Cognitive Therapy and Research
https://doi.org/10.1007/s10608-025-10593-2

ORIGINAL ARTICLE

Mediators and Predictors of Treatment Response in a Brief Online Intervention for Rumination and Worry

Emily Upton[1,2] · Venkatesha Venkatesha[1] · Amy E. Joubert[1] · Alison E. J. Mahoney[3] · Michelle L. Moulds[1] · Aliza Werner-Seidler[1,2] · Jill M. Newby[1,2]

Accepted: 5 March 2025

Abstract

Background Repetitive Negative Thinking (RNT) is a key transdiagnostic mechanism underlying anxiety and depressive disorders, and targeting RNT specifically leads to improved treatment outcomes. There is a lack of research however into mechanisms of change in RNT-focused interventions and factors that predict treatment response. The aim of this study was to examine the mediators and predictors of outcome (RNT, depression, anxiety, and distress) in a brief online intervention for RNT in adults.

Methods This study used secondary data from a Randomised Controlled Trial of the *Managing Rumination and Worry Program* (Joubert et al. in Beh Res Therapy, 168:104378, 2023) in which N = 137 adults with elevated levels of RNT were randomly allocated to a 3-lesson clinician-guided or self-guided version of the program delivered over 6 weeks, or a treatment-as-usual (TAU) control condition. Self-report measures of depression, anxiety, distress, and RNT were administered at baseline, post-treatment, and 3-month follow-up; RNT and distress were also measured prior to each lesson.

Results Intention-to-treat linear mixed models showed a gradual reduction in RNT and distress over treatment in both active conditions, with the largest reductions in RNT occurring after the lessons containing the active treatment strategies (2 and 3). Structural equation modelling mediation analyses showed that reductions in transdiagnostic RNT mediated reductions in distress between Lessons 2 and 3, and reductions in rumination specifically mediated reductions in distress and depression between post-treatment and follow-up, but there was no consistent pattern of mediation by RNT throughout treatment. Finally, higher baseline symptom severity (particularly rumination) significantly predicted poorer post-treatment outcomes, while higher treatment expectancy and clinician guidance significantly predicted better post-treatment outcomes.

Conclusion This is one of the first studies to examine mediators and predictors of change in a brief, online RNT-focused intervention for adults with elevated RNT. Further research in larger samples is needed, examining additional possible mediating and predictor variables and across more time points, to better understand how and for whom this intervention reduces RNT, anxiety and depression.

Australian and New Zealand Clinical Trials Registration number: ACTRN 12620000959976. Date of registration: 25/09/2020.

Keywords Rumination · Worry · Anxiety · Depression · Mediation · Predictors

✉ Emily Upton
e.upton@blackdog.org.au

✉ Jill M. Newby
j.newby@unsw.edu.au

Venkatesha Venkatesha
venkatesh.bhagavath@hotmail.com

Amy E. Joubert
amy_joubert@hotmail.com

Alison E. J. Mahoney
Alison.Mahoney@svha.org.au

Michelle L. Moulds
m.moulds@unsw.edu.au

Aliza Werner-Seidler
a.werner-seidler@blackdog.org.au

[1] UNSW Sydney, Sydney, Australia

[2] Black Dog Institute, Sydney, Australia

[3] St Vincent's Hospital Sydney, Darlinghurst, Australia

Published online: 17 March 2025

Introduction

Depression and anxiety disorders are among the most prevalent mental illnesses contributing substantially to the global burden of disease (Santomauro et al., 2021), underscoring the key need for more accessible treatment. Repetitive Negative Thinking (RNT) is a key causal and maintaining process across multiple depressive and anxiety disorders (Ehring & Watkins, 2008). RNT encapsulates the process of perseverative and unhelpful thinking in both rumination (repeated abstract, negative thinking about symptoms, causes, meanings, and past events, frequently seen in depression) and worry (repeated catastrophic thinking about potential negative future events, typically characteristic of anxiety; Watkins, 2004). There is evidence that RNT is frequently involved in the onset, maintenance and severity of depressive and anxiety disorders, and the risk of relapse (Ehring & Watkins, 2008; Wahl et al., 2019), and that individuals with higher levels of baseline RNT respond more poorly to cognitive behavioural therapy (CBT) interventions for depression and anxiety (Crane & Williams, 2010; Schmaling et al., 2002). RNT therefore is an important transdiagnostic target for intervention.

Researchers have therefore developed psychological treatments specifically targeting RNT, with evidence that targeting RNT explicitly leads to improved overall treatment outcomes compared to CBT treatments for depression and anxiety that do not specifically address RNT (Spinhoven et al., 2018; Watkins, 2015; Watkins & Roberts, 2020; Watkins, 2022). Rumination-Focused CBT (RF-CBT; Watkins, 2018), for example, was developed to specifically target depressive rumination in the context of depression. RF-CBT significantly reduces worry, rumination, and depression and anxiety symptoms, compared to treatment as usual (Hvenegaard et al., 2020; Teismann et al., 2014; Topper et al., 2017), including in samples of patients with chronic and/or treatment-resistant depression (Watkins et al., 2011). Moreover, RF-CBT reduces the risk of relapse in adolescents and adults with a history of depression (Jacobs et al., 2016), and prevents the development of anxiety and depressive disorders in adolescents and young adults who are at-risk owing to high trait levels of RNT (Cook et al., 2019; Topper et al., 2017).

While there is a growing evidence base demonstrating the effectiveness of RNT-focused interventions, more research is needed to investigate proposed mechanisms of change in these treatments (Ehring, 2021; Watkins, 2009). Specifically, there is a lack of research investigating how RNT-focused treatments work, including whether they successfully alleviate (or prevent) depression or anxiety through changing RNT, and whether changes in RNT precede changes in symptoms (Watkins, 2009). In one trial of RF-CBT (Watkins et al., 2011), decreases in rumination mediated treatment effects on depression symptom severity. More research is needed to replicate these findings, and to extend them by studying the potential mediating effect of changes in RNT on anxiety as well as depression symptoms. Another recent trial which tested whether RF-CBT could *prevent* depression and Generalised Anxiety Disorder (GAD) in high-risk adolescents (Topper et al., 2017) found that the benefits of the treatment (operationalised as lower prevalence of depression and GAD relative to the control condition) were mediated by changes in RNT during treatment. It is important to examine whether this same pattern of mediation found in prevention studies is observed in currently anxious or depressed individuals in treatment studies.

It is also unknown for whom RNT-focused interventions are most effective, due to the lack of research investigating the factors that predict treatment outcomes in these interventions. Only two identified trials of RNT-focused treatments have each investigated a potential predictor variable. The first (Cook et al., 2019) was a trial of online RF-CBT for the prevention of depression in undergraduate students with high levels of RNT. As hypothesised, due to the interaction between rumination and stressful life events, treatment was more likely to prevent the onset of depression in participants who reported moderate or severe stressful life events at baseline (Cook et al., 2019). The second was a recent study of group-delivered RF-CBT (Wallsten et al., 2023). Despite previous literature showing that patients with higher ratings of treatment credibility and effectiveness prior to commencement (i.e., treatment expectancy) generally experience better outcomes in various psychological therapies (Tambling, 2012), Wallsten et al. (2023) found participants' ratings of treatment expectancy were not correlated with changes in depression or anxiety symptoms over treatment. To our knowledge, no other studies have investigated potential predictive factors beyond baseline stressful life events or treatment expectancy. In non-RNT-focused CBT interventions for depression and anxiety, participants with higher baseline depression and anxiety severity, and higher baseline rumination and worry, show better treatment response to non RNT-focused CBT interventions (Barrio-Martínez et al., 2023; Karyotaki et al., 2021; Niles et al., 2021; Reins et al., 2021). Further research is needed to examine who is most likely to benefit from RNT-focused treatments and explore how they work, in order to target treatments to appropriate populations, and further enhance their efficacy.

The Current Intervention

There is also evidence that adapting treatments to be brief, and delivered online, can increase their accessibility and uptake while maintaining their effectiveness (Andersson & Carlbring, 2017; Bisby et al., 2024; Ebert et al., 2018; Ruiz et al., 2020). Joubert et al (2021) developed a brief, three-lesson online intervention that specifically targets RNT (Joubert et al., 2021) using principles guided from multiple treatment frameworks including RF-CBT (Watkins, 2018), mindfulness-based cognitive therapy (MBCT; Segal, 2018) and concreteness training (Watkins et al., 2012). The *Managing Rumination and Worry Program* was developed based on the needs and treatment preferences of individuals with high RNT (Joubert et al., 2022). It was designed to be transdiagnostic in scope, for both clinical and sub-clinical populations who demonstrate high trait levels of RNT, are at risk of developing depression or anxiety, have current symptoms, or are vulnerable to relapse.

The *Managing Rumination and Worry Program* has been evaluated in a pilot trial (Joubert et al., 2021) and randomised controlled trial (RCT) (Joubert et al., 2023) which showed it was acceptable to participants, and efficacious in reducing the frequency of RNT, as well as symptoms of anxiety, depression, and distress, compared to treatment as usual, both immediately post-treatment and at 3-month follow-up (Joubert et al., 2023). The current study extended their research by exploring the mechanisms of change and factors that predict benefit from this brief online intervention.

Study Aims and Hypotheses

The overall aim of this study was to investigate mediators and predictors of change in depression, anxiety and distress outcomes in the *Managing Rumination and Worry Program*. Psychological distress was included as an outcome as it is a transdiagnostic variable highly correlated with diagnosis and severity of anxiety and depressive disorders (Andrews & Slade, 2001), and brief to measure (using the *Kessler Psychological Distress Scale–10;* K-10; Kessler et al., 2002), so it was administered at more frequent timepoints during treatment (prior to each lesson as well as at pre, post, and follow-up). A brief transdiagnostic measure of RNT (the *Repetitive Thinking Questionnaire 10-item; RTQ-10;* McEvoy et al., 2010) was also administered prior to each lesson, enabling more comprehensive analysis of change in this variable across treatment in addition to pre-to-post change.

1) *Pattern of symptom change across treatment.* Firstly, we wanted to understand how RNT and distress changed across each session of treatment, to explore whether there were larger improvements after particular sessions, as a first step towards identifying the most beneficial treatment components. While there is no data to our knowledge on patterns of symptom change in RNT-focused interventions, studies of general CBT for depression and anxiety show varied patterns of symptom improvement in patients who respond well to treatment, including sudden gains after the first session or a gradual improvement over time (Andrews et al., 2020; Bisby et al., 2023; Robinson et al., 2020; Skelton et al., 2023). Thus, these questions were exploratory.
2) *Mediating effect of RNT.* Secondly, we aimed to investigate whether changes in RNT mediated changes in psychological distress, depression, and anxiety across treatment. We explored this in two ways, given that some measures were also administered prior to each lesson, while others were administered only at pre, post, and follow-up timepoints.

    a) *Lesson-by-lesson mediation.* First, we examined whether changes in RNT after each treatment session mediated lower levels of distress at the next lesson. No studies to our knowledge have examined session-by-session mechanisms of change in RNT-focused interventions. However, Patel et al. (2023) measured rumination and depression symptom severity periodically throughout CBT treatment for depression in an outpatient tertiary setting. They found that lower rumination levels at each treatment time point prospectively predicted lower symptoms of depression at the next time point. Based on these findings, and the findings of Watkins et al. (2011) and Topper et al. (2017) that reductions in depression symptoms (or likelihood of developing depression or anxiety symptoms) were mediated by changes in RNT during treatment, we hypothesised that changes in RNT at each time point would predict changes in distress at the following timepoint.
    b) *Pre- to post and follow-up mediation.* Next, we examined whether changes in RNT mediated the effect of treatment from pre- to post-treatment and follow-up on the key clinical outcome measures (depression, anxiety, and distress symptoms). As more measures were available, we examined this using both the transdiagnostic measure of RNT (RTQ-10) and specific measures of maladaptive rumination (the *Ruminative Response Scale—Brooding Subscale;* RRS—Brooding; Treynor et al., 2003) and worry (the *Penn State Worry Questionnaire;* PSWQ; Meyer et al., 1990), to determine whether the same pattern of mediation was observed in both sub-types of RNT. Based on evidence that reductions in RNT are associated with decreases in

depressive and anxiety symptoms in CBT interventions (Newby et al., 2014; Spinhoven et al., 2018), as well as the mediation findings in the studies of RNT-focused treatments by Watkins et al (2011) and Topper et al (2017) above, we hypothesised that reductions in RNT would mediate the reductions in pre-to post-treatment and follow-up severity of depression, anxiety, and distress.

