ARTICLE

Do metacognitive beliefs predict rumination and psychological distress independently of illness representations in adults with diabetes mellitus? A prospective mediation study

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Abstract

Objective: Adults with Diabetes Mellitus (DM) experience high levels of depression and anxiety that are not always effectively ameliorated by current therapeutic approaches. The Self-Regulatory Executive Function (S-REF) model, which underpins metacognitive therapy (MCT), posits that depression and anxiety become persistent when stored metacognitive beliefs guide an individual to respond to common thoughts and feelings in a certain way. We hypothesized that (i) metacognitive beliefs would predict depression and anxiety independently of participants' representations of their illness; and (ii) rumination would mediate independent prediction of depression and anxiety by metacognitive beliefs.

Design: A prospective mediation study.

Methods: Four hundred and forty-one adults with DM (Types 1 and 2) completed a two time-point survey. Metacognitive beliefs, illness representations and rumination were measured at baseline, and depression and anxiety measured at baseline and 6-months later. Data were analysed using structural equation modelling. Baseline illness representations, depression and anxiety were used as control variables.

Results: A structural equation analysis showed potential mediation, by baseline rumination, of any effects of baseline metacognitive variables on 6-month distress in Type 1 and 2 diabetes samples. Significant standardized coefficients for relationships between the metacognitive latent variable and rumination were .67 (Type 1) and .75 (Type 2) and

between rumination and distress of .36 and .43, respectively. These effects were independent of direct and independent effects of illness representation variables.

Conclusions: Findings are consistent with metacognitive beliefs playing a key role in depression and anxiety by increasing the likelihood of rumination in adults with DM. MCT may be an effective intervention for this population, subsequent to further longitudinal testing of the S-REF model.

KEYWORDS
diabetes, distress, illness representations, metacognitive beliefs, rumination, worry

Statement of Contribution

What is already known on this subject?

- Adults with Diabetes Mellitus (DM) experience high levels of depression and anxiety that are not effectively ameliorated by current therapeutic approaches.
- New approaches to intervention may benefit patients.
- The Self-Regulatory Executive Functioning (S-REF) model, which underpins metacognitive therapy (MCT), may help us to understand distress in this population.

What does this study add?

- Metacognitive beliefs play a key role in depression and anxiety by increasing maladaptive rumination.
- MCT may be an effective intervention for adults with DM.

INTRODUCTION

By 2030, approximately 578 million people worldwide will have a diagnosis of Diabetes Mellitus (DM), with prevalence projected to increase to 642 million by 2045 (Saeedi et al., 2019). Adults living with DM are twice as likely to have Major Depressive Disorder and 1.5 times more likely to have clinical levels of anxiety than those without DM (Collins et al., 2009; Li et al., 2008; Roy & Lloyd, 2012). Depression and anxiety reduce quality of life, increase healthcare costs and increase risk of complications by impairing patients' adherence to exercise, diet and medication regimes (Ciechanowski et al., 2000; Gonzalez et al., 2008; Molosankwe et al., 2012; Trief et al., 2019).

Adults living with DM prefer psychological to pharmacological treatment for depression and anxiety (van Schaik et al., 2004), but outcomes of current psychological interventions in this patient group are small to modest and short-lived (Baumeister et al., 2012; Chew et al., 2017; Schmidt et al., 2018; Steed et al., 2003; Sturt et al., 2015). Thus, new approaches to intervention may benefit patients. Metacognitive therapy (MCT) is a relatively new psychotherapeutic approach, theoretically grounded in the trans-diagnostic Self-Regulatory Executive Function (S-REF) model (Wells & Mathews, 1994, 1996). The S-REF model has been extensively tested in adults with mental and physical health difficulties (Cherry et al., 2019; Fisher et al., 2017, 2019; McNicol et al., 2012) but has not been prospectively tested in DM (Capobianco et al., 2020; Jamal, 2015). This study is the first to examine the applicability of the S-REF model in prospectively predicting depression and anxiety in a DM population.

