on the anhedonia-related variables and future thinking characteristics; (2) power set at 0.80; and (3) alpha set at 0.05 (two-tailed). Based on these parameters, G*Power version 3.1 (Faul et al., 2007) indicated that at least 35 participants would be needed in each group. Given participants were recruited online, and this is known to be associated with high drop-out rates (Melville et al., 2010), we aimed to oversample at baseline.

Procedure

Participants completed the informed consent and screening questions online and were followed up with a phone call during which the MINI was administered. They were then randomized to a group and provided with a link to complete the baseline survey. All surveys were completed online, and the presentation of the EFT-T, AMT, and FTT was randomized for each participant at each time-point to mitigate against order effects. If allocated to the FEST group, participants commenced within a week of completing the baseline survey and completed the two sessions spaced one week apart. They were sent links to the one and three-month follow-ups. Those in the control group were invited to complete the one and three-month follow-ups at the corresponding time-points following completion of the baseline survey. Email reminders and follow-up phone calls were used to encourage completion of follow-ups. Ongoing involvement in the study was at the participant's discretion and no compensation was offered. FEST was offered to participants in the control group following cessation of the study.

Data Analysis Plan

Author *removed* conducted the main analyses while blind to participants' group allocation and the study's aims and hypotheses. The analyses followed the principles of intention-to-treat (ITT), with individuals retained in the group they were randomized to. Full information maximum

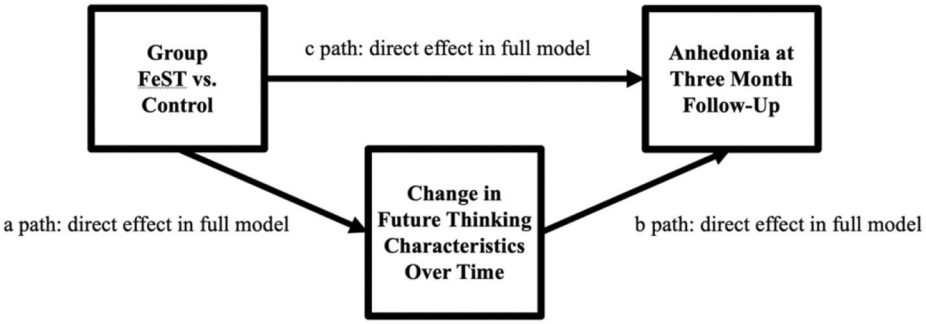

Fig. 1 Proposed Mediation Model of the Effect of Future Event Specificity Training (FEST) on Anhedonia at Three-Month Follow-Up Through Change in Future Thinking Characteristics

likelihood estimation was used, meaning that all available, fully completed measures at each time-point were used to estimate inferential statistics. In cases where measures were partially complete the following rules were used: (1) When more than 50% of a participant's responses to a measure was missing, that measure was omitted for that participant at that time-point.; (2) Where less than 50% of items from a measure were incomplete, expectation maximisation was used at the item level to replace missing responses. Preprocessing was conducted in IBM SPSS 26.0 (IBM Corp., 2019). Main analyses were conducted in Mplus Version 8.3 (Muthén & Muthén, 2017). To assess group differences in the proportion of people who met the anhedonia criterion and MDE diagnosis on the e-PASS, chi-square tests were used. Group differences for continuous variables at follow-up time-points were tested with linear mixed effects models, with main effects for time (dummy coded at each follow-up time-point relative to baseline) and group (intervention vs. control), random effects for time as dummy variables clustered within individuals, and time x group interactions to assess hypotheses about changes based on group. An unstructured variance-covariance matrix was used for random effects, and no issues of non-convergence due to high correlation among the random effects were observed. To control for Type 1 errors, the false discovery rate procedure was used for analyses of outcome variables at one and three-months separately(Benjamini & Hochberg, 1995). Mediation analyses were conducted using the PROCESS macro (Bolin, 2014). Exploratory analyses were conducted to assess whether changes in future thinking characteristics mediated the effect of FEST on meeting the anhedonia criterion, using a series of logistic regression mediation models. The model used group allocation as the IV (FEST coded as 1 and the control group coded as 0), residualized change scores of the future thinking characteristic as the mediator, and the dichotomous variable of meeting criteria for anhedonia on the e-PASS as the DV (meeting criteria for anhedonia coded as 1 and not meeting anhedonia criteria as 0). Mediation effects were calculated using percentile bootstrap 95% confidence intervals with 5000 samples, whereby intervals that did not cross over zero indicated significant effects at the $p < .05$ level. Figure 1 shows the proposed mediation model.

Results

Participant flow and Characteristics

In total, 1,549 individuals attempted screening for the study. Of these, 1,372 were excluded as ineligible or could not be followed up. This number was high due to the registration portal being advertised openly on social media, and anyone who was interested could commence the screening process, with no prerequisite to demonstrate clinically-significant depressive symptoms prior to this. Following the screening process, 177 in total were randomized to a group and provided some baseline data (see Fig.2 for CONSORT flowchart). Table1 shows the demographic characteristics. The average age of participants was early to mid 40s ($M = 43.7$, $SD = 11.8$) and most were female (80.8%). The groups did not significantly differ on demographic characteristics (all $p > .05$). To assess potential baseline factors that might have affected whether participants dropped out by the three-month follow-up, and whether this differed between groups, a series of factorial ANOVAs (group by dropout) were conducted. Participants who dropped out had higher mean depressive symptoms at baseline than completers ($M = 20.2$ vs. 18.6, $F[1,169] = 5.2$, $p = .024$, partial eta$^2 = 0.03$), but this did not differ by group, with a non-significant interaction ($F[1, 169] = 0.5$, $p = .468$, partial eta$^2 < 0.01$). There were no differences on baseline future thinking characteristics or demographic variables for those who dropped out by three-months, or interactions with group (all $ps > 0.05$). However, those that were receiving some kind of mental health support at baseline were more likely to stay in the study until the three-month follow-up (89% vs. 75.5%, $F[1,173] = 8.3$, $p = .004$, partial eta$^2 = 0.046$), with no interaction with group ($F[1, 173] = 1.4$, $p = .230$, partial reek eta$^2 < 0.01$).

At baseline, most participants were receiving some form of mental health support (82.5%) with no difference between groups in these proportions ($\chi^2[1] = 1.7$, $p = .193$).