3) *Predictors of treatment response.* Our final aim was to explore predictors of treatment response, in order to identify which individuals benefit most from this treatment. Owing to the lack of previous research in RNT-focused interventions, we based our hypotheses on studies of general CBT interventions for depression and anxiety, which show that participants with higher baseline depression and anxiety severity, and higher baseline rumination and worry, show better treatment response (Barrio-Martínez et al., 2023; Karyotaki et al., 2021; Niles et al., 2021; Reins et al., 2021). We have also referred to the literature on treatment expectancy as a predictor of better treatment outcome (Tambling, 2012), despite Wallsten et al.'s (2023) finding that treatment expectancy was not correlated with change in group RF-CBT. Therefore, we hypothesised that higher baseline severity (RNT and depression and anxiety symptom severity), and higher treatment expectations, would predict better response to treatment.

Method

Setting, Participants and Procedure

This study used secondary data from the RCT (Joubert et al., 2023) that compared the online *Managing Rumination and Worry* program delivered with or without clinician guidance to a treatment-as-usual (TAU) control condition in which participants accessed the program in self-help format after an 18-week waiting period. For a full description of the study's methods, including other measures assessed not presented in this paper, see (Joubert et al., 2023). The RCT was approved by St Vincent's Hospital Sydney Human Research Ethics Committee (HREC/18/SVH/220) and prospectively registered with the Australian and New Zealand Clinical Trials Registry (ACTRN 12620000959976).

In brief, eligible participants were aged 18 years or older, lived in Australia, were fluent in English, had access to a computer and internet, and experienced elevated levels of rumination and/or worry (RTQ-10 total score≥28). Participants were excluded if their RTQ-10 score was≤27, they had severe depression (*Patient Health Questionnaire-9* [PHQ-9; Kroenke et al., 2001a] total score>23), were actively suicidal, self-reported diagnoses of schizophrenia, bipolar disorder, or psychosis, commenced psychological therapy in the preceding month, commenced or changed dosage of depression or anxiety medication in the preceding two months, or enrolled in an online program for depression or anxiety in the preceding year.

Participants were recruited between August 2020 and March 2021, via social media advertisements and email newsletters. Eligible participants completed informed consent, eligibility screening and demographic questionnaires online, before completing a brief telephone interview including a structured diagnostic interview (abbreviated *Anxiety and Related Disorders Interview Schedule for DSM-5*; ADIS-5; Brown & Barlow, 2014) to assess current and past MDD and GAD diagnoses, and a risk assessment. They were then randomly assigned to either the 3-lesson clinician-guided or self-guided online intervention program, or the TAU waitlist control group. All participants were able to continue with any current psychological or pharmacological treatment (except those specified in the exclusion criteria) but were discouraged from commencing new treatments during the study participation period.

Participants completed online self-report measures at pre-treatment (immediately prior to Lesson 1), post-treatment (one week after completing Lesson 3), and at three-month follow-up (12 weeks after post-treatment). They also completed a measure of RNT (the RTQ-10) and distress (the K-10) prior to each lesson. The ADIS-5 MDD and GAD modules were re-administered by a Clinical Psychologist during the 3-month follow-up telephone interview.

Measures

Repetitive Thinking Questionnaire-10 (RTQ-10; McEvoy et al., 2010). The RTQ-10 is a transdiagnostic measure of the extent to which an individual engages in RNT in response to distressing situations. The scale has demonstrated excellent internal consistency across both clinical and non-clinical samples (α's=0.89–0.94; McEvoy et al., 2014, 2018), and high convergent and divergent validity (Mahoney et al., 2012; McEvoy et al., 2010, 2014).

Patient Health Questionnaire-9 (PHQ-9; Kroenke et al., 2001b). The PHQ-9 is a reliable and widely validated measure of depression symptom severity over the past two weeks (Kroenke et al., 2001b, 2016; Titov et al., 2011). It has good internal consistency (α=0.86–0.89), test–retest reliability (r=0.84), sensitivity and specificity (both 0.88), construct validity, and convergent validity (Kroenke et al., 2001b, 2016).

Generalised Anxiety Disorder 7-item Scale (GAD-7; Spitzer et al., 2006). The GAD-7 is a brief self-report scale that measures general anxiety symptom severity over the past two weeks. It has strong reliability and validity in identifying probable DSM-IV GAD (American Psychiatric Association, 2013), hand symptom severity, in both psychiatric and general populations (α = 0.89–0.92; Löwe et al., 2008; Plummer et al., 2016; Spitzer et al., 2006).

Kessler Psychological Distress Scale—10-item (K-10; Kessler et al., 2002). The K-10 is a 10-item screening measure of psychological distress over the past two weeks. It has strong psychometric properties across a wide range of samples including good discriminant validity between clinical and non-clinical samples (Kessler et al., 2002), convergent validity (Andrews & Slade, 2001), temporal stability (ICC = 0.86–0.89, r = 0.76–0.80; Merson et al., 2021), and high internal consistency (α = 0.93; Kessler et al., 2002).

Ruminative Response Scale– Brooding Subscale (RRS-Brooding; Treynor et al., 2003). This 5-item scale is a subset of the original 10-item measure of rumination, the RRS, and measures the more maladaptive form of rumination, brooding. The scale possesses strong predictive validity for depression (Schoofs et al., 2010), test re-test reliability and internal consistency (α = 0.69–0.78; Schoofs et al., 2010), convergent validity with other measures of rumination and depression (Griffith & Raes, 2014; Schoofs et al., 2010; Valencia & Paredes-Angeles, 2022), and discriminant validity (Schoofs et al., 2010).

Penn State Worry Questionnaire (PSWQ; Meyer et al., 1990). This 16-item questionnaire measures trait worry, including intensity, frequency, and perceived uncontrollability. It possesses good psychometric properties (Zlomke, 2009), with high internal consistency (α = 0.86–0.95; Brown et al., 1992), and test–retest reliability (r = 0.74—0.93; Meyer et al., 1990), good convergent validity with other measures of worry, anxiety and depression (Brown et al., 1992; Van Rijsoort et al., 1999), and good discriminant validity (Brown et al., 1992).

Table 1 Brief summary of the Managing Rumination and Worry Program content

Lesson	Skills overview
1	Psychoeducation about rumination and worry
	Self-monitoring of rumination/worry
	Activity Planning for "high risk" times
2	Three Rules of Thumb to differentiate helpful vs unhelpful rumination/worry
	Structured Problem Solving
	Worry Time
	Disengaging from rumination/worry by Shifting Attention onto present moment
3	Managing Rumination and Worry at Night
	Shifting from General to Specific Thinking
	Summary of program content and relapse prevention

Credibility/Expectancy Questionnaire (CEQ; Devilly & Borkovec, 2000). This is a brief measure of participants' perception of the credibility and perceived benefit of a treatment which was administered prior to completion of Lesson 1 of the program. It has high internal consistency (α = 0.85–0.090) and test–retest reliability, and good predictive validity for treatment outcome (Devilly & Borkovec, 2000).

Description of Intervention

The *Managing Rumination and Worry Program* comprises three lessons, delivered via an online research platform (e.g., The Virtual Clinic), that participants complete over a period of three to six weeks. Lessons are in the form of an illustrated comic-style story following two fictional characters who learn to better manage rumination and worry. Slides follow the character's stories, introduce treatment skills, and show their application in the characters' lives.

Program content[1] (see Table 1) was informed by several CBT approaches. Drawing on RF-CBT, for example, participants learn to recognise when they are ruminating or worrying, identify their individual warning signs, proactively plan activities for high-risk times, and practice more adaptive alternative strategies such as structured problem-solving (Watkins, 2018). Using skills from MBCT (Segal et al., 2018), participants learn to shift their attention away from ruminating or worrying to focus on the present moment. Another lesson teaches participants to recognise when they are engaging in an unhelpful, abstract and evaluative thinking style characteristic of rumination, and encourages them to shift to a more helpful thinking style that is specific and action-oriented, or 'concrete' (Watkins et al., 2007, 2012).

After each lesson participants download a one-to-two page lesson summary of key concepts and skills and an action plan for practicing the skills over the coming week. Optional extra resources are also accessible. A lesson is considered complete once all lesson slides have been viewed and the lesson summary/activity plan downloaded. The program is self-paced; one sequential lesson is made available each week, and a five-day lockout period between lessons encourages participants to revise and practice the previous lesson skills before accessing the next module. Participants received automated email and SMS reminders from the Virtual Clinic platform to complete lessons, questionnaires, and practice activities to encourage adherence and engagement. Participants in the clinician-guided group received brief, semi-structured check-in calls from a Provisional or Clinical Psychologist in the days following lesson completion to help summarise treatment content, answer questions,

[1] Program materials can be made available by contacting the corresponding author.

provide encouragement, and assist with implementation of treatment skills. All participants had access to technical support throughout the treatment period. Clinical and research staff also contacted participants by phone or email if they had failed to log in or complete the next lesson, or to assess their safety in response to a significant deterioration in their PHQ-9 or K-10 scores.

Statistical Analyses

1. *Pattern of symptom change across treatment:* Intention to treat linear mixed models, with fixed effects of group (clinician-guided versus self-guided), time, and group by time interaction effect were conducted to explore lesson-by-lesson changes in a) RTQ-10 and b) K-10 scores. All models included a random intercept for each subject. Pairwise comparisons, with Bonferroni corrections applied for multiple comparisons, examined whether there were statistically significant changes in scores between each lesson. In the original RCT study, significant baseline group differences were found for depression (PHQ-9) and anxiety (GAD-7) symptom severity, and current psychotherapy (see (Joubert et al., 2023) for further detail). Accordingly, we repeated the analyses controlling for these baseline variables as covariates. These and the predictor analyses were performed in IBM SPSS Statistics v28.0.1.0.
2. *Mediation analyses.* Longitudinal mediation analysis of RNT changes on outcome variables was initially planned and conducted using a random-intercept cross-lagged panel model (RI-CLPM). However, the goodness of fit measure of the RI-CLPM model did not achieve the optimal convergence. Therefore, we conducted alternate Structural Equation Modelling (SEM)-based mediation analyses. The total effect was decomposed into direct and indirect effects with the indirect effect accounting for the magnitude of the mediation. An alpha of 0.05 was used to determine statistical significance. Mediation analyses were performed in R, version 4.3.4, and STATA version 18.0.

    a) *Lesson-by-lesson mediation*. The mediating effect of changes in RNT (RTQ-10) on changes in distress (K-10) was analysed across three intervals: from Lesson 1 to Lesson 2, from Lesson 2 to Lesson 3, and from Lesson 3 to post-intervention. To test whether the reverse pattern of mediation occurred, the mediating effect of changes in distress (K-10) on RNT (RTQ-10) was repeated across the three intervals above (Lesson 1 to 2, 2 to 3, and 3 to post-treatment).

    b) *Pre-post and follow-up mediation.* Mediation analyses were repeated to separately assess the mediation effect of RNT (measured by changes in the RTQ-10), then worry (PSWQ), and rumination (RRS-Brooding), on longitudinal changes in depression (PHQ-9), anxiety (GAD-7), and distress (K-10). These analyses were conducted separately for the pre- to post-treatment outcomes, and post-treatment to 3-month follow-up outcomes.

3. *Predictor analyses.* To investigate whether the hypothesised predictor variables (treatment expectancy, and baseline depression, anxiety, RNT, worry, and rumination) predicted treatment outcomes (over and above initial symptoms and treatment group), we conducted separate linear mixed models with each outcome measure as the dependent variable (DV). In these models, we included fixed effects of time and treatment group allocation (clinician-guided or self-help), as well as each of the hypothesised predictor variables (e.g., treatment expectancy, baseline depression symptoms, baseline anxiety, baseline repetitive thinking variables). Treatment condition was included as a variable given the results of the original RCT; i.e., that participants in the clinician-guided condition had better outcomes. All models included a random intercept for each subject to account for individual differences in treatment response.