The self-regulatory executive functioning model

The S-REF model posits that depression and anxiety become persistent when stored maladaptive metacognitive beliefs guide an individual to respond to commonly occurring thoughts and feelings in a certain way, termed the Cognitive Attentional Syndrome (CAS; Wells & Mathews, 1994, 1996). The CAS consists of three components: (i) perseverative thinking such as worry and rumination, (ii) attentional bias towards threat, and (iii) cognitive and behavioural coping strategies (e.g., getting angry with oneself, delaying attending appointments). Short-term CAS activation is a normal response to negative thoughts and feelings, but prolonged CAS activation leads to emotional distress. Several types of maladaptive metacognitive beliefs activate and sustain the CAS, leading to and maintaining emotional distress. Of particular importance are negative metacognitive beliefs about the uncontrollability and danger of worry/rumination (e.g., 'I can't stop thinking about the impact of having a lifelong illness on my life') and positive metacognitive beliefs about the usefulness of the CAS (e.g., 'Thinking about possible DM complications will help me to prepare for the worst'). Positive maladaptive metacognitive beliefs are hypothesized to indirectly cause and sustain emotional distress by increasing an individual's likelihood of choosing to respond to thoughts with repetitive negative thinking. As well as having a direct effect, negative maladaptive metacognitive beliefs about the uncontrollability and danger of worry are theorized to indirectly cause and sustain emotional distress because they decrease the likelihood of disengaging from repetitive negative thinking due to beliefs that thinking cannot be controlled (Wells & Mathews, 1994, 1996).

Consistent with the S-REF model, maladaptive metacognitive beliefs are associated with depression and anxiety across diverse chronic illnesses including epilepsy, coronary heart disease, chronic obstructive pulmonary disease, chronic fatigue syndrome, Parkinson's disease and cancer at all stages of the treatment trajectory (Capobianco et al., 2020). These associations are mediated by the CAS. The treatment underpinned by the S-REF model – MCT, which aims to modify maladaptive metacognitive beliefs and therefore perseverative thinking (worry, rumination, questioning, doubting and overanalysing) and internal and external attentional processes (e.g., monitoring for negative thoughts/feelings)—appears to be an acceptable and effective brief intervention for emotional distress experienced by adult chronic illness patients (Cherry et al., 2019; Fisher et al., 2017, 2019; McNicol et al., 2012).

The S-REF model is theoretically attractive because it provides a well-established explanation of how anxiety and depression are established and maintained. Worry and rumination about the negative implications and characteristics of illness (Soo et al., 2009) increase the likelihood of depression and anxiety (Brown, 2004; Lu et al., 2014) and are widely acknowledged as proximal causes in the mental health. A practical advantage of the S-REF model is the focus on potentially modifiable processes, such as worry and rumination, which influence anxiety and depression. Current models in health psychology, such as the common sense model (Leventhal et al., 1980, 1984), pertain to content cognitions—that is, they attribute emotional distress to perceptions that illness is severe, enduring or unchangeable (Gould et al., 2010; Hagger & Orbell, 2003; Hudson et al., 2014; Leventhal et al., 1980, 1984). Unfortunately, these perceptions are often realistic and immutable (e.g., 'DM is a severe illness'). The S-REF model specifies a content-independent process that is theoretically tied to the proximal causes of depression and anxiety. The S-REF model is therefore particularly useful where patients' illness representations are realistically negative.

Current study

We aimed to prospectively test the prediction that metacognitive beliefs, as proposed in the S-REF model, prospectively predict depression and anxiety mediated by rumination in people with DM. To emphasize the distinctiveness of the S-REF model's focus on internal events (i.e., processes), we predicted that metacognitive beliefs would predict depression and anxiety independently of participants' perceptions of their illness. Thus, we controlled for illness representations specific to DM identified by the Diabetes Illness Representations Questionnaire (DIRQ; Skinner et al., 2003). A second aim was to examine

whether rumination mediates prediction of depression and anxiety by metacognitive beliefs. We tested a mediational model whereby an indirect positive effect of baseline metacognitive beliefs on changes in anxiety and depression over the subsequent 6 months will be mediated by greater baseline rumination. We hypothesized that this effect would be independent of illness representations and baseline depression or anxiety and thus controlled for baseline illness representations and baseline depression or anxiety within the model.