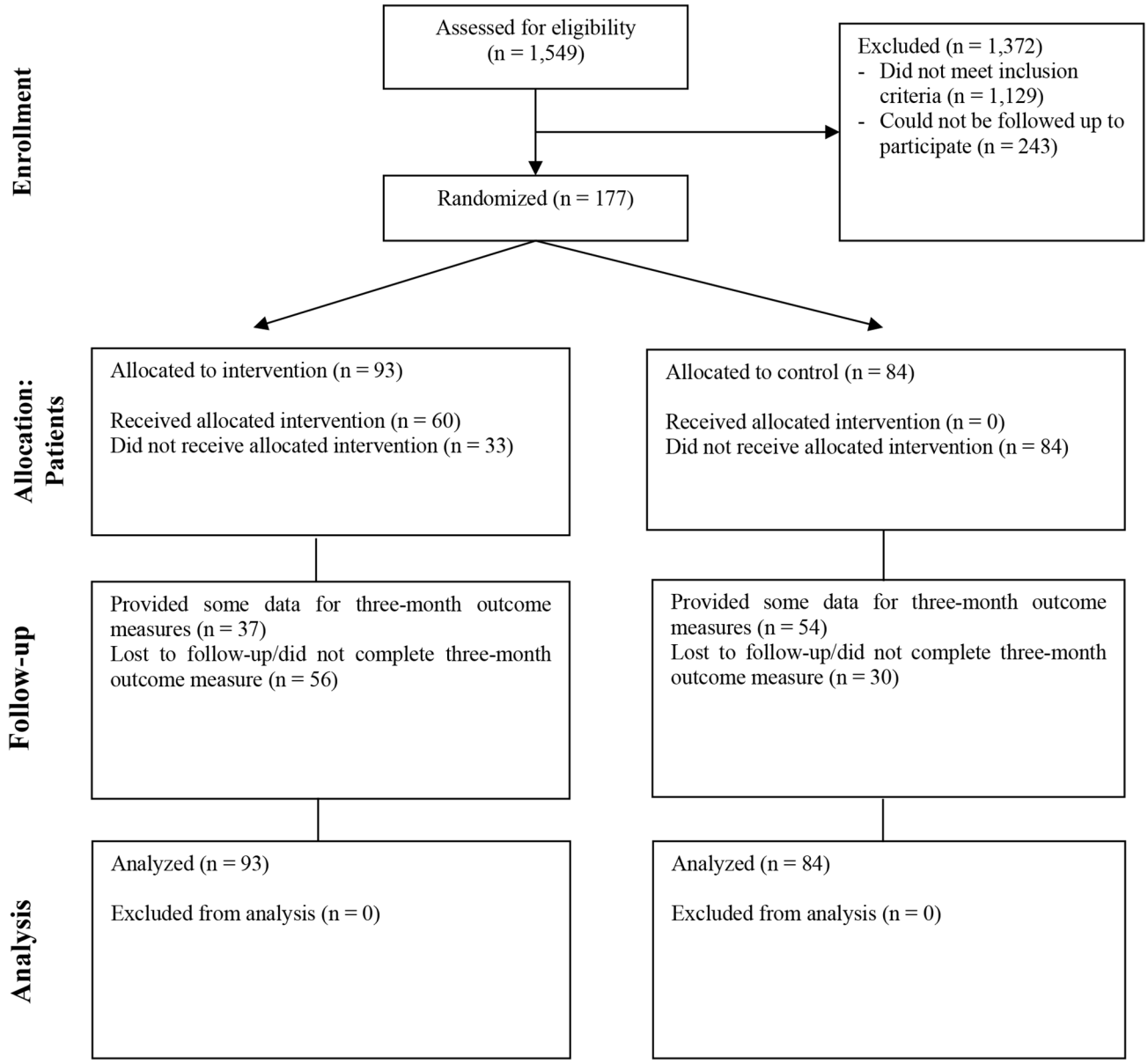

Fig. 2 Participant Flowchart

Most participants were receiving psychological therapy or counselling (78.9%) with no significant difference between the groups, ($\chi^2[1] = 0.03$, $p = .850$), and more than half were on antidepressant treatment (63.8%), again with no difference between the groups, ($\chi^2[1] = 1.0$, $p = .314$). Smaller proportions of participants reported taking other medications for mental health such as quetiapine or benzodiazepines (30.9%), engaging in group therapy (10.5%), or had "other" supports (13.6%), with no group differences, all ($\chi^2[1] < 0.7$, $ps > 0.409$). At the three-month follow-up, these proportions were similar, with 85.7% receiving some form of support with no difference between groups ($\chi^2[1] = 1.9$, $p = .163$), and no differences between specific forms of support being received (all $\chi^2[1] < 2.7$, $p > .103$): psychological therapy or counselling (74.4%), antidepressants (61.5%), other medications for mental health (26.9%), group therapy (6.4%), or "other" supports (15.4%).

Outcomes

Future Thinking Characteristics As indicated in Table2, EFT specificity, detail, and imagery was significantly higher in the FEST group at both follow-ups, with moderate to large effect sizes (all d's > 0.52, all p's < 0.020). There was no significant effect found for future thinking fluency despite there being non-trivial, small to moderate mean differences at

Table 1 Characteristics of Participants

Characteristic	Full Sample ($N=177$)	Control ($n=84$)	FEST Group ($n=93$)	Statistics
Age	43.7 ($SD=11.8$)	44.9 ($SD=12.1$)	42.5 ($SD=11.4$)	$t=1.3$, $p=.171$
Number of Females	143 (80.8%)	67 (79.8%)	76 (81.7%)	$\chi^2=0.1$, $p=.947$
Highest Level of Education				$\chi^2=2.3$, $p=.501$
High School	24 (13%)	10 (11.9%)	14 (15.1%)	
Diploma	68 (37.3%)	29 (34.5%)	39 (41.9%)	
Undergraduate Degree	56 (30.3%)	31 (36.9%)	25 (26.9%)	
Postgraduate Degree	29 (15.7%)	14 (16.7%)	15 (16.1%)	
Currently Studying	43 (23.2%)	18 (21.4%)	25 (26.9%)	$\chi^2=0.7$, $p=.398$
Employed	101 (57.1%)	44 (52.4%)	57 (61.3%)	$\chi^2=2.5$, $p=.279$
Ethnicity				$\chi^2=0.8$, $p=.843$
Caucasian/ White European	155 (87.6%)	72 (85.5%)	83 (89.2%)	
Asian	8 (4.3%)	5 (6%)	3 (3.2%)	
African	0 (0%)	0 (0.0%)	2 (0.8%)	
Arab/Middle Eastern	4 (2.2%)	2 (2.4%)	2 (2.2%)	
Latino	0 (0%)	1 (0.9%)	0 (0.0%)	
Other	10 (5.4%)	5 (6%)	5 (5.4%)	

one and three-month follow-up ($d=0.28$, $p=.207$, $d=0.40$, $p=.077$, respectively). Those in the FEST group, relative to the control group, reported a significantly stronger sense of perceived control over positive future events and likelihood that they could happen, with moderate to large effects at both follow-ups (d's >0.56, p's <0.015). For memory specificity, the results were not statistically significant, but there were small to moderate-sized mean group differences (d's >0.33, p's >0.114).

Anhedonia-related Variables At the one-month follow-up, there were significantly fewer participants in the FEST group that met criteria for anhedonia relative to the control group (35.4% vs. 62.7%, 17/48 vs. 37/59 participants), $\chi^2[1]=7.8$, $p=.014$. At the three-month follow-up these proportions were almost identical, with the findings again indicating there were fewer participants in the FEST group that met criteria for anhedonia relative to the control group (35.1% vs. 61.1%, 13/37 vs. 33/54 participants), $\chi^2[1]=5.9$, $p=.023$.

As indicated in Table3, for state anticipatory and anticipated pleasure, assessed through ratings of self-generated future events, no significant differences were observed at one-month although the mean differences favoured the FEST group ($d=0.27$, $p=.210$, $d=0.20$, $p=.332$, respectively). At the three-month follow-up there were significant moderate to large group differences indicating higher anticipatory and anticipated pleasure in the FEST group ($d=0.63$, $p=.009$, $d=0.77$, $p=.007$, respectively). For trait anticipatory pleasure, participants in the FEST group reported significantly higher scores at the one-month follow-up ($d=0.44$, $p=.037$). These were non-significant at the three-month follow-up, but with mean differences still small to moderate and favouring the FEST group ($d=0.38$, $p=.078$). For trait consummatory pleasure, significant moderate to large group differences favouring the FEST group were observed at one and three-month follow-ups ($d=0.72$, $p=.001$, $d=0.59$, $p=.005$, respectively).

Clinical Outcomes At the one-month follow-up, there were fewer participants in the FEST group that met criteria for a Major Depressive Episode relative to the control group, but this was not statistically significant (40.4% vs. 50.8%, 19/47 vs. 30/59 participants), $\chi^2(1)=1.1$, $p=.322$. However, at the three-month follow-up there were significantly fewer participants in the FEST group that met criteria for a Major Depressive Episode relative to the control group (37.8% vs. 64.8%, 14/37 vs. 35/54 participants), $\chi^2(1)=6.4$, $p=.018$. As indicated in Table4, for depressive symptoms there were small to moderately sized group differences, with lower symptoms in the FEST group, however, these were not statistically significant at one or three-month follow-ups after corrections for multiple tests ($d=0.31$, $p=.141$, $d=0.41$, $p=.062$, respectively). To further characterise symptom changes, a reliable change index was calculated as a change of 5.37 points on the PHQ using the full sample baseline standard deviation of 4.70 and internal reliability of the depression scale (0.83) (Christensen & Mendoza, 1986; Jacobson & Truax, 1991). Using this index, in the FEST group 48.6% of participants reliably decreased in symptoms by the three-month follow-up, while 51.4% did not reliably change and 0% increased. In the control group only 28.3% reliably decreased, 64.1% did not reliably change and 7.6% increased. No group differences were found for cognitive reappraisal at one or three-month time-points, although the group differences favouring FEST were small to moderate at the three-month time-point ($d=0.10$, $p=.617$, $d=0.24$, $p=.263$, respectively). On the measures of functioning, there were significant, moderate to large group differences on behavioural activation at one- and three-month follow-ups ($d=0.78$ $p=.005$, $d=0.76$, $p=.002$, respectively), and similar results for global functioning ($d=0.71$, $p=.007$,