Results

Pattern of Symptom Change Across Treatment

Estimated marginal means and between-group comparisons for RTQ-10 and K-10 scores across treatment (lesson-by-lesson) and follow-up are presented in Table 2, with results of the covariate-adjusted analyses (controlling for baseline PHQ-9 and GAD-7, and current psychotherapy) presented in Table 3.

a) Changes in RNT across treatment. There was a significant effect of time ($F(4, 294) = 56.99$, $p < 0.001$), group ($F(1, 89) = 7.85$, $p = 0.006$), and a time by group interaction ($F(4, 293) = 2.67$, $p = 0.032$), showing that RNT reduced in both online treatment groups, with a larger reduction on the RTQ-10 observed in the clinician-guided group. As can be seen in Table 2 and Fig. 1, RTQ-10 scores improved across treatment and to follow-up, in both treatment groups. Both treatment groups experienced small to medium reductions in RNT after each lesson (within-group effect sizes ranging from 0.28 to 0.57; see Table 2 for effect sizes and confidence intervals). In the clinician-guided group, there was

Table 2 Estimated marginal means for repetitive negative thinking (RTQ-10) and distress (K-10) by lesson and treatment group

Measure	Group	Baseline (Pre-Lesson 1)		Lesson 2		Lesson 3		Post-treatment		3-Month follow-up		L1-L2	L2-L3	L3-Post	Post-FU
		EMM	SD	EMM	SD	EMM	SD	EMM	SD	EMM	SD	Hedges g (95% CI)	Hedges g (95% CI)	Hedges g (95% CI)	Hedges g (95% CI)
RTQ-10	Clinician guided	38.67	7.30	36.57	7.65	33.04	8.11	28.39	8.03	25.48	8.47	0.28 (-0.16, 0.72)	0.44 (-0.04, 0.92)	**0.57 (0.08, 1.05)***	0.35 (-0.16, 0.86)
	Self-help	41.06	7.30	38.63	7.49	35.03	7.80	31.71	7.95	32.58	8.18	0.33 (-0.09, 0.75)	**0.47 (0.02, 0.92)***	0.42 (-0.04, 0.88)	0.11 (-0.37, 0.58)
K-10	Clinician guided	23.93	7.45	22.71	7.63	20.35	7.85	18.25	7.81	17.15	8.02	0.16 (-0.28, 0.60)	0.30 (-0.18, 0.78)	0.27 (-0.21, 0.74)	0.14 (-0.37, 0.64)
	Self-help	27.30	7.45	25.25	7.55	24.76	7.69	23.12	7.76	22.12	7.90	0.27 (-0.15, 0.69)	0.06 (-0.38, 0.51)	0.21 (-0.25, 0.67)	0.13 (-0.36, 0.61)

EMM: Estimated marginal means, SD: Standard deviation, RTQ-10: Repetitive Thinking Questionnaire – 10, K-10: Kessler Psychological Distress Scale – 10 item, CI: Confidence Interval

*significant at .05 level (p<.05)

a significant reduction in RTQ-10 scores between Lesson 3 and post-treatment ($p=0.003$), and the reduction in RTQ-10 between Lesson 2 and 3 approached significance ($p=0.052$). In the self-help group, the only statistically significant reduction was between Lesson 2 and 3 ($p=0.024$).

The same pattern of results was found in the covariate-adjusted analyses (see Table 3) with the only exception being that in the clinician-guided group, the reduction in RNT between Lesson 2 and 3 was statistically significant ($p=0.046$).

b) Changes in Distress across treatment. There was a significant effect of time ($F(4, 287)=34.29$, $p<0.001$) and group ($F(1, 90)=7.91$, $p=0.006$), but no time by group interaction ($F(4, 287)=1.65$, $p=0.162$), showing that distress (K-10 scores) reduced in both treatment groups (see Fig. 2, and Table 2 for results including within-group effect sizes and confidence intervals). Examining lesson-by-lesson scores on the K-10, both groups experienced small but mostly non-significant improvements in distress after each lesson, with within-group effect sizes ranging from 0.06 to 0.30. In the clinician-guided group, the only statistically significant reduction in distress occurred between Lesson 2 and 3 ($p=0.046$). In the self-help group the largest reduction in distress occurred between Lesson 1 and 2, approaching statistical significance (mean difference=2.05, $p=0.060$; see Table 2). The same pattern of findings was observed in the covariate-adjusted analyses (see Table 3).

Mediating Effect of RNT

Lesson-By-Lesson Mediation

Mediating Effect of RNT on Distress The mediating effect of changes in RNT (RTQ-10) on changes in distress (K-10) was analysed across three intervals: from Lesson 1–2, from Lesson 2–3, and from Lesson 3 to post-intervention; see Table 4. From Lesson 1 to Lesson 2, the overall indirect effect was β=0.036 (95% CI −0.02–0.10), indicating a non-significant reduction in distress mediated by changes in repetitive negative thinking (with 58.2% of this effect attributed to the indirect pathway). Although the magnitude of the effect was larger in the self-help group than the clinician-guided group (62.7% vs. 6.5% of the total effect), both mediation effects remained non-significant (clinician-guided: β=0.014, 95% CI −0.08–0.11; self-help: β=0.05, 95% CI−0.01–0.12).

From Lesson 2 to Lesson 3, the results showed a significant overall indirect effect of β=0.08 (95% CI 0.02–0.14), indicating a significant reduction in distress levels through changes in repetitive negative thinking with the magnitude of the mediated effect 1.85 times that of the total effect. In

Table 3 Estimated Marginal means for repetitive negative thinking (RTQ-10) and distress (K-10) by lesson and treatment group (covariate-adjusted analyses)

Measure	Group	Baseline (Pre-Lesson 1)		Lesson 2		Lesson 3		Post-treatment		3-Month Follow-Up		L1-L2	L2-L3	L3-Post	Post-FU
		EMM	*SD*	EMM	*SD*	EMM	*SD*	EMM	*SD*	EMM	*SD*	*Hedges g (95% CI)*	*Hedges g (95% CI)*	*Hedges g (95% CI)*	*Hedges g (95% CI)*
RTQ-10	Clinician guided	38.88	7.49	36.77	7.78	33.20	8.26	28.56	8.19	25.65	8.63	0.27 (-0.17, 0.71)	0.44 (-0.04, 0.92)	**0.56 (0.07, 1.04)***	0.34 (-0.17, 0.85)
	Self-help	40.61	6.90	38.18	7.10	34.56	7.42	31.27	7.56	32.14	7.79	0.34 (-0.08, 0.77)	**0.49 (0.04, 0.94)***	0.43 (-0.03, 0.90)	0.11 (-0.36, 0.59)
K-10	Clinician guided	25.12	5.31	23.90	5.49	21.41	5.80	19.35	5.75	18.13	6.02	0.22 (-0.22, 0.66)	0.44 (-0.04, 0.92)	0.35 (-0.13, 0.83)	0.20 (-0.30, 0.71)
	Self-help	26.33	4.85	24.28	4.98	23.77	5.18	22.11	5.27	21.03	5.47	0.41 (-0.01, 0.84)	0.10 (-0.34, 0.54)	0.31 (-0.14, 0.77)	0.20 (-0.28, 0.68)

EMM: Estimated marginal means, SD: Standard deviation, RTQ-10: Repetitive Thinking Questionnaire – 10, K-10: Kessler Psychological Distress Scale – 10 item

significant at .05 level ($p<.05$), CI = Confidence Interval

the clinician-guided subgroup, the indirect effect was notably stronger (2.41 times that of the total effect) at β = 0.13 (95% CI 0.03–0.25), demonstrating a significant mediating effect of RNT on distress. However, in the self-help subgroup, the indirect effect was non-significant, β = 0.05 (95% CI − 0.04–0.15).

From Lesson 3 to the post-intervention period, there was no evidence of the mediation effect of change in RNT on distress for overall, clinician-guided, and self-help subgroups with a relatively small proportion of total effect mediated by RNT changes (7% for overall, 9% for clinician-led and 3% for self-help subgroup).

Mediating effect of distress on RNT The mediating effect of changes in distress (K-10) on RNT (RTQ-10) was repeated across the three intervals above (Lesson 1–2, 2–3, and 3 to post-treatment). As above, the mediating effect of change in distress on change in RNT showed variability across different lessons and groups, but no effects reached statistical significance (see Table 5). Only one indirect mediating effect of changes in distress on changes in RNT bordered on statistical significance: from Lesson 3 to post-intervention, in the clinician-guided group there was an indirect effect of β = − 0.08 (95% CI − 0.21–0.003), with a substantial 56.9% mediation. No other effects were statistically significant.

Pre- to Post and Follow-Up Mediation

Mediating Effect of RNT For the overall sample, the pre- to post-treatment change in RNT (RTQ-10) on post-treatment depression (PHQ-9), anxiety (GAD-7), and distress (K-10) showed small indirect mediating effects, none of which reached statistical significance (see Table 6), with the proportion of total effect mediated ranging from 0.03 to 0.14 (3–14%). When each sub-group (clinician-guided and self-help) was analysed separately, the indirect mediation effects of RNT for each outcome variable were similarly small and non-significant.

In the post-intervention to 3-month follow-up period, there was a significant indirect effect of RNT on depression overall collapsed across treatment groups (β = 0.06, 95% CI 0.01–0.13), with 7% of the total effect being mediated. However, when assessing clinician-led or self-help subgroups separately, there was no evidence of the significant mediation effect. There were also no significant mediation effects of post- to follow-up changes in RNT on post to follow-up changes in anxiety or distress, either overall or for the subgroups separately.

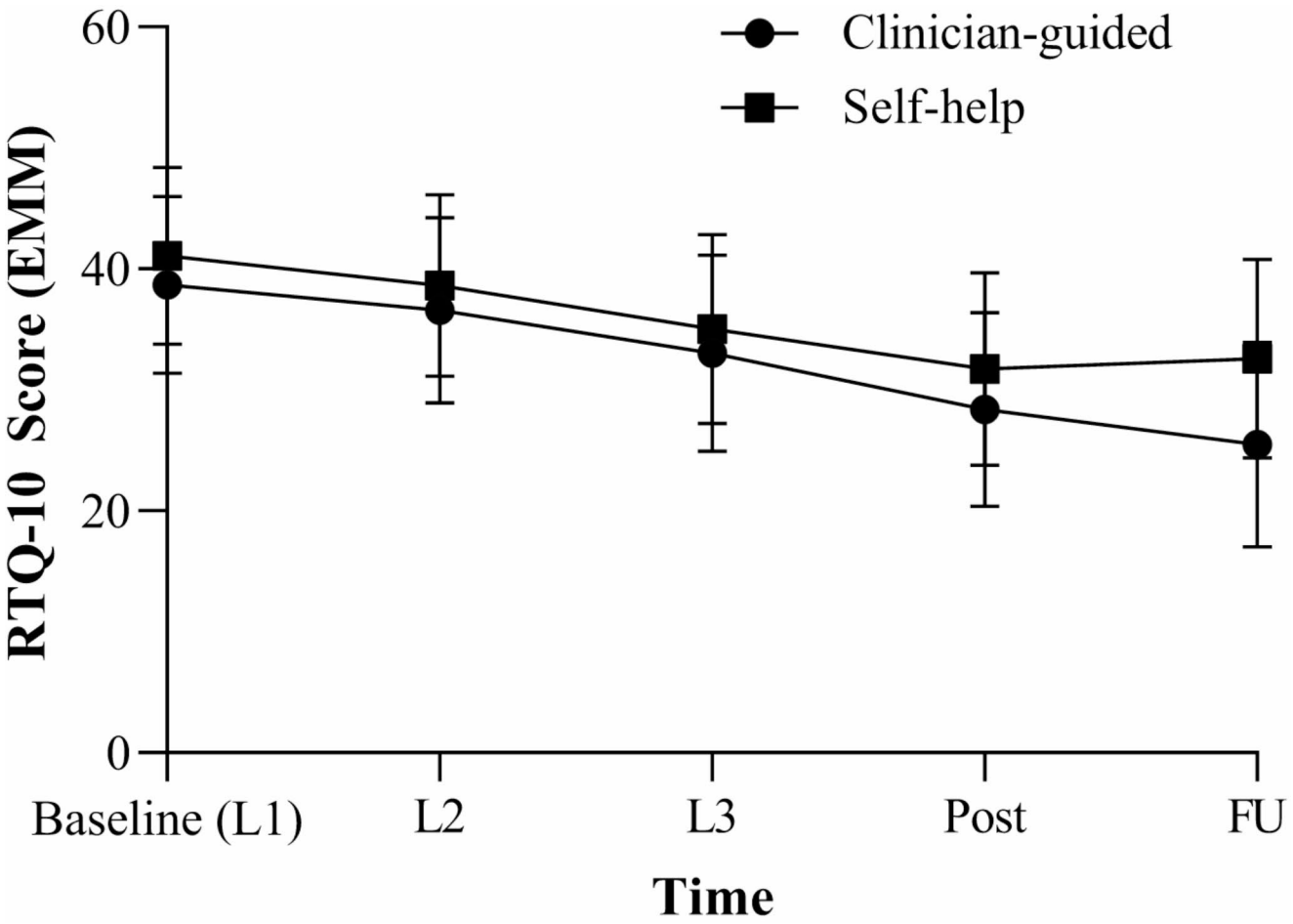

Fig. 1 Estimated marginal means for repetitive negative thinking (RTQ-10) by lesson and treatment group

Mediating Effect of Worry The mediating effect of changes in worry on changes in depression, anxiety, and distress also varied across periods and groups, with none of the effects reaching statistical significance (see Table 7). There were no significant mediation effects of changes in worry from pre-to post-treatment on pre- to post-treatment changes in depression, anxiety, or distress, either overall or for the subgroups separately. There were also no significant mediation effects of worry on the outcomes from post-treatment to follow-up.