METHOD

Design

We used a two-observation prospective design, in which depression, anxiety, metacognitive beliefs, illness representations and rumination were measured at baseline, and depression and anxiety were re-measured 6 months later.

Participants

Participants were adults with DM recruited via advertisements placed by the HELP DiaBEATes National Institute for Health Research (NIHR) Clinical Research Network, diabetes-support.org.uk, diabetes.co.uk and diabetes United Kingdom. Eligible participants confirmed that they were aged ≥18 years of age, could understand written English and had a diagnosis of either Type 1 or Type 2 DM. After giving informed consent and providing brief demographic and clinical information, participants completed measures assessing depression and anxiety, illness representations, metacognitive beliefs and rumination, via an online platform. Participants at baseline were asked to provide an email address and were emailed a link to re-complete measures of depression and anxiety 6 months later. Ethical approval was obtained from the [Retracted for anonymous peer review]. No remuneration was offered to participants for their participation.

Materials and methods

Anxiety

Anxiety was assessed using the Generalized Anxiety Disorder (7-item) scale (GAD-7; Spitzer et al., 2006). The GAD-7 assesses the frequency of symptoms of anxiety over the preceding 2 weeks, using a 4-point Likert scale (0 = not at all; 3 = every day). Items are summed to provide a total score, ranging from 0 to 21. Higher scores indicate greater anxiety symptoms. The GAD-7 is a reliable and valid measure of anxiety in chronic illness populations (Spitzer et al., 2010), with baseline reliability α = .93 and 6-month reliability α = .92 in the current study. The region of clinical concern is defined as greater than or equal to 8 (Stoop et al., 2015).

Depression

Depression was assessed using the 9-item Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001). The PHQ-9 assesses the frequency of common symptoms of depression over the preceding 2 weeks. Responses are scored on a 4-point Likert scale (0 = not at all; 3 = nearly every day) and summed to produce a total score (range 0–27). Higher scores indicate greater depressive symptoms. The PHQ-9 demonstrates good psychometric properties in chronic illness populations (Spitzer et al., 2010), with base-

line reliability α = .91 and 6-month reliability α = .91 in the current study. The region of clinical concern is defined as greater than or equal to 7 (Stoop et al., 2015).

Illness representations

Illness representations were assessed using the DIRQ (Skinner et al., 2003), a 30-item measure which assesses five domains of illness perception related to DM: (i) Coherence (perceived understanding of DM), (ii) Timeline (perception that DM is a lifelong illness), (iii) Personal Responsibility (perception that DM is controllable), (iv) Seriousness (perception that DM will have serious consequences) and (v) Impact (perceived adverse impact on quality of life). Each item is scored on a 5-point Likert scale and is summed to provide five subscale scores (range 6–30), with higher scores indicating greater coherence, longer timeline and greater personal responsibility, seriousness and impact. The DIRQ demonstrates adequate to good internal consistency for adults with DM (Skinner et al., 2011); in the current study, reliabilities (Cronbach alpha) were coherence .64, timeline .70, personal responsibility .76, seriousness .66 and impact .85.

Metacognitive beliefs

Metacognitive beliefs were assessed using the 30-item Metacognition Questionnaire (MCQ-30; Wells & Cartwright-Hatton, 2004). The MCQ-30 assesses five domains of metacognitive belief: (i) negative beliefs about worry (e.g., 'my worrying is dangerous for me'), (ii) positive beliefs about worry (e.g., 'worrying helps me to avoid problems in the future'), (iii) low cognitive confidence (e.g., 'I have little confidence in my memory for words and names'), (iv) beliefs about the need to control thoughts (e.g., 'I should be in control of my thoughts at all times') and (v) cognitive self-consciousness (e.g., 'I pay close attention to the way my mind works'). Items are scored using a 4-point Likert scale, extending from 1 (do not agree) to 4 (agree very much). Responses are summed to give a total score (range 30–120) and five subscale scores (range 6–24), with higher scores indicating higher levels of maladaptive metacognitive beliefs. The MCQ-30 is widely used in chronic illness populations and demonstrates good psychometric properties (Cook et al., 2015a). In the current study, reliabilities (Cronbach alpha) were negative beliefs .87, positive beliefs .90, cognitive confidence .91, beliefs about need to control thoughts .77 and cognitive self-consciousness .86.