Table 2 Outcomes on Future Thinking Characteristics Showing Descriptive Statistics, Adjusted Means, Effect Sizes, and p-values

	Control Group		FEST Group		Adjusted difference (c-MeST - control)		
Outcomes	*N*	Mean (*SD*)	*N*	Mean (*SD*)	Mean (95% CI)	Cohen's *d*	Corrected *p*-value
EFT Specificity							
Baseline	74	5.22 (3.00)	91	5.35 (2.63)			
1mth-post	54	5.62 (2.79)	42	6.81 (2.14)	1.15 (0.28, 2.02)	0.53	0.019
3mth-post	52	4.62 (3.16)	35	6.22 (2.59)	1.47 (0.37, 2.54)	0.56	0.016
EFT detail							
Baseline	74	5.76 (1.65)	89	5.49 (1.71)			
1mth-post	53	5.88 (1.46)	43	6.35 (1.69)	0.96 (0.35, 1.58)	0.62	0.008
3mth-post	50	5.79 (1.84)	33	6.78 (1.03)	1.27 (0.72, 1.83)	0.98	0.001
EFT imagery							
Baseline	74	5.96 (1.47)	89	5.97 (1.52)			
1mth-post	53	6.01 (1.57)	43	6.38 (1.97)	1.08 (0.32, 1.83)	0.57	0.017
3mth-post	50	5.75 (1.98)	33	6.85 (1.21)	1.29 (0.53, 2.04)	0.73	0.004
EFT Fluency							
Baseline	84	10.07 (6.26)	94	11.59 (5.69)			
1mth-post	52	12.26 (5.11)	43	13.95 (7.14)	1.70 (-0.67, 4.07)	0.28	0.207
3mth-post	49	11.46 (5.01)	35	13.45 (6.24)	2.20 (-0.11, 4.51)	0.40	0.077
EFT Perceived Control							
Baseline	74	5.60 (1.78))	94	5.51 (1.97)			
1mth-post	52	5.02 (1.52)	43	5.83 (1.76)	1.08 (0.32, 1.83)	0.57	0.014
3mth-post	50	4.97 (1.72)	35	6.11 (1.47)	1.29 (0.53, 2.04)	0.73	0.003
EFT Likelihood							
Baseline	74	6.69 (1.22)	94	6.35 (1.60)			
1mth-post	53	6.22 (1.56)	43	6.67 (1.56)	0.86 (0.13, 1.60)	0.47	0.039
3mth-post	50	6.34 (1.46)	35	7.09 (1.11)	1.08 (0.49, 1.66)	0.80	0.010
AMT Specificity							
Baseline	74	5.75 (2.60)	93	6.11 (2.43)			
1mth-post	53	5.78 (2.48)	45	6.71 (2.50)	0.79 (0.04, 1.55)	0.37	0.102
3mth-post	52	5.31 (2.88)	35	6.77 (2.40)	0.84 (0.08, 1.59)	0.34	0.114

Note. The adjusted difference reflects the group x time interaction. EFT = Episodic Future Thinking, AMT = Autobiographical Memory Test

Table 3 Outcomes on Anhedonia-Related Variables Showing Descriptive Statistics, Adjusted Means, Effect Sizes, and p-values

	Control Group		FEST Group		Adjusted difference (c-MeST - control)		
Outcomes	*N*	Mean (*SD*)	*N*	Mean (*SD*)	Mean (95% CI)	Cohen's *d*	Corrected *p*-value
EFT Anticipatory Pleasure							
Baseline	74	5.82 (1.44)	89	5.78 (1.53)			
1mth-post	52	6.01 (1.34)	43	6.32 (1.56)	0.45 (-0.20, 1.10)	0.27	0.210
3mth-post	50	5.70 (1.56)	33	6.46 (1.21)	0.92 (0.29, 1.55)	0.63	0.009
EFT Anticipated Pleasure							
Baseline	74	5.31 (1.52)	89	5.29 (1.62)			
1mth-post	53	5.66 (1.40)	44	5.88 (1.76)	0.34 (-0.32, 1.00)	0.20	0.332
3mth-post	50	5.26 (1.68)	33	6.23 (1.19)	1.07 (0.47, 1.66)	0.77	0.007
Trait Anticipatory Pleasure							
Baseline	80	2.95 (0.98)	93	3.16 (0.89)			
1mth-post	59	2.94 (0.96)	49	3.46 (0.79)	0.28 (0.04, 0.52)	0.44	0.037
3mth-post	54	2.90 (0.94)	37	3.34 (0.94)	0.25 (-0.01, 0.52)	0.38	0.078
Trait Consummatory Pleasure							
Baseline	80	3.82 (1.00)	93	3.87 (0.94)			
1mth-post	59	3.73 (1.10)	49	4.32 (0.75)	0.51 (0.24, 0.76)	0.72	0.001
3mth-post	54	3.73 (1.07)	37	4.19 (0.90)	0.47 (0.14, 0.80)	0.59	0.005

Note. The adjusted difference reflects the group x time interaction. EFT = Episodic Future Thinking, AMT = Autobiographical Memory Test

Table 4 Outcomes on Clinical Variables Showing Descriptive Statistics, Adjusted Means, Effect Sizes, and p-values

	Control Group		FEST Group		Adjusted difference (c-MeST - control)		
Outcomes	*N*	Mean (*SD*)	*N*	Mean (*SD*)	Mean (95% CI)	Cohen's *d*	Corrected *p*-value
Depressive Symptoms							
Baseline	80	19.47 (4.80)	93	19.36 (4.60)			
1mth-post	59	15.98 (6.44)	43	13.65 (6.60)	1.74 (-0.31, 3.78)	0.31	0.141
3mth-post	53	15.77 (5.37)	33	12.14 (6.04)	2.21 (0.02, 4.41)	0.41	0.062
Cognitive Reappraisal							
Baseline	70	3.75 (1.29)	93	3.63 (1.07)			
1mth-post	54	3.91 (1.29)	49	4.04 (1.24)	0.10 (-0.31, 0.52)	0.10	0.617
3mth-post	48	3.94 (1.14)	37	4.25 (1.19)	0.26 (-0.19, 0.72)	0.24	0.263
Behavioural Activation							
Baseline	70	2.36 (0.89)	93	2.12 (0.77)			
1mth-post	51	2.44 (0.96)	44	2.95 (1.15)	0.72 (0.35, 1.08)	0.78	0.005
3mth-post	42	2.44 (0.86)	33	3.14 (1.25)	0.76 (0.33, 1.19)	0.76	0.002
Global Assessment of Functioning							
Baseline	70	55.16 (11.99)	92	53.40 (12.10)			
1mth-post	55	53.93 (16.75)	49	62.84 (17.09	9.95 (4.46, 15.43)	0.71	0.007
3mth-post	48	60.23 (13.45)	37	66.29 (15.67)	6.88 (1.21, 12.55)	0.52	0.024

Note. The adjusted difference reflects the group x time interaction

$d = 0.52$, $p = .024$, respectively), indicative of improved functioning following the intervention.

Mediation Analyses

A total of six models were conducted, assessing whether changes from baseline to three-month follow-up for future thinking specificity, detail, imagery, fluency, perceived control, and perceived likelihood mediated the effect of group on the e-PASS anhedonia criterion. For models assessing changes in specificity, imagery, and fluency, the direct and indirect effects were in the expected direction, but confidence intervals for the indirect effects crossed over zero and therefore were considered non-significant (see Supplementary Materials for non-significant mediation models). For future thinking detail, perceived control, and perceived likelihood, all pathways were in the expected direction and there were significant indirect effects, indicating that FEST predicted a lower likelihood of meeting the anhedonia criteria at three-month follow-up through changes over time in ratings of detail in future thinking, perceived control over future events, and the perceived likelihood that future events would occur. Figure3 shows the mediation models and results of bootstrapped regression analyses. An exploratory parallel mediation model was then conducted including detail, perceived control, and perceived likelihood as mediators. Bootstrapped estimates indicated there was no direct effect from group to anhedonia (b = -0.34 [SE = 0.64], 95%CI -1.65, 0.93), there was an independent indirect effect through perceived control (b = -0.82 [SE = 0.41], 95%CI -1.795, -0.16), but not through detail (b = -0.11 [SE = 0.35], 95%CI -0.82, 0.58) or perceived likelihood (b = -0.25 [SE = 0.40], 95%CI -1.02, 0.58).