Mediating Effect of Rumination The mediating effect of changes in rumination (RRS-Brooding) on changes in depression, anxiety, and distress also varied across periods and groups (see Table 8). From pre- to post-intervention, no mediating effects of rumination were statistically significant either overall or for each subgroup.

From post-intervention to 3-month follow-up, however, there was a significant overall indirect effect of rumination on follow-up distress (K-10 scores, β = 0.07, 95% CI 0.01–0.14, mediating 7.9%). The effects on depression and anxiety were not significant (depression: β = 0.07, 95% CI −0.002–0.13; anxiety: β = 0.02, 95% CI −0.02–0.08).

In the clinician-led group, there were no significant mediation effects of rumination on follow-up outcome variables. In the self-help group, there was a significant mediation effect of rumination on follow-up depression (β = 0.15, 95% CI 0.05–0.29) and distress (β = 0.24 (95% CI 0.11–0.40), but not anxiety (β = 0.15 (95% CI −0.004–0.35), mediating 15.5%, 17.4%, and 31.3%, respectively.

Predictors of Treatment Response

Coefficients and statistics for the predictor analyses are presented in Table 9 (Depression and anxiety outcome measures: PHQ-9 and GAD-7) and Table 10 (Repetitive Negative Thinking outcome variables: RTQ-10, PSWQ and RRS-Brooding). For each outcome measure (PHQ-9, GAD-7, RTQ-10, PSWQ and RRS-Brooding), higher severity at baseline predicted higher severity of that same measure.

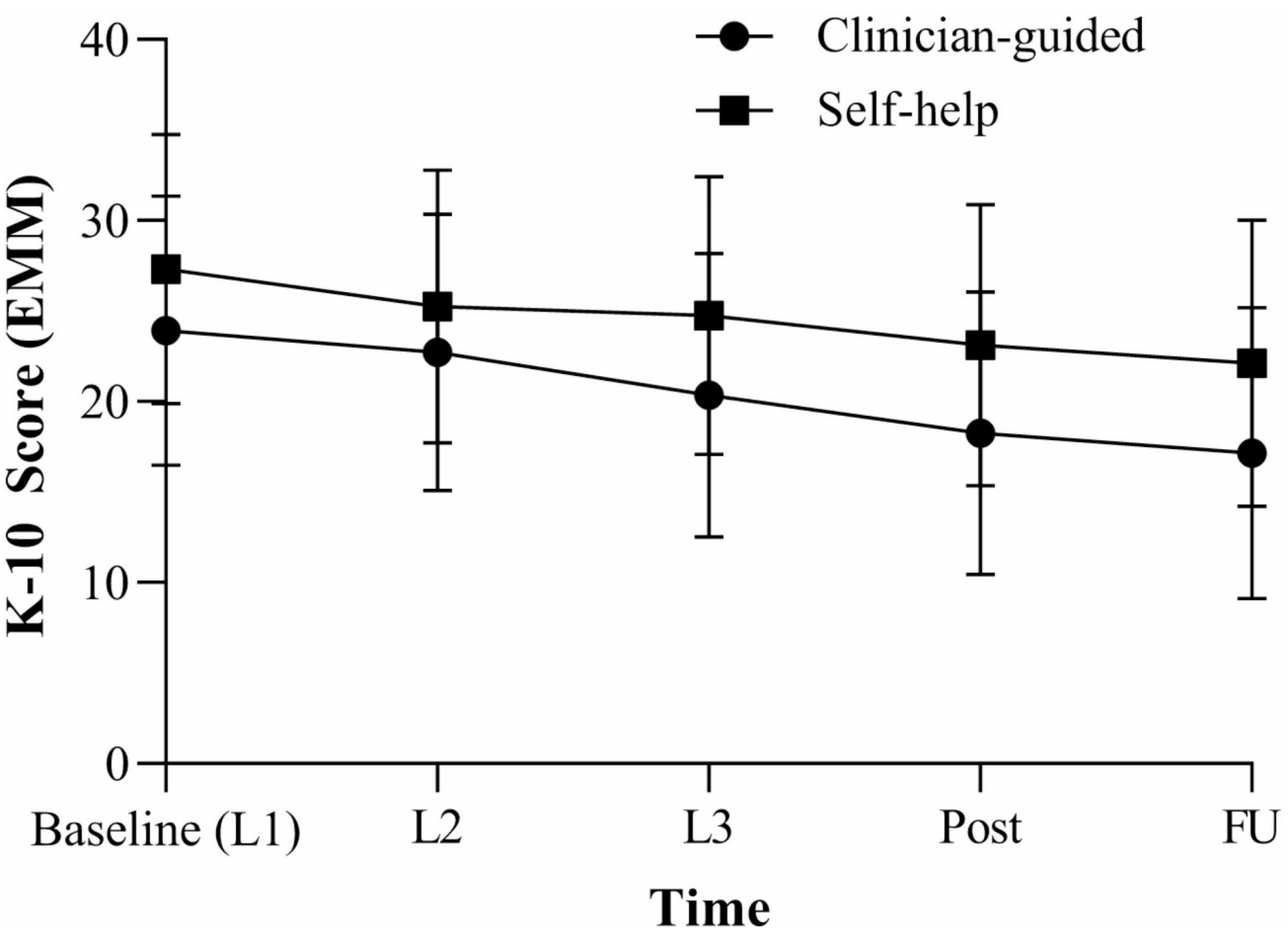

Fig. 2 Estimated marginal means for distress (K-10) by lesson and treatment group

Table 4 Lesson-wise mediation of distress levels (K-10) by changes in RNT (RTQ-10)

Time	Group	Indirect effect β (95% CI)	Proportion of total effect mediated
Lessons 1-2	Overall	0.036 (-0.02– 0.10)	0.582
	Clinician-guided	0.014 (-0.08– 0.11)	0.065
	Self-help	0.05 (-0.01– 0.12)	0.627
Lessons 2-3	Overall	0.08 (0.02—0.14) *	1.85
	Clinician-guided	0.13 (0.03—0.25) *	2.41
	Self-help	0.05 (-0.04– 0.15)	0.91
Lesson 3-Post	Overall	0.02 (-0.06– 0.10)	0.07
	Clinician-guided	0.03 (-0.03– 0.13)	0.09
	Self-help	0.01 (-0.14– 0.14)	0.03

CI: confidence interval

*significant at .05 level ($p<.05$)

Table 5 Lesson-wise mediation of RNT levels (RTQ-10) by changes in distress (K-10)

Time	Group	Indirect effect β (95% CI)	Proportion of total effect mediated
Lessons 1—2	Overall	0.04 (−0.03– 0.13)	0.137
	Clinician-guided	0.07 (−0.05– 0.23)	0.192
	Self-help	0.02 (−0.08– 0.11)	0.057
Lessons 2—3	Overall	0.02 (−0.12– 0.16)	0.066
	Clinician-guided	−0.03 (−0.19– 0.09)	0.278
	Self-help	0.13 (-0.08– 0.39)	0.291
Lesson 3—Post	Overall	−0.02 (−0.13– 0.09)	0.084
	Clinician-guided	−0.08 (−0.21– 0.003)	0.569
	Self-help	0.03 (−0.21– 0.27)	0.104

CI: confidence interval

Treatment condition was also a significant predictor of anxiety (GAD-7) in favour of the clinician-guided group (i.e., assignment to the clinician-guided treatment group predicted lower scores following treatment). Over and above baseline severity and treatment group, the principle significant predictors of treatment outcomes were baseline treatment expectancy (CEQ), and baseline rumination (RRS). Higher treatment expectancy at baseline significantly predicted lower scores on all measures. In addition, higher baseline rumination on the RRS significantly predicted

Table 6 Mediation effect of changes in RNT (RTQ-10) on longitudinal changes in depression (PHQ-9), anxiety (GAD-7), and distress (K-10)

Time	Group	Depression (PHQ-9)		Anxiety (GAD-7)		Distress (K-10)	
		Indirect effect	Total effect mediated	Indirect effect	Total effect mediated	Indirect effect	Total effect mediated
		β (95% CI)	Proportion	β (95% CI)	Proportion	β (95% CI)	Proportion
Pre-Post	Overall	0.03 (−0.03– 0.09)	0.04	0.08 (−0.02– 0.19)	0.14	0.02 (−0.06– 0.09)	0.03
	Clinician-guided	0.002 (−0.08– 0.08)	0.01	0.03 (−0.08– 0.15)	0.09	0.01 (−0.12– 0.14)	0.01
	Self-help	0.01 (−0.07– 0.11)	0.02	0.02 (−0.22– 0.25)	0.04	0.004 (−0.12– 0.13)	0.01
Post-FU	Overall	0.06 (0.01– 0.13)*	0.07	0.04 (−0.03– 0.12)	0.05	0.06 (0.00– 0.13)	0.07
	Clinician	0.02 (−0.05– 0.13)	0.04	0.01 (−0.07– 0.09)	0.02	0.04 (−0.09– 0.24)	0.07
	Self-help	0.02 (−0.02– 0.07)	0.02	0.09 (−0.06– 0.35)	0.12	0.04 (−0.04– 0.18)	0.06

FU: 3-month follow-up, CI: confidence interval

* significant at .05 level (p<.05)

Table 7 Mediation effect of changes in worry (PSWQ) on longitudinal changes in depression (PHQ-9), anxiety (GAD-7), and distress (K-10)

Time	Group	Depression (PHQ9)		Anxiety (GAD7)		Distress (K10)	
		Indirect effect	Total effect mediated	Indirect effect	Total effect mediated	Indirect effect	Total effect mediated
		β (95% CI)	Proportion	β (95% CI)	Proportion	β (95% CI)	Proportion
Pre-Post	Overall	0.004 (−0.04– 0.05)	0.01	0.10 (−0.004– 0.22)	0.141	0.03 (−0.02– 0.10)	0.04
	Clinician-guided	0.01 (−0.03– 0.06)	.026	0.07 (−0.004– 0.17)	0.169	0.04 (−0.03– 0.12)	0.07
	Self-help	0.03 (−0.04– 0.12)	.037	0.02 (−0.13– 0.19)	0.04	0.05 (−0.07– 0.17)	0.054
Post-FU	Overall	0.04 (−0.001– 0.09)	0.04	0.07 (−0.001– 0.16)	0.087	0.04 (−0.01– 0.11)	0.057
	Clinician-guided	0.01 (−0.06– 0.09)	0.01	0.01 (−0.08– 0.11)	0.033	0.02 (−0.07– 0.16)	0.039
	Self-help	0.01 (−0.03– 0.06)	0.01	0.01 (−0.12– 0.15)	0.008	0.01 (−0.06– 0.09)	0.009

FU: 3-month follow-up, CI: confidence interval

*significant at .05 level (p<.05); **significant at .01 level (p<.01)

Table 8 Mediation effect of changes in rumination (RRS-Brooding) on longitudinal changes in depression (PHQ-9), anxiety (GAD-7), and distress (K-10)