Rumination

Rumination was assessed using the 22-item Ruminative Response Scale (RRS; Nolen-Hoeksema, 1991). Participants rate how often they engage in ruminative responses using a 4-point Likert scale (1 = never; 4 = always). Items are summed to produce three subscale scores: (i) reflection (five items, such as 'analyse your personality to try and understand why you are depressed'; range 5–20), (ii) brooding (five items, such as 'think what I am doing to deserve this?' range 5–20), and (iii) depression-related brooding (12-items, such as 'think about how sad you feel'; range 12–48). Higher subscale scores indicate higher ruminative responding. The RRS demonstrates good reliability (α = .90) and validity (Luminet, 2004; Nolen-Hoeksema, 2004), with a reliability of α = .96 in the current study.

Analysis plan

Mean age (with *S.D.*) and frequencies of gender, ethnic origin and Type 1 and 2 DM diagnoses were calculated in SPSS v28, as were Pearson correlations between study variables. Initially, we planned to conduct

correlational analyses separately for Type 1 and Type 2 DM participants. Type 1 and Type 2 DM populations' summary scores differed in magnitude, but correlation matrixes were virtually identical. Therefore, correlations are presented for all participants rather than for Type 1 and Type 2 DM patients separately.

We used structural equation modelling (SEM) in AMOS v24 to assess the fit of a mediational model and to estimate individual parameters. The initial measurement model (Figure 1) incorporated all baseline illness representation variables and metacognitive beliefs as single latent variables. The initial structural model proposed an indirect effect, whereby the metacognitive latent variable would predict changes in anxiety and depression, from baseline to 6-months, mediated by baseline rumination (Wells & Mathews, 1994, 1996). We controlled for all effects of illness representations by including a direct effect on anxiety and depression. Based on Soo et al. (2009), we also modelled an indirect effect of illness representations on distress mediated by rumination. Prediction by metacognitive variables, independently of illness representations (Aim 1), would be indicated by a significant structural path to rumination, with mediation (Aim 2) indicated by a further significant structural path between rumination and anxiety and depression.