FEST Participant Evaluation

Of the sixty people that received the intervention, 50 completed evaluation questions (83.3%). Almost all agreed the intervention was easy to understand (92.2% agreed, 5.9% disagreed, 1.9% unsure). The majority reported it was helpful (74.5% agreed, 13.7% disagreed, 11.8% unsure), found

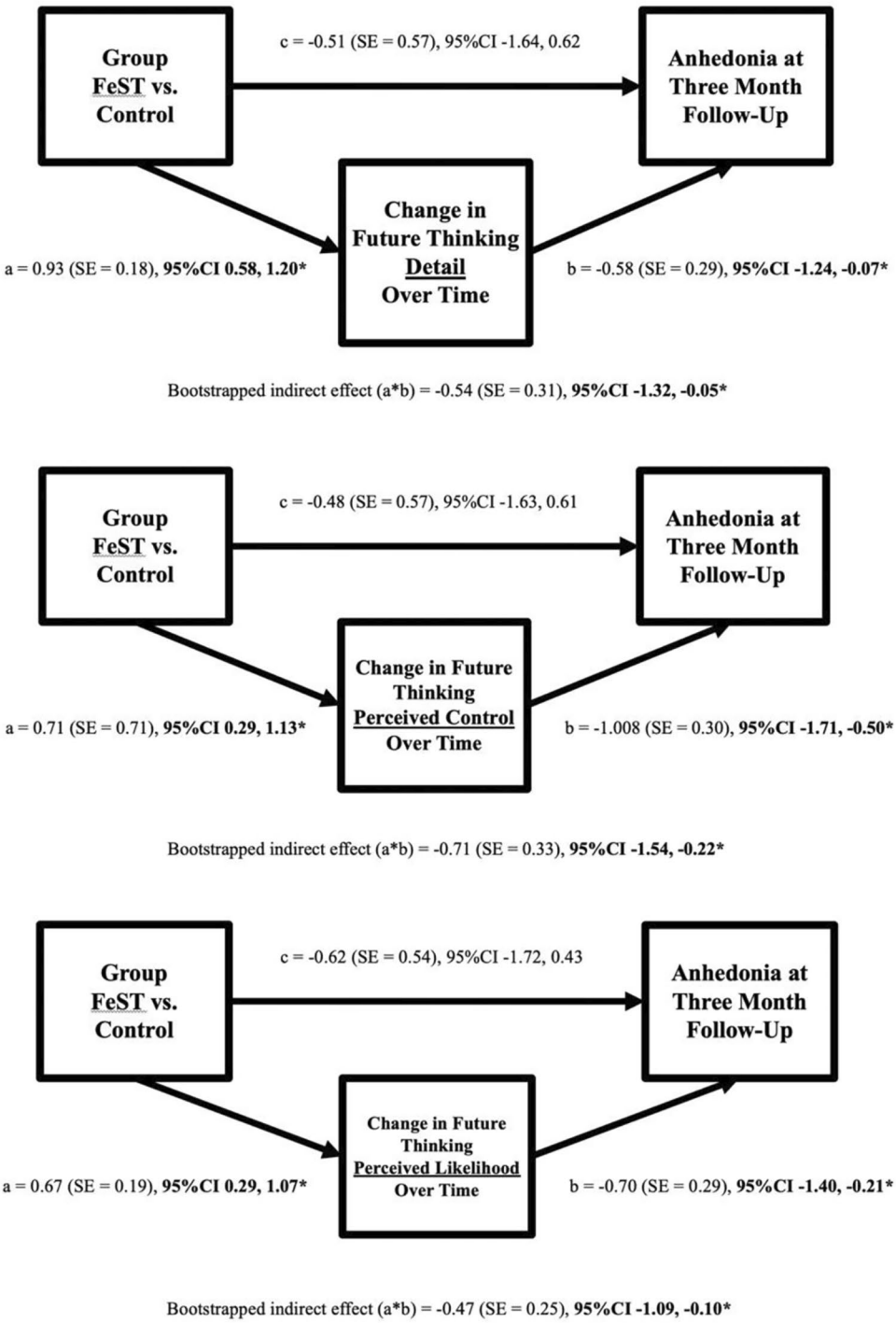

Fig. 3 Mediation Models Indicating Change in Future Thinking Detail, Perceived Control, and Perceived Likelihood Mediated the Effect of FEST on Anhedonia at Three-Month Follow-Up. *Note*: Confidence intervals in bold indicate that regression coefficients are significant at the $p < .05$ level

the feedback from facilitators accurate and helpful (80.4% agreed, 3.9% disagreed, 15.7% unsure) and would recommend it to other people (72.5% agreed, 9.8% disagreed, 17.6% unsure). Half of participants thought it was long enough, and a third appeared to want a longer intervention (51% agreed, 31.4% disagreed, 17.6% unsure).

Discussion

This randomised controlled study evaluated the effects of training in future thinking (FEST) in a sample of people meeting criteria for a depressive episode (MDE). At follow-up, participants in the FEST group, relative to the control group, reported higher specificity, detail, mental imagery, perceived control and likelihood of occurrence for future

events. Differences in fluency in future thinking were not significant, but did favour FEST with non-trivial mean differences. People in the FEST group were less likely to meet the anhedonia criterion at follow-up. Evidence for other changes on anhedonia-related measures were also observed, including increased anticipatory and anticipated pleasure when generating personally-relevant future events, higher trait consummatory pleasure, higher trait anticipatory pleasure which was significant at the one-month point. Broader clinical effects were also noted at the three-month follow-up, including fewer people in the FEST group meeting criteria for a depressive episode, more reliable change in symptoms, increased behavioural activation, and improved global functioning.

Impairments in characteristics of future thinking in major depression, such as specificity, detail, mental imagery, and fluency have been well documented now (Gamble et al., 2019; Hallford et al., 2018; Holmes et al., 2016; MacLeod et al., 1997; MacLeod & Salaminiou, 2001; Morina et al., 2011), however, few studies to date have examined specific effects of concerted training on this thought process, and fewer have examined how these effects might disrupt depressive pathology. This study extends on preliminary findings of the efficacy of FEST in a community sample (Hallford, Yeow, et al., 2020) to show that several aspects of future thinking can be trained and improved among people meeting criteria for an MDE. The effects on memory specificity were meaningful in size, but only approached, rather than reached, statistical significance. This suggests that training in future thinking may produce transfer effects onto memory specificity, but these effects may be smaller than on future specificity and a higher "dose" of training might be needed to observe statistically significant changes.

Central to the purpose of FEST, less people met criteria for anhedonia at follow-up relative to the control group. In addition, there were changes on a trait measure of consummatory pleasure, and effects on anticipated pleasure and predictions of pleasure (affective forecasting) of future events. Therefore, FEST caused participants to perceive future events as more pleasurable, and to experience stronger positive affect when thinking about them. These findings provide further evidence that targeting the autobiographical processes of future thinking can reduce anhedonia pathology that contributes to poorer wellbeing in depression (Ducasse et al., 2018; Vinckier et al., 2017). Crucially, there was evidence for the proposed mechanism of effect, with changes in future thinking detail, perceived control, and perceived likelihood of events mediating reductions in anhedonia at follow-up. Previous studies have indicated that the likelihood predictions can be altered in those with depression (Miranda et al., 2017), and that improvements in the perceived control and likelihood of personally-relevant future events might be particularly important in affecting depressive pathology, given they relate to information about self-efficacy and plausibility that might be used to appraise whether or not someone will actually engage in a behaviour (Armitage & Conner, 2001; Brown et al., 2002). The parallel mediation model provided strongest support for perceived control and its indirect effects on anhedonia. Although pathways for other future thinking characteristics in this parallel mediation model, and single mediation tests of specificity, imagery, and verbal fluency, were in the expected directions, they did not reach statistical significance. This may be due to there being relatively smaller changes on these characteristics, relative to those that were significant mediators. It is important to acknowledge that there was limited statistical power in these analyses to detect significant indirect effect sizes. The current findings suggest that future studies with larger samples or methods of generating larger effects, such as increasing the length of training, may find that other characteristics of future thinking also mediate effects on anhedonia.