Time	Group	Depression (PHQ9)		Anxiety (GAD7)		Distress (K10)	
		Indirect effect	Total effect mediated	Indirect effect	Total effect mediated	Indirect effect	Total effect mediated
		β (95% CI)	Proportion	β (95% CI)	Proportion	β (95% CI)	Proportion
Pre-Post	Overall	0.01 (−0.04– 0.06)	0.015	−0.001 (−0.08– 0.08)	0.001	0.01 (−0.03– 0.06)	0.012
	Clinician-guided	0.04 (−0.002– 0.10)	0.084	0.02 (−0.06– 0.10)	0.043	0.04 (−0.01– 0.11)	0.08
	Self-help	−0.04 (−0.17– 0.06)	0.056	−0.11 (−0.30– 0.02)	0.228	−0.13 (−0.29—0.01)	0.157
Post-FU	Overall	0.07 (−0.002– 0.13)	0.072	0.02 (−0.02– 0.08)	0.025	0.07 (0.01– 0.14)*	0.079
	Clinician-guided	0.001 (−0.04– 0.04)	0.002	−0.01 (−0.07– 0.04)	0.039	−0.001 (−0.04– 0.04)	0.001
	Self-help	0.15 (0.05– 0.29)*	0.155	0.15 (−0.004– 0.35)	0.174	0.24 (0.11– 0.40)**	0.313

FU = 3-month follow-up; CI confidence interval; *significant at .05 level (p<.05); **significant at .01 level (p<.01)

Table 9 Predictors of outcome on the PHQ-9 and GAD-7

	Estimate	SE	df	T	*p*	95% Confidence Interval	
						Lower	Upper
DV = PHQ-9							
Intercept	0.74	2.07	90.54	0.36	0.72	−3.37	4.85
Pre	3.82	0.41	163.15	9.39	<0.001**	3.02	4.63
Post	0.42	0.43	155.21	1.00	0.32	−0.42	1.27
Follow-up	0.00	0.00					
Clinician-guided	−0.59	0.39	86.48	−1.49	0.14	−1.37	0.19
Self-guided	0.00	0.00					
CEQ	−0.15	0.04	88.94	−3.47	<0.001**	−0.24	−0.06
RTQ	0.02	0.04	87.90	0.50	0.62	−0.06	0.10
PHQ-9	0.70	0.05	80.98	15.61	<0.001**	0.61	0.79
GAD-7	−0.03	0.05	92.76	−0.55	0.58	−0.14	0.08
PSWQ	0.00	0.03	99.86	0.18	0.86	−0.05	0.06
RRS-Brooding	0.17	0.07	81.85	2.41	0.02*	0.03	0.31
DV = GAD-7							
Intercept	1.62	2.18	216.00	0.74	0.46	−2.69	5.92
Pre	4.68	0.48	216.00	9.76	<0.001**	3.74	5.63
Post	0.39	0.50	216.00	0.78	0.43	−0.60	1.39
Follow-up	0.00	0.00					
Clinician-guided	−1.31	0.41	216.00	−3.16	<0.001**	−2.13	−0.49
Self-guided	0.00	0.00					
CEQ	−0.10	0.05	216.00	−2.14	0.03*	−0.19	−0.01
RTQ	0.02	0.04	216.00	0.57	0.57	−0.06	0.11
PHQ-9	0.02	0.05	216.00	0.42	0.67	−0.07	0.11
GAD-7	0.64	0.06	216.00	11.23	<0.001**	0.52	0.75
PSWQ	−0.03	0.03	216.00	−1.02	0.31	−0.09	0.03
RRS-Brooding	0.14	0.07	216.00	1.95	0.05	0.00	0.29

*significant at .05 level (p<.05); **significant at .01 level (p<.01)

higher depression (PHQ-9), and approached significance as a predictor of higher anxiety scores (GAD-7; p = 0.052).

Discussion

This study is one of the first to investigate mediators and predictors of treatment outcome in a brief, online RNT-focused intervention for adults, the *Managing Rumination and Worry Program.* We found that RNT and distress gradually reduced over the course of treatment in both self-guided and clinician-guided treatment groups, with the largest improvements occurring after Lessons 2 and 3. While we predicted that changes in RNT would mediate lesson-by-lesson and pre- to post-treatment changes in outcome measures, the pattern of mediation findings was mixed, with no clear mediation pattern emerging. Our results also showed that baseline severity of depression, anxiety, distress, and RNT (particularly rumination)—and over and above these, treatment expectancy—were significant predictors of treatment outcome.

Pattern of Symptom Change Across Treatment

Studies that examine the pattern of improvement across treatment, and identify which treatment modules produce the greatest change, are important to further optimise effective treatments and increase our understanding of how they work (Watkins & Newbold, 2020). In this study, we found that both treatment groups improved throughout the program and to follow-up, with small to moderate improvements in RNT and distress after each lesson, consistent with other studies of efficacious treatments showing a gradual course of symptom improvement (e.g., Andrews et al., 2020; Skelton et al., 2023). The smallest improvements in RNT occurred after Lesson 1 (within-group Hedge's *g*: 0.28–0.33), which focused on psychoeducation and monitoring, and between post-treatment and follow-up (within group *g's* = 0.11–0.34), whereas the largest improvements occurred following the lessons containing the core therapeutic skills, from Lesson 2 to 3 (within-group *g*'s = 0.44–0.49), and from Lesson 3 to post-treatment (within-group *g*'s = 0.43–0.56). Distress decreased gradually in small to moderate increments after each lesson and to follow-up. The

Table 10 Predictors of outcome on the RTQ-10, PSWQ and RRS

	Estimate	SE	df	T	*P*	95% Confidence Interval	
						Lower	Upper
DV = RTQ-10							
Intercept	9.89	5.26	94.55	1.88	0.06	−0.55	20.33
Pre	10.45	0.94	165.21	11.06	<0.001**	8.58	12.31
Post	0.87	0.99	157.28	0.88	0.38	−1.08	2.82
Follow-up	0.00	0.00					
Clinician-guided	−1.41	1.01	92.94	−1.39	0.17	−3.41	0.60
Self-guided	0.00	0.00					
CEQ	−0.27	0.11	93.58	−2.43	0.02*	−0.49	−0.05
RTQ	0.59	0.10	93.97	5.78	<0.001**	0.38	0.79
PHQ-9	0.10	0.12	87.62	0.85	0.40	−0.13	0.33
GAD-7	−0.05	0.14	99.03	−0.36	0.72	−0.32	0.22
PSWQ	0.00	0.07	104.89	−0.02	0.99	−0.14	0.14
RRS-Brooding	0.31	0.18	88.29	1.72	0.09	−0.05	0.66
DV = PSWQ							
Intercept	15.35	6.04	94.44	2.54	0.01*	3.36	27.34
Pre	10.70	1.10	163.95	9.72	<0.01**	8.53	12.88
Post	2.24	1.15	155.06	1.95	0.05	−0.02	4.51
Follow-up	0.00	0.00					
Clinician-guided	−1.57	1.15	91.08	−1.36	0.18	−3.86	0.72
Self-guided	0.00	0.00					
CEQ	−0.31	0.13	93.43	−2.44	0.02*	−0.56	−0.06
RTQ	−0.04	0.12	92.16	−0.36	0.72	−0.27	0.19
PHQ-9	−0.05	0.13	86.30	−0.36	0.72	−0.31	0.22
GAD-7	0.10	0.16	97.16	0.66	0.51	−0.21	0.41
PSWQ	0.70	0.08	103.33	8.80	<0.001**	0.54	0.86
RRS-Brooding	0.27	0.20	86.55	1.35	0.18	−0.13	0.68
DV = RRS-Brooding							
Intercept	0.79	1.54	94.03	0.51	0.61	−2.27	3.85
Pre	2.64	0.30	165.32	8.88	<0.001**	2.05	3.22
Post	0.78	0.31	156.36	2.53	0.01*	0.17	1.40
Follow-up	0.00	0.00					
Clinician-guided	−0.47	0.29	90.22	−1.59	0.12	−1.05	0.12
Self-guided	0.00	0.00					
CEQ	−0.08	0.03	92.63	−2.58	0.01*	−0.15	−0.02
RTQ	0.00	0.03	91.54	−0.11	0.91	−0.06	0.06
PHQ-9	0.05	0.03	85.16	1.40	0.17	−0.02	0.11
GAD-7	−0.02	0.04	96.47	−0.57	0.57	−0.10	0.06
PSWQ	0.00	0.02	103.25	0.23	0.82	−0.04	0.05
RRS-Brooding	0.80	0.05	85.54	15.51	<0.001**	0.70	0.91

* significant at .05 level ($p<.05$); ** significant at .01 level ($p<.01$)

larger reductions in RNT after Lessons 2 and 3 suggest that the active treatment strategies in these sessions (i.e., structured problem-solving, worry time, disengaging from RNT, concreteness training) are more powerful in reducing RNT than less specific treatment elements of psychoeducation and monitoring in Lesson 1. It appears that these treatment components are effective at reducing RNT and distress, despite the brevity of the treatment, thus are important elements to retain in future iterations of the program. It is still unclear however which of these strategies are driving the benefit. In a recent dismantling study, Watkins et al. (Watkins et al., 2023) examined which CBT treatment components (including RNT-focused strategies such as concreteness training) were most effective in reducing depression. Although absorption training was found to be important, it was still unclear which treatment strategies were most potent in driving change. Absorption training teaches skills to help patients to become immersed in positive activities (Watkins et al., 2012, 2023), and shares similarities with the attention shifting/disengaging from RNT skills in Lesson 2 of this

program as well as activity scheduling in Lesson 1. Further dismantling studies of RNT-focused treatments such as the *Managing Rumination and Worry Program* are important to identify the most active ingredients of these treatments; for example, using experimental designs that test the effects of single ingredients.

Mediating Effects of RNT

As the current treatment was designed to reduce symptoms of depression, anxiety and distress through reducing RNT, we hypothesised that changes in RNT lesson-by-lesson, and across treatment to the follow-up period, would mediate the reductions in pre-to post-treatment and follow-up clinical outcome measures. Contrary to hypotheses, there was no clear pattern of mediating effects of RNT on clinical outcomes. Some significant mediation effects emerged: reductions in RNT mediated reductions in distress between Lesson 2 and 3 (overall and in the clinician-guided group specifically), and reductions in RNT from post-treatment to follow-up significantly mediated reductions in depression (overall). Further, in the post-treatment to follow-up period there was a significant mediating effect of rumination specifically (Brooding subscale of the RRS) on follow-up distress (overall), and in the self-help group a significant mediating effect of rumination on follow-up depression and distress. Despite these findings, a consistent pattern of mediating effects of RNT on changes in depression, anxiety and distress did not emerge across the analyses. Similarly, and as expected, the reverse pattern did not reach significance; changes in distress did not mediate changes in RNT across each lesson. The lack of consistent mediation effect of RNT contrasts with the few studies that have examined mediation in RNT-focused interventions and found that decreases in RNT did mediate treatment outcome (Topper et al., 2017; Watkins et al., 2011).

There are several possible explanations for these findings. Firstly, there may have been a lack of sufficient power to detect all mediation effects in this sample. While the power calculations informing the RCT's target sample size were aimed at detecting a medium to large between-group effect size (Hedge's g = 0.7) between the treatment groups and control group, based on (Topper et al. 2017; see Joubert et al., 2023), it is possible that the sample was not large enough to detect all mediation effects. Indeed Topper et al. (2017) found significant mediation effects of changes in RNT over the course of their study with a larger sample size (N = 251 vs. N = 137 in the current study), and it has been recommended that sample sizes are large in studies utilising mediation analyses (e.g., Fairchild & McDaniel, 2017). Thus it is possible that more uniform significant mediation effects may emerge when investigating the treatment in a larger sample in future studies.

Secondly, it is possible the lack of mediation findings was due to the transdiagnostic measure used in the lesson-by-lesson mediation analyses, which assessed the *frequency* of RNT. There may be a delineation between the mediating effect of the different sub-types of RNT, rumination and worry, as seen in the post-treatment to follow-up period (where rumination, but not worry, mediated follow-up depression and distress). This pattern gives support to the strong role of rumination on depressive symptoms (e.g., Ehring & Watkins, 2008; Nolen-Hoeksema, 2000; Nolen-Hoeksema et al., 2008). Interestingly, our analysis did not find evidence of a mediating role of reductions in RNT (transdiagnostically or by subtype) on reductions in anxiety symptoms across treatment, which contrasts with research showing that RNT plays a key causal and maintaining role in anxiety as well as depressive disorders (e.g., Ehring & Watkins, 2008; Wahl et al., 2019). Further research is needed investigating which factors mediate change in anxiety as well as depressive symptoms in RNT-focused treatment.