We used maximum likelihood estimation based upon unbiased co-variances. Good fit was defined as RMSEA <.08. Missing data were less than 1% and replaced using unbiased full information maximum likelihood estimation. Depression and anxiety were strongly correlated, ($r = .80$ at baseline and .84 at 6-month follow-up); thus, T1 values were treated as indicators of a latent variable 'distress'. The dependent variable was a latent variable comprising T1–T2 change scores for depression and anxiety. Change scores were used instead of T2 scores because this improved model fit from RMSEA of .079 to .065.
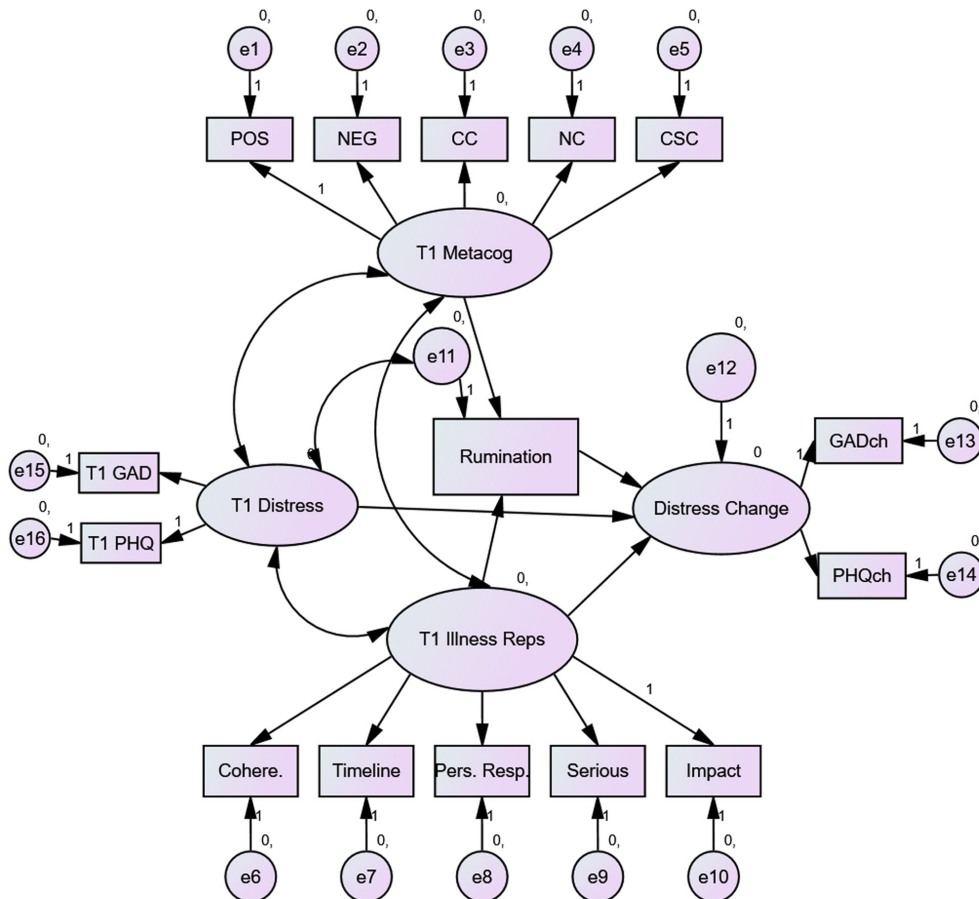

FIGURE 1 Hypothesized model.

An initial model showed poor fit, CMIN = 377.05, df = 51, CFI = .884, RMSEA = .089. Further models allowing group comparisons based on Type 1 versus 2 diabetes and gender were fitted. A two group Type 1 versus 2 model showed acceptable fit. Appendix 1 shows the initial model, whilst the two group (Type 1 vs. 2) model is described in the results.

RESULTS

Participant characteristics

Of 614 participants recruited at baseline, 441 provided data at 6-month follow-up and thus were included in analyses. Demographic characteristics are displayed in Table 1. Around half (54.4%; n = 240) had Type 1 DM and the remainder (45.6%; n = 201) had Type 2 DM. Summary statistics for depression, anxiety and illness representations are presented in Table 1. Type 1 DM patients were younger and reported greater anxiety at follow-up than Type 2 DM patients (Table 2). Type 1 DM patients also scored significantly higher than Type 2 DM patients on DIPQ Coherence, most MCQ-30 subscales (except for Need to Control Thoughts) and the total RRS rumination score, and significantly lower on the DIPQ Impact subscale (Table 2). Mean anxiety and depression scores for the total sample were indicative of mild levels of anxiety and depression at both baseline (means of 5.21 and 8.23 respectively) and 6-month follow-up (means of 5.18 and 7.88 respectively).

Table 2 displays Person's correlations between study variables. Although Type 1 and Type 2 DM populations' summary scores differed in magnitude, correlation matrixes were virtually identical. Therefore, correlations are presented for all participants rather than for Type 1 and Type 2 DM patients separately. Depression and anxiety were highly correlated (r = .80 at baseline and .84 at 6-month follow-up) with autocorrelations of .74 and .61, respectively. DIPQ Seriousness and Impact subscale scores were negatively correlated with depression and anxiety. Depression and anxiety at both time-points were positively associated with all MCQ-30 subscale scores. Rumination was correlated with all study variables except for DIRQ Timeline.