Turning to other clinical variables, the remission rate in FEST was substantially higher than the control group. Around 65% of people in the FEST group no longer met criteria for an MDE compared to 35% in the control group, the latter of which is consistent with average remission rates in care-as-usual control groups (Cuijpers et al., 2014). Relatedly, more participants in the FEST group showed reliable changes in symptom severity. The effects observed on behavioural activation and the global functioning measure complement these findings and show that people in the FEST group were reporting clinically-meaningful improvements in goal-directed behaviour and psychological, social and occupational functioning at follow-up.

The participants reported finding FEST to be easy to understand and helpful and would recommend it to others. Around half of the participants did not agree that it was long enough. Given that FEST had previously been validated in a community sample (Hallford, Yeow, et al., 2020), the same short two-session format was retained for this study. However, at least some participants may be receptive to additional sessions, which may help to strengthen the effects on future thinking variables, and potentially produce stronger mediated effects on the remission of anhedonia also.

Limitations and Future Directions

This study provides evidence for the efficacy of FEST in the context of depression among adults who meet the anhedonia criterion. One important step forward for this research, and other studies that target autobiographical thinking as a means of improving mental health, are comparator groups that can control for so-called common factors or generalizable

processes. Without such comparators it cannot be determined whether FEST has distinguishable effects, and pathways of effect. In addition to common benefits such as positive interactions in the group, expectations effects etc., in the case of FEST it would be important to control for generalizable autobiographical thinking processes that occur when thinking about the present or the past also. Although the current study showed evidence for specific mechanisms of change of FEST through mediation effects, it is important to distinguish this from other mechanisms that might overlap, such as thinking about general schematic representations of positive events that are not personal in nature, or events from one's past. Recent research on delay discounting and future thinking has adopted such comparator groups involving autobiographical recall of recent activities that are engaged as part of the protocol (O'Donnell et al., 2017; Stein et al., 2016; Sze et al., 2017). These are, however, used in controlled laboratory experiments or short-term studies in which the generalizability to a clinical context is not clear. Another important consideration is whether this training in voluntary, effortful future thinking would have effects on characteristics of involuntary, spontaneous future thinking. If, as suggested by Cole & Kvavilashvili (2021), spontaneous, future thoughts are "pre-made" or iterations of previously constructed future events, then improvements in purposeful future thinking might be also affect spontaneous, involuntary future thinking. Of note, however, is that research suggests impairments in deliberate future thinking characteristics, such as specificity or vividness, may not be observed in spontaneous future thinking in depression (Ji et al., 2019; Watson et al., 2013).

The evaluation of FEST was positive overall with a high proportion of intervention completers providing feedback. However, despite efforts to contact participants via email and phone, there was a substantial amount of dropout in terms of completion of follow-up outcome measures, and particularly in the FEST group by the three-month time-point. Of the 93 people allocated to the intervention, 60 in total started and completed the intervention (the remaining 33 did not start the intervention), however, a great many of these did not complete follow-up measures. Low response rate in follow-ups is typical of online interventions (Melville et al., 2010). However, in this case it does not necessarily reflect engagement in the intervention itself, but low motivation to complete surveys to assess outcome. Potentially, it was low due to the limited nature of involvement in the intervention and interaction with the researchers, and that all measures were completed online and in their own time. Further, the completion of follow-up measures may have been relatively higher in the control group due to the incentive of receiving FEST at cessation of the study. While this low response rate was not accounted for by variables such as symptom severity or demographics, it does mean there are some unknowns in terms of outcomes and generalizability for this significant subsample of participants. It is possible that people who found the treatment less helpful were less likely to respond to requests for follow-up surveys. Another limitation is that co-morbid disorders were not assessed in the current study. It is possible that specific disorders could moderate the effect of FEST on future thinking and anhedonia. However, comorbidities were also not excluded. This may increase the generalizability, given depression is commonly known to co-occur with other disorders. Although many participants reported receiving mental health support, we did not verify this beyond self-report. Also, while the groups did not differ in how many received support, this was not characterized further in terms of which type of support and how much, therefore not accounted for in the trial beyond the expected balancing outcome of randomization. Signs that additional support may have made some difference across both groups comes from the finding that support was associated with more likelihood of completing the follow-up surveys. It would be useful to better characterize types of support in future and assess whether engagement in particular forms of support, such as psychological treatment, interact with engagement in FEST. The longevity of the observed effects is unknown past the three-month follow-up, and research could investigate if these effects are maintained over time. Notably, there was a strong reliance on self-report measures for outcomes, which does introduce the possibility of demand characteristics, consistent with other studies of psychological interventions that utilize these methods. Including objective measures in future studies will help strengthen confidence in the findings. That notwithstanding, including multidimensional measures of anhedonia that tap into different domains, such as social activities, hobbies and sensory experiences (e.g., the Dimensional Anhedonia Rating Scale (Rizvi et al., 2015) or Snaith-Hamilton Pleasure Scale (Snaith et al., 1995), may be helpful to identify more precisely if where change occurs. Another important next step is to include an active control group without a specific focus on the future, potentially that involves some form of autobiographical thinking, such as on the recent past or activities completed in the session.

Training in future thinking may have benefits for people with other mental health issues; particularly given transdiagnostic occurrence of anhedonia (Hallford & Sharma, 2019; Trøstheim et al., 2020), and impairments in future thinking (Hallford et al., 2018).It's use as a relapse prevention program for depression could be explored, given there appears to be deficits in autobiographical thinking in those with remitted depression (Hallford, Rusanov, Yeow, & Barry, 2022), although this is less clear for future thinking. FEST, or other future thinking training programs, might

be examined as an adjunct to evidence-based behavioural activation treatment(Ekers et al., 2014) or integrated as a specific focus of the treatment prior to, or concurrent with, activity scheduling. This process of positively adjusting expectations of events before the event is even experienced may be a strong contribution to information that could also be elicited or provided after events to further disconfirm negative expectations (see Kube et al., 2019). Another option could be to add sessions to FEST that specifically support people to generate personal (values-based) goals or rewarding activities and engage in future thinking for simulating the process and outcome of these behaviours. Similar interventions targeting autobiographical thinking, namely Memory Specificity Training, have recently been computerized and automatized in an easily accessible online form (i.e., c-MeST; Takano et al., 2017). Two trials have now shown that c-MeST can reduce depressive symptoms for people experiencing a Major Depressive Episode (Hallford et al. 2021; Hallford, Austin, Takano, Yeow, et al., 2021), and this format may be one option for FEST in the future also. As discussed above, residual anhedonia is a risk factor in the relapse of an MDE (McMakin et al., 2012; Uher et al., 2012), and therefore examining the value of FEST as a relapse prevention may be worthwhile.

In conclusion, training in future thinking in MDE can enhance subjective and objectively rated aspects of future thinking. It also has effects in reducing anhedonia, which is mediated by changes in future thinking. Broader clinical effects are also observed, including in remission and psychosocial functioning. Targeting future thinking appears to be a mechanism through which to disrupt depressive pathology.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s10608-022-10330-z.

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Conflict of Interest The authors declare that they have no conflict of interest.

References

American Psychiatric Association (2013). American Psychiatric Association: Diagnostic and Statistical Manual of Mental Disorders Fifth Edition. In *Arlington*

Appelbaum, M., Cooper, H., Kline, R. B., Mayo-Wilson, E., Nezu, A. M., & Rao, S. M. (2018). Journal article reporting standards for quantitative research in psychology: The APA publications and Communications Board task force report. *American Psychologist*, *73*(1), https://doi.org/10.1037/amp0000191

Armitage, C. J., & Conner, M. (2001). Efficacy of the theory of planned behaviour: A meta-analytic review. *British Journal of Social Psychology*, *40*(4), https://doi.org/10.1348/014466601164939

Association, A. P. (1994). Diagnostic and statistical manual IV. *Washington DC: American Psychiatric …*, *1998*

Barry, T. J., Hallford, D. J., & Takano, K. (2021). Autobiographical Memory Impairments as a Transdiagnostic Feature of Mental Illness: A meta-analytic review of investigations into autobiographical memory specificity and overgenerality amongst people with psychiatric diagnoses. Psychological Bulletin. 147(10), 1054.