Similarly, it is possible that other variables not measured in this study mediated the treatment effects. Some preliminary research has found improvements in behavioural activation (Feldhaus et al., 2020), for example, may mediate change in RNT-focused treatments. This program does encourage participants to engage in behavioural activation, and schedule in distracting activities for times when they are at high risk of ruminating. Change in metacognitive beliefs about RNT (e.g., 'ruminating helps me to solve my problems') is a further alternative mediating variable. Some studies of one type of RNT-focused intervention, metacognitive therapy for GAD, found that reductions in negative beliefs about worry mediated reduction in worry over treatment (McEvoy et al., 2015; Wahlund et al., 2022). Another study found that participants higher in positive metacognitive beliefs about the usefulness of rumination were less likely to have positive expectations of action-oriented treatment strategies, several of which are included in the present treatment (e.g., structured problem-solving; Ophir & Mor, 2014). Other studies of transdiagnostic CBT for depression and anxiety, however, have found no significant mediation effects of either negative (Barrio-Martínez et al., 2023) or positive metacognitive beliefs (Enrique et al., 2021), so the impact of metacognitive beliefs warrants further investigation. Decentering, the metacognitive ability to appraise one's thoughts and feelings as temporary phenomena as opposed to reality (Fresco et al., 2007), is a related variable that has been shown to reduce the link between negative or stressful events, rumination, and depressive symptoms (Feldman et al., 2010; Wu et al., 2022). While these variables were not measured in the current study, they could be measured

in future studies to help elucidate alternative mediators of treatment effects beyond changes in the frequency of RNT.

The lack of a clear overall mediation pattern in this study suggests that further research is needed into which factors mediate treatment change in RNT-focused treatments such as this program. Future investigations should examine a larger sample and measure a wider range of potential mediating variables, including metacognitive beliefs about RNT and decentering, and subtypes of RNT as well as frequency. The use of moderated mediation analysis could also help understand potential interaction effects between predictor and mediating variables.

Predictors of Treatment Response

The current study is one of the first to examine predictors of treatment response in an RNT-focused intervention. Our results showed some interesting predictors of improvement—specifically, baseline severity (particularly rumination), treatment group (as a predictor of anxiety scores), and treatment expectancy—that provide some insight at the outset of the program who may benefit most.

Baseline symptom severity. In line with our hypotheses, baseline severity of outcome measures significantly predicted treatment response. In contrast to predictions however, higher baseline severity in symptoms of depression, anxiety, distress, RNT, worry and rumination, significantly predicted *higher* rather than lower scores in each of these outcomes following treatment. This finding is consistent with another study by Barrio-Martinez et al. (2023) in which higher baseline rumination was also associated with lower post-treatment functioning. However it contrasts with Cook et al.'s (2019) finding that participants with higher baseline stress levels demonstrated greater (preventative) benefit from RF-CBT, and another study by Niles et al. (2021) in which higher frequency of baseline negative automatic thoughts was associated with stronger improvement from general CBT treatment. In a review on predictors and moderators of treatment outcome in online psychological treatments more broadly, Haller et al. (2023) found that, similar to our study, higher baseline symptom severity predicted higher post-treatment scores; but overall, participants with higher baseline scores demonstrated greater symptom *change* over treatment (i.e., greater treatment benefits). It is possible that this pattern also occurred in the current intervention, as participants who received treatment on average demonstrated strong treatment benefits (*g*s = 0.41–0.97; Joubert et al., 2023). Future studies could examine this further by analysing the magnitude of change in participants with greater baseline severity over the course of this intervention using moderated mediation analysis.

Clinician guidance. Our results also confirm that clinician guidance predicts strong outcomes in the current treatment, particularly in post-treatment anxiety (GAD-7) scores. As shown in the RCT (Joubert et al., 2023), participants in the clinician-guided group demonstrated lower depression, anxiety and rumination scores both at post-treatment and follow-up, than the self-guided group; our analyses further show this group demonstrated larger reductions in RNT and distress lesson by lesson, and experienced reductions in RNT earlier in treatment than the self-guided group. These results are consistent with studies showing that therapist guidance and alliance is associated with stronger treatment outcomes and adherence in online treatments compared to unguided versions (Karyotaki et al., 2021; Musiat et al., 2022; Newby et al., 2024). Moderated mediation analysis in future studies could help elucidate the interaction between other predictor variables and clinician guidance, as some research shows the importance of therapist guidance relates particularly to patients with more severe baseline symptoms (e.g., Karyotaki et al., 2021; Newby et al., 2024)).

Treatment expectancy. Over and above baseline severity and treatment group, and in line with our expectations, higher treatment expectancy at baseline significantly predicted lower post-treatment depression, anxiety, RNT, rumination and worry. These findings suggest that it may be important to assess and address low treatment expectancies at treatment outset, given it is associated with clinical outcomes, and drop-out in this treatment (see Joubert et al., 2023). These findings are in line with a broader research literature showing that treatment expectancies influence the likelihood that individuals commence treatment, put effort into change, and obtain treatment benefits (Glass et al., 2001; Noble et al., 2001; Tambling, 2012), including from rumination interventions (e.g., Rebstock et al., 2020). They contrast with the recent study of group RF-CBT (Wallsten et al., 2023), but this may be explained by the smaller symptom change they found compared to the present study. Addressing negative treatment expectations may be particularly challenging however given they can be difficult to shift in depressed individuals (Everaert et al., 2018; Kube et al., 2019; Rutherford et al., 2010). Further research is needed to understand how to best alter negative expectations in RNT-focused treatments (e.g., providing reputable evidence of treatment efficacy before strategies are introduced).

Rumination. Over and above baseline severity and treatment group, higher baseline rumination also emerged as a significant predictor of higher depression, and approached significance as a predictor of higher anxiety after treatment. Changes in rumination across treatment also significantly mediated follow-up distress, as well as follow-up depression in the self-help group. These findings further support the literature showing that pre-treatment levels of

rumination are predictive of outcomes in general CBT treatments for anxiety and depression (e.g., Bredemeier et al., 2020; Crane & Williams, 2010). It is possible that in this transdiagnostic RNT-focused treatment, there should be an inclusion of additional strategies, or more intensive treatment, to explicitly address rumination, in order to improve outcomes for those identified at the outset of treatment as high in this type of RNT.

Limitations

The results above should be interpreted in the context of several limitations. Due to the small sample size, there may have been a lack of power to detect statistically significant mediation. Future research should repeat mediation and predictor analyses in a larger sample. Mediation analyses in this study were limited by the variables measured in the RCT. Future studies of this and other RNT-focused interventions should measure a wider selection of potential mediating variables, such as metacognitive beliefs about RNT, decentering, behavioural activation and therapeutic alliance, or other variables not yet identified in the literature. Conclusions about the direction of the mediation effects seen in this study are also limited by the fact that the mediation and outcome variables were measured concurrently. While these results provide valuable information about the association between changes in RNT variables and outcome variables, in order for the temporal relationship of mediation to be established, future studies should include more time points across treatment to investigate true mediation effects (i.e., that changes in RNT cause changes in anxiety and depression). A further limitation relates to the generalisability of the sample. Participants were mostly female, employed, and well-educated. They were also self-selected, and partly recruited from a mailing list of previous users of the THIS WAY UP digital clinic, so may have been more likely to engage and/or had previous experience with online treatment. Future studies of the treatment in routine-care community settings are warranted to explore mediators and predictors of treatment response in more representative samples. Finally, participants were permitted to access concurrent treatment during the trial, limiting our ability to distinguish between mediators of the current treatment's effects and other potential treatments.

Conclusion

This study is one of the first to examine the mechanisms of how an efficacious, brief, online, RNT-focused treatment works, and what factors predict treatment response. We found a gradual improvement in RNT and distress throughout treatment, with the largest reductions in RNT occurring after the lessons with the main active treatment strategies. While there was some evidence of changes in outcomes being mediated by reductions in RNT over the course of treatment, a lack of consistent mediation pattern was seen, suggesting that further research examining alternative mediating variables and across more time points is needed to clarify the processes that mediate change. Higher baseline severity of anxiety, depression and rumination predicted worse outcome, whereas clinician guidance predicted better treatment outcome. In addition to these, higher treatment expectations and baseline levels of rumination (rather than transdiagnostic RNT) most strongly predicted treatment response. Further research is needed to understand the best ways to assist those identified as likely to show a poorer response. Future studies employing larger samples will enable more comprehensive mediation and dismantling analyses, to further our understanding of the mechanisms by which this efficacious RNT intervention works.

Acknowledgements We thank Dr Taylor Braund (Black Dog Institute, UNSW) and Elliot Dovers (Stats Central, UNSW) for their input into the statistical analyses.

Author Contributions EU, JN, AW, MM, AM and AJ contributed to the study conception and design. The treatment design and data collection were performed by JN and AJ. Data analysis was performed by VV, EU and JN. The first draft of the manuscript was written by EU and all authors contributed to manuscript editing. All authors read and approved the final manuscript.

Funding Open Access funding enabled and organized by CAUL and its Member Institutions
This work was supported by a University of New South Wales Australian Government Research Training Program (RTP) PhD scholarship awarded to EU. JN is supported by an Australian Medical Research Future Fund (MRFF) Fellowship (1145382), and National Health and Medical Research Council Emerging Leader Fellowship (2008839). AWS is supported by a National Health and Medical Research Council (NHMRC) Emerging Leader Fellowship (1197074). The MRFF, NHMRC and University of New South Wales had no role in the study design, the collection, analysis and interpretation of the data, the writing of the manuscript or the decision to submit the paper for publication.

Data Availability Data may be made available on reasonable request by contacting the corresponding author.

Declarations

Competing interests The authors declare no competing interests.

Informed Consent Informed consent was obtained from all individual participants included in the study.

References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (5th ed.)*. American Psychiatric Association.

Andersson, G., & Carlbring, P. (2017). Internet-assisted cognitive behavioral therapy. *Psychiatric Clinics,40*(4), 689–700.

Andrews, G., & Slade, T. (2001). Interpreting scores on the Kessler psychological distress scale (K10). *Australian and New Zealand Journal of Public Health,25*(6), 494–497.

Andrews, L. A., Hayes, A. M., Abel, A., & Kuyken, W. (2020). Sudden gains and patterns of symptom change in cognitive–behavioral therapy for treatment-resistant depression. *Journal of Consulting and Clinical Psychology,88*(2), 106.

Barrio-Martínez, S., Cano-Vindel, A., Priede, A., Medrano, L. A., Muñoz-Navarro, R., Moriana, J. A., Carpallo-González, M., Prieto-Vila, M., Ruiz-Rodríguez, P., & González-Blanch, C. (2023). Worry, rumination and negative metacognitive beliefs as moderators of outcomes of transdiagnostic group cognitive-behavioural therapy in emotional disorders. *Journal of Affective Disorders,338*, 349–357.

Bisby, M. A., Balakumar, T., Scott, A. J., Titov, N., & Dear, B. F. (2024). An online therapist-guided ultra-brief treatment for depression and anxiety: A randomized controlled trial. *Psychological Medicine,54*(5), 902–913.

Bisby, M. A., Scott, A. J., Fisher, A., Gandy, M., Hathway, T., Heriseanu, A. I., Karin, E., Cross, S., Staples, L., & Titov, N. (2023). The timing and magnitude of symptom improvements during an Internet-delivered transdiagnostic treatment program for anxiety and depression. *Journal of Consulting and Clinical Psychology,91*(2), 95.

Bredemeier, K., Lieblich, S., & Foa, E. B. (2020). Pretreatment levels of rumination predict cognitive-behavioral therapy outcomes in a transdiagnostic sample of adults with anxiety-related disorders. *Journal of Anxiety Disorders,75*, 102277.

Brown, T. A., Antony, M. M., & Barlow, D. H. (1992). Psychometric properties of the Penn State worry questionnaire in a clinical anxiety disorders sample. *Behaviour Research and Therapy,30*(1), 33–37.

Brown, T. A., & Barlow, D. (2014). *Anxiety and related disorders interview schedule for DSM-5 (ADIS-5)*. Oxford University Press.