Mediational analysis

The final, best fit, SEM model was a two-group analysis based upon distinctions between Type 1 and Type 2 participants (Unconstrained Model; CMIN = 472.53, df = 164, p < .001, RMSEA = .065 (CI = .059, .072)).[1] Type 1 and 2 models are presented separately in Figure 2a,b. Both suggest mediation, with significant standardized coefficients between the metacognitive latent variable and rumination, of .67 and .85 (Types 1 and 2, respectively), and between rumination and distress of .36 and .43 (Types 1 and 2, respectively). Illness representations showed neither direct nor indirect relationships with distress in either group.[2]

DISCUSSION

Consistent with S-REF theory, we found that a baseline measure of rumination mediated the positive relationship between a latent variable representing five metacognitive beliefs at baseline and subsequent 6-month changes in anxiety and depression. The relationship between metacognitive beliefs and rumination was independent of illness representations. Whilst several studies have examined the role of maladaptive metacognitive beliefs and rumination in predicting distress in physical illness samples, this study is important because few studies have used prospective designs and no prospective studies have been conducted in DM samples (Capobianco et al., 2020).

TABLE 1 Distributions of study variables.

	Full sample $N = 441$	Type 1 $N = 240$	Type 2 $N = 201$
Age	52.07 (14.78)	45.82 (14.16)	59.54 (11.73)
Gender	Male = 186 (42.2%) Female = 255 (57.8%)	Male = 81 (33.8%) Female = 159 (64.2%)	Male = 105 (52.2%) Female = 96 (47.8%)
Ethnicity	White = 420 (95.2%) Other = 21 (4.8%)	White = 226 (94.2%) Other = 14 (5.8%)	White = 194 (96.5%) Other = 7 (43.5%)
Anxiety (baseline)	5.21 (5.39)	5.90 (5.57)	4.42 (5.06)
Anxiety – clinical concern	109 (24.9%)	70 (21.2)	34 (19.1)
Depression (baseline)	8.23 (7.36)	8.77 (7.27)	7.58 (7.43)
Depression – clinical concern	180 (40.4%)	104 (51.2%)	74 (37.8%)
Anxiety (follow-up)	5.18 (5.30)	5.74 (5.34)	4.52 (5.18)*
Depression (follow-up)	7.88 (7.26)	8.55 (7.13)	7.09 (7.33)
DIRQ coherence	17.49 (3.71)	17.88 (3.60)	17.02 (3.80)*
DIRQ timeline	17.39 (2.75)	17.26 (2.73)	17.54 (2.78)
DIRQ personal responsibility	15.93 (2.63)	15.95 (2.73)	15.90 (2.53)
DIRQ seriousness	16.15 (2.66)	16.05 (2.63)	16.27 (2.70)
DIRQ impact	21.73 (5.42)	20.02 (5.03)	23.77 (5.16)*
MCQ-30 total score	54.55 (16.55)	56.84 (17.10)	51.8 (15.47)*
MCQ-30 POS	9.53 (3.82)	10.09 (4.19)	8.86 (3.22)*
MCQ-30 NEG	10.75 (4.97)	11.24 (9.44)	10.17 (4.56)*
MCQ-30 CC	11.73 (5.08)	11.51 (6.40)	10.55 (4.64)*
MCQ-30 NC	9.88 (3.77)	10.18 (3.95)	9.53 (3.53)
MCQ-30 CSC	13.31 (4.62)	13.83 (54.53)	12.68 (4.67)*
RRS Total Score	43.29 (15.53)	45.92 (15.37)	40.13 (15.16)*

Abbreviations: CC, cognitive confidence; CSC, cognitive self-consciousness; DIRQ, Diabetes Illness Representations Questionnaire; MCQ-30, Metacognitions Questionnaire – 30; NC, need to control thoughts; NEG, negative metacognitive beliefs; POS, positive metacognitive beliefs; RRS, Ruminative Response Scale.