Barry, T. J., Sze, W. Y., & Raes, F. (2019). A meta-analysis and systematic review of Memory Specificity Training (MeST) in the treatment of emotional disorders. *Behaviour Research and Therapy*, *116*. https://doi.org/10.1016/j.brat.2019.02.001

Barsics, C., van der Linden, M., & D'Argembeau, A. (2016). Frequency, characteristics, and perceived functions of emotional future thinking in daily life. *Quarterly Journal of Experimental Psychology*, *69*(2), https://doi.org/10.1080/17470218.2015.1051560

Baumgartner, H., Pieters, R., & Bagozzi, R. P. (2008). Future-oriented emotions: Conceptualization and behavioral effects. *European Journal of Social Psychology*, *38*(4), https://doi.org/10.1002/ejsp.467

Benjamini, Y., & Hochberg, Y. (1995). Controlling the False Discovery Rate: A Practical and Powerful Approach to Multiple Testing. *Journal of the Royal Statistical Society: Series B (Methodological)*, *57*(1), https://doi.org/10.1111/j.2517-6161.1995.tb02031.x

Blackwell, S. E., Browning, M., Mathews, A., Pictet, A., Welch, J., Davies, J., Watson, P., Geddes, J. R., & Holmes, E. A. (2015). Positive imagery-based cognitive bias modification as a web-based treatment tool for depressed adults: A randomized controlled trial. *Clinical Psychological Science*, *3*(1), https://doi.org/10.1177/2167702614560746

Blairy, S., Neumann, A., Nutthals, F., Pierret, L., Collet, D., & Philippot, P. (2008). Improvements in autobiographical memory in schizophrenia patients after a cognitive intervention: A preliminary study. *Psychopathology*, *41*(6), https://doi.org/10.1159/000155217

Bodlund, O., Kullgren, G., Ekselius, L., Lindström, E., & von Knorring, L. (1994). Axis V—Global Assessment of Functioning Scale: Evaluation of a self-report version. *Acta Psychiatrica Scandinavica*, *90*(5), https://doi.org/10.1111/j.1600-0447.1994.tb01604.x

Bolin, J. H., & Hayes, Andrew, F. (2014). (2013). Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach. New York, NY: The Guilford Press. *Journal of Educational Measurement*, *51*(3). https://doi.org/10.1111/jedm.12050

Brown, G. P., MacLeod, A. K., Tata, P., & Goddard, L. (2002). Worry and the simulation of future outcomes. *Anxiety Stress and Coping*, *15*(1), https://doi.org/10.1080/10615800290007254

Chen, G., Luo, H., yue, Wu, G., Zhou, C., Wang, K., Feng, K., Xiao, Z., Huang, J., jing, Gan, J., chun, Zhao, P., Liu, P. Z., & Wang, Y. (2020). Improving Mental Time Travel in Schizophrenia: Do Remembering the Past and Imagining the Future Make a

Difference? *Cognitive Therapy and Research*, *44*(5), https://doi.org/10.1007/s10608-020-10083-7

Christensen, L., & Mendoza, J. L. (1986). A method of assessing change in a single subject: An alteration of the RC index. In *Behavior Therapy* (Vol.17, Issue 3). https://doi.org/10.1016/S0005-7894(86)80060-0

Cole, S., & Kvavilashvili, L. (2021). Spontaneous and deliberate future thinking: a dual process account. In *Psychological Research* (Vol.85, Issue 2). https://doi.org/10.1007/s00426-019-01262-7

Craske, M. G., Treanor, M., Dour, H., Meuret, A., & Ritz, T. (2019). Positive Affect Treatment for Depression and Anxiety: A Randomized Clinical Trial for a Core Feature of Anhedonia. *Journal of Consulting and Clinical Psychology*, *87*(5), https://doi.org/10.1037/ccp0000396

Cuijpers, P., Karyotaki, E., Weitz, E., Andersson, G., Hollon, S. D., & van Straten, A. (2014). The effects of psychotherapies for major depression in adults on remission, recovery and improvement: A meta-analysis. *Journal of Affective Disorders*, *Vol. 159*, https://doi.org/10.1016/j.jad.2014.02.026

D'Argembeau, A., & van der Linden, M. (2012). Predicting the phenomenology of episodic future thoughts. *Consciousness and Cognition*, *21*(3), https://doi.org/10.1016/j.concog.2012.05.004

Ducasse, D., Loas, G., Dassa, D., Gramaglia, C., Zeppegno, P., Guillaume, S., Olié, E., & Courtet, P. (2018). Anhedonia is associated with suicidal ideation independently of depression: A meta-analysis. *Depression and Anxiety*, *35*(5), https://doi.org/10.1002/da.22709

Dunn, B. D., German, R. E., Khazanov, G., Xu, C., Hollon, S. D., & DeRubeis, R. J. (2020). Changes in Positive and Negative Affect During Pharmacological Treatment and Cognitive Therapy for Major Depressive Disorder: A Secondary Analysis of Two Randomized Controlled Trials. *Clinical Psychological Science*, *8*(1), https://doi.org/10.1177/2167702619863427

Ekers, D., Webster, L., van Straten, A., Cuijpers, P., Richards, D., & Gilbody, S. (2014). Behavioural activation for depression; An update of meta-analysis of effectiveness and sub group analysis. *Plos One*, *9*(6), https://doi.org/10.1371/journal.pone.0100100

Engel, M., Fritzsche, A., & Lincoln, T. M. (2013). Anticipatory pleasure and approach motivation in schizophrenia-like negative symptoms. *Psychiatry Research*, *210*(2), https://doi.org/10.1016/j.psychres.2013.07.025

Faul, F., ErdFelder, E., Lang, A. G., & Buchner, A. (2007). G*Power 3.1 manual.Behavioral Research Methods, *39*(2)

Fuhr, K., Hautzinger, M., Krisch, K., Berking, M., & Ebert, D. D. (2016). Validation of the Behavioral Activation for Depression Scale (BADS) - Psychometric properties of the long and short form. *Comprehensive Psychiatry*, *66*. https://doi.org/10.1016/j.comppsych.2016.02.004

Gamble, B., Moreau, D., Tippett, L. J., & Addis, D. R. (2019). Specificity of Future Thinking in Depression: A Meta-Analysis. *Perspectives on Psychological Science*, *14*(5), https://doi.org/10.1177/1745691619851784

Gard, D. E., Gard, M. G., Kring, A. M., & John, O. P. (2006). Anticipatory and consummatory components of the experience of pleasure: A scale development study. *Journal of Research in Personality*, *40*(6), https://doi.org/10.1016/j.jrp.2005.11.001

Gross, J. J., & John, O. P. (2003). Individual Differences in Two Emotion Regulation Processes: Implications for Affect, Relationships, and Well-Being. *Journal of Personality and Social Psychology*, *85*(2), https://doi.org/10.1037/0022-3514.85.2.348

Hallford, D. J., & Austin, D. W. (2021). Wanting and Liking: Testing the Factor Structure of The Temporal Experience of Pleasure Scale in Major Depression and Community Samples. *Assessment*. https://doi.org/10.1177/1073191121998767

Hallford, D. J., Austin, D. W., Takano, K., Fuller-Tyszkiewicz, M., & Raes, F. (2021). Computerized Memory Specificity Training (c-MeST) for major depression: A randomised controlled trial. *Behaviour Research and Therapy*, *136*. https://doi.org/10.1016/j.brat.2020.103783

Hallford, D. J., Austin, D. W., Takano, K., & Raes, F. (2018). Psychopathology and episodic future thinking: A systematic review and meta-analysis of specificity and episodic detail. *Behaviour Research and Therapy*, *102*. https://doi.org/10.1016/j.brat.2018.01.003

Hallford, D. J., Austin, D. W., Takano, K., Yeow, J. J., Rusanov, D., Fuller-Tyszkiewicz, M., & Raes, F. (2021). Improving Usual Care Outcomes in Major Depression in Youth by Targeting Memory Specificity: A Randomized Controlled Trial of Adjunct Computerised Memory Specificity Training (c-MeST). In *Preprint*