Cook, L., Mostazir, M., & Watkins, E. (2019). Reducing stress and preventing depression (RESPOND): Randomized controlled trial of web-based rumination-focused cognitive behavioral therapy for high-ruminating university students. *Journal of Medical Internet Research,21*(5), e11349.

Crane, C., & Williams, J. M. G. (2010). Factors associated with attrition from mindfulness-based cognitive therapy in patients with a history of suicidal depression. *Mindfulness,1*, 10–20.

Devilly, G. J., & Borkovec, T. D. (2000). Psychometric properties of the credibility/expectancy questionnaire. *Journal of Behavior Therapy and Experimental Psychiatry,31*(2), 73–86.

Ebert, D. D., Van Daele, T., Nordgreen, T., Karekla, M., Compare, A., Zarbo, C., Brugnera, A., Overland, S., Trebbi, G., & Jensen, K. L. (2018). Internet-and mobile-based psychological interventions: Applications, efficacy, and potential for improving mental health. *European Psychologist.,23*, 167–187.

Ehring, T. (2021). Thinking too much: Rumination and psychopathology. *World Psychiatry,20*(3), 441.

Ehring, T., & Watkins, E. R. (2008). Repetitive negative thinking as a transdiagnostic process. *International Journal of Cognitive Therapy,1*(3), 192–205. https://doi.org/10.1680/ijct.2008.1.3.192

Enrique, A., Eilert, N., Wogan, R., Earley, C., Duffy, D., Palacios, J., Timulak, L., & Richards, D. (2021). Are changes in beliefs about rumination and in emotion regulation skills mediators of the effects of internet-delivered cognitive-behavioral therapy for depression and anxiety? Results from a randomized controlled trial. *Cognitive Therapy and Research,45*, 805–816.

Everaert, J., Bronstein, M. V., Cannon, T. D., & Joormann, J. (2018). Looking through tinted glasses: Depression and social anxiety are related to both interpretation biases and inflexible negative interpretations. *Clinical Psychological Science,6*(4), 517–528.

Fairchild, A. J., & McDaniel, H. L. (2017). Best (but oft-forgotten) practices: Mediation analysis1,2. *The American Journal of Clinical Nutrition,105*(6), 1259–1271. https://doi.org/10.3945/ajcn.117.152546

Feldhaus, C. G., Jacobs, R. H., Watkins, E. R., Peters, A. T., Bessette, K. L., & Langenecker, S. A. (2020). Rumination-focused cognitive behavioral therapy decreases anxiety and increases behavioral activation among remitted adolescents. *Journal of Child and Family Studies,29*, 1982–1991.

Feldman, G., Greeson, J., & Senville, J. (2010). Differential effects of mindful breathing, progressive muscle relaxation, and loving-kindness meditation on decentering and negative reactions to repetitive thoughts. *Behaviour Research and Therapy,48*(10), 1002–1011.

Fresco, D. M., Moore, M. T., van Dulmen, M. H., Segal, Z. V., Ma, S. H., Teasdale, J. D., & Williams, J. M. G. (2007). Initial psychometric properties of the experiences questionnaire: Validation of a self-report measure of decentering. *Behavior Therapy,38*(3), 234–246.

Glass, C. R., Arnkoff, D. B., & Shapiro, S. J. (2001). Expectations and preferences. *Psychotherapy: Theory, Research, Practice, Training,38*(4), 455.

Griffith, J. W., & Raes, F. (2014). Factor structure of the ruminative responses scale. *European Journal of Psychological Assessment*.

Haller, K., Becker, P., Niemeyer, H., & Boettcher, J. (2023). Who benefits from guided internet-based interventions? A systematic review of predictors and moderators of treatment outcome. *Internet Interventions,33*, 100635.

Hvenegaard, M., Moeller, S. B., Poulsen, S., Gondan, M., Grafton, B., Austin, S. F., Kistrup, M., Rosenberg, N. G., Howard, H., & Watkins, E. R. (2020). Group rumination-focused cognitive-behavioural therapy (CBT) v. group CBT for depression: Phase II trial. *Psychological Medicine,50*(1), 11–19.

Jacobs, R. H., Watkins, E. R., Peters, A. T., Feldhaus, C. G., Barba, A., Carbray, J., & Langenecker, S. A. (2016). Targeting ruminative thinking in adolescents at risk for depressive relapse: rumination-focused cognitive behavior therapy in a pilot randomized controlled trial with resting state fMRI. *PLoS ONE,11*(11), e0163952. https://doi.org/10.1371/journal.pone.0163952

Joubert, A. E., Grierson, A. B., Chen, A. Z., Moulds, M. L., Werner-Seidler, A., Mahoney, A. E., & Newby, J. M. (2021). Managing rumination and worry: A pilot study of an internet intervention targeting repetitive negative thinking in Australian adults. *Journal of Affective Disorders,294*, 483–490.

Joubert, A. E., Grierson, A. B., Li, I., Sharrock, M. J., Moulds, M. L., Werner-Seidler, A., Stech, E. P., Mahoney, A. E., & Newby,

J. M. (2023). Managing rumination and worry: A randomised controlled trial of an internet intervention targeting repetitive negative thinking delivered with and without clinician guidance. *Behaviour Research and Therapy,168*, 104378.

Joubert, A. E., Moulds, M. L., Werner-Seidler, A., Sharrock, M., Popovic, B., & Newby, J. M. (2022). Understanding the experience of rumination and worry: A descriptive qualitative survey study. *British Journal of Clinical Psychology,61*(4), 929–946.

Karyotaki, E., Efthimiou, O., Miguel, C., Genannt Bermpohl, F. M., Furukawa, T. A., Cuijpers, P., Riper, H., Patel, V., Mira, A., & Gemmil, A. W. (2021). Internet-based cognitive behavioral therapy for depression: A systematic review and individual patient data network meta-analysis. *JAMA Psychiatry,78*(4), 361–371.

Kessler, R. C., Andrews, G., Colpe, L. J., Hiripi, E., Mroczek, D. K., Normand, S.-L., Walters, E. E., & Zaslavsky, A. M. (2002). Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychological Medicine,32*(6), 959–976.

Kroenke, K., Spitzer, R., & Williams, J. (2001a). The PHQ-9: Valdity of a brief depression severity measure. *Journal of General Internal Medicine,16*(9), 606–613. https://doi.org/10.1046/j.1525-1497.2001.016009606.x

Kroenke, K., Spitzer, R. L., & Williams, J. B. (2001b). The PHQ-9: Validity of a brief depression severity measure. *Journal of General Internal Medicine,16*(9), 606–613.

Kroenke, K., Wu, J., Yu, Z., Bair, M. J., Kean, J., Stump, T., & Monahan, P. O. (2016). Patient health questionnaire anxiety and depression scale: Initial validation in three clinical trials. *Psychosomatic Medicine,78*(6), 716–727.

Kube, T., Rief, W., Gollwitzer, M., Gärtner, T., & Glombiewski, J. A. (2019). Why dysfunctional expectations in depression persist-results from two experimental studies investigating cognitive immunization. *Psychological Medicine,49*(9), 1532–1544. https://doi.org/10.1017/s0033291718002106

Löwe, B., Decker, O., Müller, S., Brähler, E., Schellberg, D., Herzog, W., & Herzberg, P. Y. (2008). Validation and standardization of the generalized anxiety disorder screener (GAD-7) in the general population. *Medical Care,46*(3), 266–274.

Mahoney, A. E., McEvoy, P. M., & Moulds, M. L. (2012). Psychometric properties of the repetitive thinking questionnaire in a clinical sample. *Journal of Anxiety Disorders,26*(2), 359–367.

McEvoy, P. M., Erceg-Hurn, D. M., Anderson, R. A., Campbell, B. N., Swan, A., Saulsman, L. M., Summers, M., & Nathan, P. R. (2015). Group metacognitive therapy for repetitive negative thinking in primary and non-primary generalized anxiety disorder: An effectiveness trial. *Journal of Affective Disorders,175*, 124–132.

McEvoy, P. M., Hyett, M. P., Ehring, T., Johnson, S. L., Samtani, S., Anderson, R., & Moulds, M. L. (2018). Transdiagnostic assessment of repetitive negative thinking and responses to positive affect: Structure and predictive utility for depression, anxiety, and mania symptoms. *Journal of Affective Disorders,232*, 375–384.

McEvoy, P. M., Mahoney, A. E., & Moulds, M. L. (2010). Are worry, rumination, and post-event processing one and the same? Development of the repetitive thinking questionnaire. *Journal of Anxiety Disorders,24*(5), 509–519. https://doi.org/10.1016/j.janxdis.2010.03.008

McEvoy, P. M., Thibodeau, M. A., & Asmundson, G. J. (2014). Trait repetitive negative thinking: A brief transdiagnostic assessment. *Journal of Experimental Psychopathology,5*(3), 1–17.

Merson, F., Newby, J., Shires, A., Millard, M., & Mahoney, A. (2021). The temporal stability of the Kessler psychological distress scale. *Australian Psychologist,56*(1), 38–45.

Meyer, T. J., Miller, M. L., Metzger, R. L., & Borkovec, T. D. (1990). Development and validation of the Penn State Worry questionnaire. *Behaviour Research and Therapy,28*(6), 487–495. https://doi.org/10.1016/0005-7967(90)90135-6

Musiat, P., Johnson, C., Atkinson, M., Wilksch, S., & Wade, T. (2022). Impact of guidance on intervention adherence in computerised interventions for mental health problems: A meta-analysis. *Psychological Medicine,52*(2), 229–240.

Newby, J. M., Upton, E., Mason, E., & Black, M. (2024). Technology-based cognitive behavioral therapy interventions. *Psychiatric Clinics of North America,47*(2), 399–417. https://doi.org/10.1016/j.psc.2024.02.004

Newby, J. M., Williams, A. D., & Andrews, G. (2014). Reductions in negative repetitive thinking and metacognitive beliefs during transdiagnostic internet cognitive behavioural therapy (iCBT) for mixed anxiety and depression. *Behaviour Research and Therapy,59*, 52–60. https://doi.org/10.1016/j.brat.2014.05.009

Niles, A. N., Axelsson, E., Andersson, E., Hedman-Lagerlöf, E., Carlbring, P., Andersson, G., Johansson, R., Widén, S., Driessen, J., Santoft, F., & Ljótsson, B. (2021). Internet-based cognitive behavior therapy for depression, social anxiety disorder, and panic disorder: Effectiveness and predictors of response in a teaching clinic. *Behaviour Research and Therapy,136*, 103767. https://doi.org/10.1016/j.brat.2020.103767

Noble, L. M., Douglas, B. C., & Newman, S. P. (2001). What do patients expect of psychiatric services? A systematic and critical review of empirical studies. *Social Science & Medicine,52*(7), 985–998.

Nolen-Hoeksema, S. (2000). The role of rumination in depressive disorders and mixed anxiety/depressive symptoms. *Journal of Abnormal Psychology,109*(3), 504.

Nolen-Hoeksema, S., Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking rumination. *Perspectives on Psychological Science,3*(5), 400–424.

Ophir, Y., & Mor, N. (2014). If I only knew why: The relationship between brooding, beliefs about rumination, and perceptions of treatments. *Behavior Therapy,45*(4), 553–563.

Patel, A., Daros, A. R., Irwin, S. H., Lau, P., Hope, I. M., Perkovic, S. J. M., Laposa, J. M., Husain, M. I., Levitan, R. D., Kloiber, S., & Quilty, L. C. (2023). Associations between rumination, depression, and distress tolerance during CBT treatment for depression in a tertiary care setting. *Journal of Affective Disorders,339*, 74–81. https://doi.org/10.1016/j.jad.2023.06.063

Plummer, F., Manea, L., Trepel, D., & McMillan, D. (2016). Screening for anxiety disorders with the GAD-7 and GAD-2: A systematic review and diagnostic metaanalysis. *General Hospital Psychiatry,39*, 24–31.

Rebstock, L., Schäfer, L. N., Kube, T., Ehmke, V., & Rief, W. (2020). Placebo prevents rumination: An experimental study. *Journal of Affective Disorders,274*, 1152–1160.