Hallford, D. J., Barry, T. J., Austin, D. W., Raes, F., Takano, K., & Klein, B. (2020). Impairments in episodic future thinking for positive events and anticipatory pleasure in major depression. *Journal of Affective Disorders*, *260*. https://doi.org/10.1016/j.jad.2019.09.039

Hallford, D. J., Farrell, H., & Lynch, E. (2020). Increasing Anticipated and Anticipatory Pleasure Through Episodic Thinking. *Emotion*. https://doi.org/10.1037/emo0000765

Hallford, D. J., & Sharma, M. K. (2019). Anticipatory pleasure for future experiences in schizophrenia spectrum disorders and major depression: A systematic review and meta-analysis. *British Journal of Clinical Psychology*, *58*(4), https://doi.org/10.1111/bjc.12218

Hallford, D. J., Sharma, M. K., & Austin, D. W. (2020). Increasing Anticipatory Pleasure in Major Depression through Enhancing Episodic Future Thinking: a Randomized Single-Case Series Trial. *Journal of Psychopathology and Behavioral Assessment*, *42*(4), https://doi.org/10.1007/s10862-020-09820-9

Hallford, D. J., Takano, K., Raes, F., & Austin, D. W. (2020). Psychometric Evaluation of an Episodic Future Thinking Variant of the Autobiographical Memory Test - Episodic Future Thinking-Test (EFT-T). *European Journal of Psychological Assessment*, *36*(4), https://doi.org/10.1027/1015-5759/a000536

Hallford, D. J., Yeow, J. J. E., Fountas, G., Herrick, C. A., Raes, F., & D'Argembeau, A. (2020). Changing the future: An initial test of Future Specificity Training (FeST). *Behaviour Research and Therapy*, *131*. https://doi.org/10.1016/j.brat.2020.103638

Hoerger, M., Quirk, S. W., Chapman, B. P., & Duberstein, P. R. (2012). Affective forecasting and self rated symptoms of depression, anxiety, and hypomania: Evidence for a dysphoric forecasting bias. *Cognition and Emotion*, *26*(6), 1098–1106. https://doi.org/10.1080/02699931.2011.631985

Holmes, E. A., Blackwell, S. E., Burnett Heyes, S., Renner, F., & Raes, F. (2016). Mental Imagery in Depression: Phenomenology, Potential Mechanisms, and Treatment Implications. *Annual Review of Clinical Psychology*, *12*. https://doi.org/10.1146/annurev-clinpsy-021815-092925

Holmes, E. A., Ghaderi, A., Harmer, C. J., Ramchandani, P. G., Cuijpers, P., Morrison, A. P., Roiser, J. P., Bockting, C. L. H., O'Connor, R. C., Shafran, R., Moulds, M. L., & Craske, M. G. (2018). The Lancet Psychiatry Commission on psychological treatments research in tomorrow's science. In *The Lancet Psychiatry* (Vol.5, Issue 3). https://doi.org/10.1016/S2215-0366(17)30513-8

IBM Corp (2019). IBM SPSS Statistics for Windows, Version 26.0. In *2019*

Jacobson, N. S., & Truax, P. (1991). Clinical Significance: A Statistical Approach to Defining Meaningful Change in Psychotherapy Research. *Journal of Consulting and Clinical Psychology*, *59*(1), https://doi.org/10.1037/0022-006X.59.1.12

Ji, J. L., Geiles, D., & Saulsman, L. M. (2021). Mental imagery-based episodic simulation amplifies motivation and behavioural engagement in planned reward activities. *Behaviour Research and Therapy*, *145*. https://doi.org/10.1016/j.brat.2021.103947

Ji, J. L., Holmes, E. A., MacLeod, C., & Murphy, F. C. (2019). Spontaneous cognition in dysphoria: reduced positive bias in imagining the future. *Psychological Research Psychologische Forschung*, *83*(4), https://doi.org/10.1007/s00426-018-1071-y

Kanter, J. W., Mulick, P. S., Busch, A. M., Berlin, K. S., & Martell, C. R. (2007). The Behavioral Activation for Depression Scale (BADS): Psychometric properties and factor structure. *Journal of Psychopathology and Behavioral Assessment*, *29*(3), https://doi.org/10.1007/s10862-006-9038-5

Korn, C. W., Sharot, T., Walter, H., Heekeren, H. R., & Dolan, R. J. (2014). Depression is related to an absence of optimistically biased belief updating about future life events. *Psychological Medicine*, *44*(3), 579–592. https://doi.org/10.1017/s0033291713001074

Kroenke, K., Spitzer, R. L., Williams, J. B. W., & Löwe, B. (2010). The Patient Health Questionnaire Somatic, Anxiety, and Depressive Symptom Scales: A systematic review. *General Hospital Psychiatry*, *32*(4), https://doi.org/10.1016/j.genhosppsych.2010.03.006

Kryza-Lacombe, M., Pearson, N., Lyubomirsky, S., Stein, M. B., Wiggins, J. L., & Taylor, C. T. (2021). Changes in neural reward processing following Amplification of Positivity treatment for depression and anxiety: Preliminary findings from a randomized waitlist controlled trial. *Behaviour Research and Therapy*, *142*. https://doi.org/10.1016/j.brat.2021.103860

Kube, T., Glombiewski, J. A., Gall, J., Toussaint, L., Gärtner, T., & Rief, W. (2019). How to modify persisting negative expectations in major depression? An experimental study comparing three strategies to inhibit cognitive immunization against novel positive experiences. *Journal of Affective Disorders*, *250C*, 231–240. https://doi.org/10.1016/j.jad.2019.03.027

Lang, T. J., Blackwell, S. E., Harmer, C. J., Davison, P., & Holmes, E. A. (2012). Cognitive Bias Modification Using Mental Imagery for Depression: Developing a Novel Computerized Intervention to Change Negative Thinking Styles. *European Journal of Personality*, *26*(2), https://doi.org/10.1002/per.855

MacLeod, A. K., Rose, G. S., & Williams, J. M. G. (1993). Components of hopelessness about the future in parasuicide. *Cognitive Therapy and Research*, *17*(5), https://doi.org/10.1007/BF01173056

MacLeod, A. K., & Salaminiou, E. (2001). Reduced positive future-thinking in depression: Cognitive and affective factors. *Cognition and Emotion*, *15*(1), https://doi.org/10.1080/02699930125776

MacLeod, A. K., Tata, P., Kentish, J., & Jacobsen, H. (1997). Retrospective and Prospective Cognitions in Anxiety and Depression. *Cognition and Emotion*, *11*(4), https://doi.org/10.1080/026999397379881

MacLeod, A. K., Tata, P., Tyrer, P., Schmidt, U., Davidson, K., Thompson, S., Airlie, J., Baxter, S., Byford, S., Byrne, G., Cameron, S., Caplan, R., Catalan, J., Cooper, S., Ferguson, C., Kim, L., Freeman, C., Frost, S., Godley, J., & Wessely, S. (2005). Hopelessness and positive and negative future thinking in parasuicide. *British Journal of Clinical Psychology*, *44*(4), https://doi.org/10.1348/014466505X35704

Marroquín, B., & Nolen-Hoeksema, S. (2015).Event prediction and affective forecasting in

depressive cognition: Using emotion as information about the future. *Journal of Social and* Clinical Psychology, *34*(2),117–134. https://doi.org/10.1521/jscp.2015.34.2.117

McMakin, D. L., Olino, T. M., Porta, G., Dietz, L. J., Emslie, G., Clarke, G., Wagner, K. D., Asarnow, J. R., Ryan, N. D., Birmaher, B., Shamseddeen, W., Mayes, T., Kennard, B., Spirito, A., Keller, M., Lynch, F. L., Dickerson, J. F., & Brent, D. A. (2012). Anhedonia predicts poorer recovery among youth with selective serotonin reuptake inhibitor treatmentresistant depression. *Journal of the American Academy of Child and Adolescent Psychiatry*, *51*(4), https://doi.org/10.1016/j.jaac.2012.01.011

Melville, K. M., Casey, L. M., & Kavanagh, D. J. (2010). Dropout from internet-based treatment for psychological disorders. *British Journal of Clinical Psychology*, *49*(4), https://doi.org/10.1348/014466509X472138

Miranda, R., Weierich, M., Khait, V., Jurska, J., & Andersen, S. M. (2017). Induced optimism as mental rehearsal to decrease depressive predictive certainty. *Behaviour Research and Therapy*, *90*, 1–8. https://doi.org/10.1016/j.brat.2016.11.011

Morina, N., Deeprose, C., Pusowski, C., Schmid, M., & Holmes, E. A. (2011). Prospective mental imagery in patients with major depressive disorder or anxiety disorders. *Journal of Anxiety Disorders*, *25*(8), https://doi.org/10.1016/j.janxdis.2011.06.012

Muthén, L. K., & Muthén, B. O. (2017). Mplus User's Guide. Eighth Edition. *Los Angeles, CA: Muthén & Muthén*

Nguyen, D. P., Klein, B., Meyer, D., Austin, D. W., & Abbott, J. A. M. (2015). The diagnostic validity and reliability of an internet-based clinical assessment program for mental disorders. *Journal of Medical Internet Research*, *17*(9), https://doi.org/10.2196/jmir.4195

O'Connor, R. C., Connery, H., & Cheyne, W. M. (2000). Hopelessness: The role of depression, future directed thinking and cognitive vulnerability. *Psychology Health and Medicine*, *5*(2), https://doi.org/10.1080/713690188

O'Donnell, S., Daniel, O., T., & Epstein, L. H. (2017). Does goal relevant episodic future thinking amplify the effect on delay discounting? *Consciousness and Cognition*, *51*. https://doi.org/10.1016/j.concog.2017.02.014

Pile, V., Smith, P., Leamy, M., Oliver, A., Bennett, E., Blackwell, S. E., Meiser-Stedman, R., Stringer, D., Dunn, B. D., Holmes, E. A., & Lau, J. Y. F. (2021). A feasibility randomised controlled trial of a brief early intervention for adolescent depression that targets emotional mental images and memory specificity (IMAGINE). *Behaviour Research and Therapy*, *143*. https://doi.org/10.1016/j.brat.2021.103876

Raes, F., Williams, J. M. G., & Hermans, D. (2009). Reducing cognitive vulnerability to depression: A preliminary investigation of MEmory Specificity Training (MEST) in inpatients with depressive symptomatology. *Journal of Behavior Therapy and Experimental Psychiatry*, *40*(1), https://doi.org/10.1016/j.jbtep.2008.03.001

Ramirez, A., Ekselius, L., & Ramklint, M. (2008). Axis V - Global Assessment of Functioning Scale (GAF), further evaluation of the self-report version. *European Psychiatry*, *23*(8), https://doi.org/10.1016/j.eurpsy.2008.05.001

Renner, F., Murphy, F. C., Ji, J. L., Manly, T., & Holmes, E. A. (2019). Mental imagery as a "motivational amplifier" to promote activities. *Behaviour Research and Therapy*, *114*. https://doi.org/10.1016/j.brat.2019.02.002

Rizvi, S. J., Quilty, L. C., Sproule, B. A., Cyriac, A., Bagby, M., R., & Kennedy, S. H. (2015). Development and validation of the Dimensional Anhedonia Rating Scale (DARS) in a community sample and individuals with major depression. *Psychiatry Research*, *229*(1–2), https://doi.org/10.1016/j.psychres.2015.07.062

Schacter, D. L., Benoit, R. G., & Szpunar, K. K. (2017). Episodic future thinking: mechanisms and functions. In *Current Opinion in Behavioral Sciences* (Vol. 17). https://doi.org/10.1016/j.cobeha.2017.06.002

Schulz, K. F., Altman, D. G., & Moher, D. (2010). CONSORT 2010 statement: Updated guidelines for reporting parallel group randomized trials. In *Annals of Internal Medicine* (Vol.152, Issue 11). https://doi.org/10.7326/0003-4819-152-11-201006010-00232

Shankman, S. A., Katz, A. C., DeLizza, A. A., Sarapas, C., Gorka, S. M., & Campbell, M. L. (2014). The different facets of anhedonia and their associations with different psychopathologies. In *Anhedonia: A Comprehensive Handbook Volume I: Conceptual Issues and Neurobiological Advances*. https://doi.org/10.1007/978-94-017-8591-4_1

Sheehan, D., Lecrubier, Y., Sheehan, K. H., Amorim, P., Janavs, J., Weiller, E., Hergueta, T., Baker, R., & Dunbar, G. C. (1998). The

Mini-International Neuropsychiatric Interview (M.I.N.I.): The development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. *Journal of Clinical Psychiatry*, *59*(SUPPL. 20)

Sherdell, L., Waugh, C. E., & Gotlib, I. H. (2012). Anticipatory pleasure predicts motivation for reward in major depression. *Journal of Abnormal Psychology*, *121*(1), https://doi.org/10.1037/a0024945

Snaith, R. P., Hamilton, M., Morley, S., Humayan, A., Hargreaves, D., & Trigwell, P. (1995). A scale for the assessment of hedonic tone. The Snaith-Hamilton Pleasure Scale. *British Journal of Psychiatry*, *167*(JULY), https://doi.org/10.1192/bjp.167.1.99

Spitzer, R. L., Kroenke, K., & Williams, J. B. W. (1999). Validation and utility of a self-report version of PRIME-MD: The PHQ Primary Care Study. *Journal of the American Medical Association*, *282*(18), https://doi.org/10.1001/jama.282.18.1737

Stein, J. S., Wilson, A. G., Koffarnus, M. N., Daniel, T. O., Epstein, L. H., & Bickel, W. K. (2016). Unstuck in time: episodic future thinking reduces delay discounting and cigarette smoking. *Psychopharmacology (Berl)*, *233*, 21–22. https://doi.org/10.1007/s00213-016-4410-y

Sze, Y. Y., Stein, J. S., Bickel, W. K., Paluch, R. A., & Epstein, L. H. (2017). Bleak Present, Bright Future: Online Episodic Future Thinking, Scarcity, Delay Discounting, and Food Demand. *Clinical Psychological Science*, *5*(4), https://doi.org/10.1177/2167702617696511

Takano, K., Moriya, J., & Raes, F. (2017). Lost in distractors: Reduced Autobiographical Memory Specificity and dispersed activation spreading over distractors in working memory. *Behaviour Research and Therapy*, *94*. https://doi.org/10.1016/j.brat.2017.04.005

Trøstheim, M., Eikemo, M., Meir, R., Hansen, I., Paul, E., Kroll, S. L., Garland, E. L., & Leknes, S. (2020). Assessment of Anhedonia in Adults with and without Mental Illness: A Systematic Review and Meta-analysis. *JAMA Network Open*, *3*(8), https://doi.org/10.1001/jamanetworkopen.2020.13233

Uher, R., Perlis, R. H., Henigsberg, N., Zobel, A., Rietschel, M., Mors, O., Hauser, J., Dernovsek, M. Z., Souery, D., Bajs, M., Maier, W., Aitchison, K. J., Farmer, A., & McGuffin, P. (2012). Depression symptom dimensions as predictors of antidepressant treatment outcome: Replicable evidence for interest-activity symptoms. *Psychological Medicine*, *42*(5), https://doi.org/10.1017/S0033291711001905

Vinckier, F., Gourion, D., & Mouchabac, S. (2017). Anhedonia predicts poor psychosocial functioning: Results from a large cohort of patients treated for major depressive disorder by general practitioners. *European Psychiatry*, *44*. https://doi.org/10.1016/j.eurpsy.2017.02.485

Watson, L. A., Berntsen, D., Kuyken, W., & Watkins, E. R. (2013). Involuntary and voluntary autobiographical memory specificity as a function of depression. *Journal of Behavior Therapy and Experimental Psychiatry*, *44*(1), https://doi.org/10.1016/j.jbtep.2012.06.001

Williams, J. M. G., & Broadbent, K. (1986). Autobiographical Memory in Suicide Attempters. *Journal of Abnormal Psychology*, *95*(2), https://doi.org/10.1037/0021-843X.95.2.144

Hallford, D. J., Rusanov, D., Yeow, J. J., & Barry, T. (2022). Reduced Specificity and Increased Overgenerality of Autobiographical Memory Persist as Cognitive Vulnerabilities in Remitted Major Depression: A Meta-Analysis. Clinical Psychology & Psychotherapy. doi:10.1002/cpp.2786