Reins, J. A., Buntrock, C., Zimmermann, J., Grund, S., Harrer, M., Lehr, D., Baumeister, H., Weisel, K., Domhardt, M., Imamura, K., Kawakami, N., Spek, V., Nobis, S., Snoek, F., Cuijpers, P., Klein, J. P., Moritz, S., & Ebert, D. D. (2021). Efficacy and moderators of internet-based interventions in adults with subthreshold depression: An individual participant data meta-analysis of randomized controlled trials. *Psychotherapy and Psychosomatics,90*(2), 94–106. https://doi.org/10.1159/000507819

Robinson, L., Delgadillo, J., & Kellett, S. (2020). The dose-response effect in routinely delivered psychological therapies: A systematic review. *Psychotherapy Research,30*(1), 79–96.

Ruiz, F. J., Luciano, C., Flórez, C. L., Suárez-Falcón, J. C., & Cardona-Betancourt, V. (2020). A multiple-baseline evaluation of acceptance and commitment therapy focused on repetitive negative thinking for comorbid generalized anxiety disorder and depression. *Frontiers in Psychology,11*, 356.

Rutherford, B. R., Wager, T. D., & Roose, S. P. (2010). Expectancy and the treatment of depression: A review of experimental methodology and effects on patient outcome. *Current Psychiatry Reviews,6*(1), 1–10.

Santomauro, D. F., Herrera, A. M. M., Shadid, J., Zheng, P., Ashbaugh, C., Pigott, D. M., Abbafati, C., Adolph, C., Amlag, J. O., & Aravkin, A. Y. (2021). Global prevalence and burden of depressive and anxiety disorders in 204 countries and territories in 2020 due to the COVID-19 pandemic. *The Lancet,398*(10312), 1700–1712.

Schmaling, K. B., Dimidjian, S., Katon, W., & Sullivan, M. (2002). Response styles among patients with minor depression and dysthymia in primary care. *Journal of Abnormal Psychology,111*(2), 350–356.

Schoofs, H., Hermans, D., & Raes, F. (2010). Brooding and reflection as subtypes of rumination: Evidence from confirmatory factor analysis in nonclinical samples using the Dutch Ruminative Response Scale. *Journal of Psychopathology and Behavioral Assessment,32*, 609–617.

Segal, Z., Williams, M., & Teasdale, J. (2018). *Mindfulness-based cognitive therapy for depression*. Guilford Publications.

Skelton, M., Carr, E., Buckman, J. E. J., Davies, M. R., Goldsmith, K. A., Hirsch, C. R., Peel, A. J., Rayner, C., Rimes, K. A., Saunders, R., Wingrove, J., Breen, G., & Eley, T. C. (2023). Trajectories of depression and anxiety symptom severity during psychological therapy for common mental health problems. *Psychological Medicine,53*(13), 6183–6193. https://doi.org/10.1017/s0033291722003403

Spinhoven, P., Klein, N., Kennis, M., Cramer, A. O. J., Siegle, G., Cuijpers, P., Ormel, J., Hollon, S. D., & Bockting, C. L. (2018). The effects of cognitive-behavior therapy for depression on repetitive negative thinking: A meta-analysis. *Behaviour Research and Therapy,106*, 71–85. https://doi.org/10.1016/j.brat.2018.04.002

Spitzer, R. L., Kroenke, K., Williams, J. B., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: The GAD-7. *Archives of Internal Medicine,166*(10), 1092–1097. https://doi.org/10.1001/archinte.166.10.1092

Tambling, R. B. (2012). A literature review of therapeutic expectancy effects. *Contemporary Family Therapy,34*(3), 402–415. https://doi.org/10.1007/s10591-012-9201-y

Teismann, T., von Brachel, R., Hanning, S., Grillenberger, M., Hebermehl, L., Hornstein, I., & Willutzki, U. (2014). A randomized controlled trial on the effectiveness of a rumination-focused group treatment for residual depression. *Psychotherapy Research,24*(1), 80–90. https://doi.org/10.1080/10503307.2013.821636

Titov, N., Dear, B. F., McMillan, D., Anderson, T., Zou, J., & Sunderland, M. (2011). Psychometric comparison of the PHQ-9 and BDI-II for measuring response during treatment of depression. *Cognitive Behaviour Therapy,40*(2), 126–136.

Topper, M., Emmelkamp, P. M., Watkins, E., & Ehring, T. (2017). Prevention of anxiety disorders and depression by targeting excessive worry and rumination in adolescents and young adults: A randomized controlled trial. *Behaviour Research and Therapy,90*, 123–136. https://doi.org/10.1016/j.brat.2016.12.015

Treynor, W., Gonzalez, R., & Nolen-Hoeksema, S. (2003). Rumination Reconsidered: A Psychometric Analysis. *Cognitive Therapy and Research,27*(3), 247–259. https://doi.org/10.1023/A:1023910315561

Valencia, P. D., & Paredes-Angeles, R. (2022). Revisiting the factor structure of the ruminative response scale: A bifactor approach. *Trends in Psychology,32*, 1408–1425.

Van Rijsoort, S., Emmelkamp, P., & Vervaeke, G. (1999). The Penn state worry questionnaire and the worry domains questionnaire: Structure, reliability and validity. *Clinical Psychology & Psychotherapy: An International Journal of Theory & Practice,6*(4), 297–307.

Wahl, K., Ehring, T., Kley, H., Lieb, R., Meyer, A., Kordon, A., Heinzel, C. V., Mazanec, M., & Schönfeld, S. (2019). Is repetitive negative thinking a transdiagnostic process? A comparison of key processes of RNT in depression, generalized anxiety disorder, obsessive-compulsive disorder, and community controls. *Journal of Behavior Therapy and Experimental Psychiatry,64*, 45–53. https://doi.org/10.1016/j.jbtep.2019.02.006

Wahlund, T., Hesser, H., Perrin, S., Johansson, S., Huhn, V., Sörhus, S., Lindskog, S., Serlachius, E., Hedman-Lagerlöf, E., & Ljótsson, B. (2022). Therapist-guided online metacognitive intervention for excessive worry: A randomized controlled trial with mediation analysis. *Cognitive Behaviour Therapy,51*(1), 21–41.

Wallsten, D., Norell, A., Anniko, M., Eriksson, O., Lamourín, V., Halldin, I., Kindbom, T., Hesser, H., Watkins, E., & Tillfors, M. (2023). Treatment of worry and comorbid symptoms within depression, anxiety, and insomnia with a group-based rumination-focused cognitive-behaviour therapy in a primary health care setting: A randomised controlled trial. *Frontiers in Psychology,14*, 1196945.

Watkins, E. (2004). Appraisals and strategies associated with rumination and worry. *Personality and Individual Differences,37*(4), 679–694. https://doi.org/10.1016/j.paid.2003.10.002

Watkins, E. R. (2009). Depressive rumination: investigating mechanisms to improve cognitive behavioural treatments. *Cognitive Behaviour Therapy,38*(Supp1), 8–14.

Watkins, E. (2015). Psychological treatment of depressive rumination. *Current Opinion in Psychology,4*, 32–36. https://doi.org/10.1016/j.copsyc.2015.01.020

Watkins, E. R. (2018). *Rumination-focused cognitive-behavioral therapy for depression*. Guilford Publications.

Watkins, E. (2022). Worry and Rumination. *Oxford research encyclopedia of psychology.* Oxford University Press.

Watkins, E. R., Mullan, E., Wingrove, J., Rimes, K., Steiner, H., Bathurst, N., Eastman, R., & Scott, J. (2011). Rumination-focused cognitive-behavioural therapy for residual depression: Phase II randomised controlled trial. *British Journal of Psychiatry,199*(4), 317–322. https://doi.org/10.1192/bjp.bp.110.090282

Watkins, E. R., & Newbold, A. (2020). Factorial designs help to understand how psychological therapy works. *Frontiers in Psychiatry,11*, 429.

Watkins, E., Newbold, A., Tester-Jones, M., Collins, L. M., & Mostazir, M. (2023). Investigation of active ingredients within internet-delivered cognitive behavioral therapy for depression: A randomized optimization trial. *JAMA Psychiatry,80*(9), 942–951.

Watkins, E. R., & Roberts, H. (2020). Reflecting on rumination: Consequences, causes, mechanisms and treatment of rumination. *Behaviour Research and Therapy,127*, 103573. https://doi.org/10.1016/j.brat.2020.103573

Watkins, E., Scott, J., Wingrove, J., Rimes, K., Bathurst, N., Steiner, H., Kennell-Webb, S., Moulds, M., & Malliaris, Y. (2007). Rumination-focused cognitive behaviour therapy for residual depression: A case series. *Behaviour Research and Therapy,45*(9), 2144–2154. https://doi.org/10.1016/j.brat.2006.09.018

Watkins, E. R., Taylor, R. S., Byng, R., Baeyens, C., Read, R., Pearson, K., & Watson, L. (2012). Guided self-help concreteness training as an intervention for major depression in primary care: A phase II randomized controlled trial. *Psychological Medicine,42*(7), 1359–1371. https://doi.org/10.1017/s0033291711002480

Wu, J. L., Hamilton, J. L., Fresco, D. M., Alloy, L. B., & Stange, J. P. (2022). Decentering predicts attenuated perseverative thought and internalizing symptoms following stress exposure: A multilevel, multi-wave study. *Behaviour Research and Therapy,152*, 104017.

Zlomke, K. R. (2009). Psychometric properties of internet administered versions of Penn state worry questionnaire (PSWQ) and depression, anxiety, and stress scale (DASS). *Computers in Human Behavior,25*(4), 841–843.

Terms and Conditions

Springer Nature journal content, brought to you courtesy of Springer Nature Customer Service Center GmbH (“Springer Nature”).
Springer Nature supports a reasonable amount of sharing of research papers by authors, subscribers and authorised users (“Users”), for small-scale personal, non-commercial use provided that all copyright, trade and service marks and other proprietary notices are maintained. By accessing, sharing, receiving or otherwise using the Springer Nature journal content you agree to these terms of use (“Terms”). For these purposes, Springer Nature considers academic use (by researchers and students) to be non-commercial.
These Terms are supplementary and will apply in addition to any applicable website terms and conditions, a relevant site licence or a personal subscription. These Terms will prevail over any conflict or ambiguity with regards to the relevant terms, a site licence or a personal subscription (to the extent of the conflict or ambiguity only). For Creative Commons-licensed articles, the terms of the Creative Commons license used will apply.
We collect and use personal data to provide access to the Springer Nature journal content. We may also use these personal data internally within ResearchGate and Springer Nature and as agreed share it, in an anonymised way, for purposes of tracking, analysis and reporting. We will not otherwise disclose your personal data outside the ResearchGate or the Springer Nature group of companies unless we have your permission as detailed in the Privacy Policy.
While Users may use the Springer Nature journal content for small scale, personal non-commercial use, it is important to note that Users may not:

1. use such content for the purpose of providing other users with access on a regular or large scale basis or as a means to circumvent access control;
2. use such content where to do so would be considered a criminal or statutory offence in any jurisdiction, or gives rise to civil liability, or is otherwise unlawful;
3. falsely or misleadingly imply or suggest endorsement, approval , sponsorship, or association unless explicitly agreed to by Springer Nature in writing;
4. use bots or other automated methods to access the content or redirect messages
5. override any security feature or exclusionary protocol; or
6. share the content in order to create substitute for Springer Nature products or services or a systematic database of Springer Nature journal content.

In line with the restriction against commercial use, Springer Nature does not permit the creation of a product or service that creates revenue, royalties, rent or income from our content or its inclusion as part of a paid for service or for other commercial gain. Springer Nature journal content cannot be used for inter-library loans and librarians may not upload Springer Nature journal content on a large scale into their, or any other, institutional repository.
These terms of use are reviewed regularly and may be amended at any time. Springer Nature is not obligated to publish any information or content on this website and may remove it or features or functionality at our sole discretion, at any time with or without notice. Springer Nature may revoke this licence to you at any time and remove access to any copies of the Springer Nature journal content which have been saved.
To the fullest extent permitted by law, Springer Nature makes no warranties, representations or guarantees to Users, either express or implied with respect to the Springer nature journal content and all parties disclaim and waive any implied warranties or warranties imposed by law, including merchantability or fitness for any particular purpose.
Please note that these rights do not automatically extend to content, data or other material published by Springer Nature that may be licensed from third parties.
If you would like to use or distribute our Springer Nature journal content to a wider audience or on a regular basis or in any other manner not expressly permitted by these Terms, please contact Springer Nature at

onlineservice@springernature.com