*$p < .05$.

Findings support the S-REF model as a description of the processes that cause and maintain depression and anxiety in adults living with DM and are consistent with prior research demonstrating the utility of the S-REF model for explaining depression and anxiety in adults with mental and physical health diagnoses (Allott et al., 2005; Cook et al., 2015a, 2015b; Fisher et al., 2018; Purewal & Fisher, 2018). Potential mediation by rumination ties the findings more directly to S-REF theory, which views rumination (one component of the CAS) as being driven by maladaptive metacognitive beliefs (Wells & Mathews, 1994, 1996). A recent systematic review of the relationship between metacognitive beliefs and anxiety and depression in physical health samples (Capobianco et al., 2020) has shown similar effect sizes, albeit in largely cross-sectional studies, to both the correlation matrix and the standardized coefficients in the current study. However, this is among the first physical illness studies to show a clear mediational path that implicates rumination using a prospective design.

Metacognitive beliefs predicted distress independently of illness representations, mediated by rumination. This is consistent with the main thesis of the S-REF model, suggesting that it is how an individual thinks about, and *responds* to, commonly occurring thoughts and feelings, such as negative illness perceptions, that is of importance, more so than the content of these thoughts (Wells & Mathews, 1994, 1996). This is in comparison with illness representation theory whereby content of thoughts about illness (e.g., 'my illness will last a long time') are seen as direct contributors to distress (Leventhal et al., 1980, 1984). Mediation by rumination is grounded in the S-REF model, which identifies rumination as a key

TABLE 2 Correlations between study variables.

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Age	-.26**	-.22**	-.29**	-.29**	.04	.08	-.07	.14**	.27**	-.21**	-.13**	-.26**	-.04	-.15**	-.22**	-.38**
2. Anxiety (T2)		.83**	.85**	.73**	-.23**	.05	.11*	-.21**	-.42**	.60**	.33**	.74**	.37**	.58**	.44**	.71**
3. Depression (T2)			.72**	.86**	-.20**	-.02	.13*	-.20**	-.39**	.55**	.25**	.66**	.40**	.50**	.33**	.61**
4. Anxiety (T1)				.80**	-.19**	-.01	.16**	-.21**	-.41**	.65**	.29**	.69**	.41**	.55**	.39**	.71**
5. Depression (T1)					-.19**	.00	.16**	-.21**	-.41**	.69**	.29**	.70**	.46**	.56**	.41**	.73**
6. DIPQ coherence						.13**	-.05	.20**	.21**	-.17**	-.16**	-.19**	-.03	-.17**	-.11*	-.15**
7. DIPQ timeline							.10*	.07	.00	.04	.03	.04	-.01	.04	.04	.03
8. DIPQ PR								.01	-.12**	.06	-.03	.14**	.05	-.01	.06	.13**
9. DIPQ seriousness									.25**	-.21**	-.16**	-.20**	-.09	-.17**	-.18**	-.25**
10. DIPQ impact										-.39**	-.23**	-.40**	-.21**	-.38**	-.24**	-.46**
11. MCQ-30 total											.68**	.83**	.66**	.86**	.73**	.77**
12. MCQ-30 POS												.43**	.23**	.53**	.46**	.42**
13. MCQ-30 NEG													.44**	.69**	.55**	.75**
14. MCQ-30 CC														.51**	.19**	.46**
15. MCQ-30 NC															.55**	.65**
16. MCQ-30 CSC																.58**
17. RRS total																

Abbreviations: CC, cognitive confidence; CSC, cognitive self-consciousness; DIRQ, Diabetes Illness Representations Questionnaire; MCQ-30, Metacognitions Questionnaire; MCQ-30, Metacognitions Questionnaire – 30; NC, need to control thoughts; NEG, negative metacognitive beliefs; POS, positive metacognitive beliefs; PR, Personal Responsibility; RRS, Ruminative Response Scale.

*Correlation is significant at the .05 level (two-tailed).

**Correlation is significant at the .01 level (two-tailed).
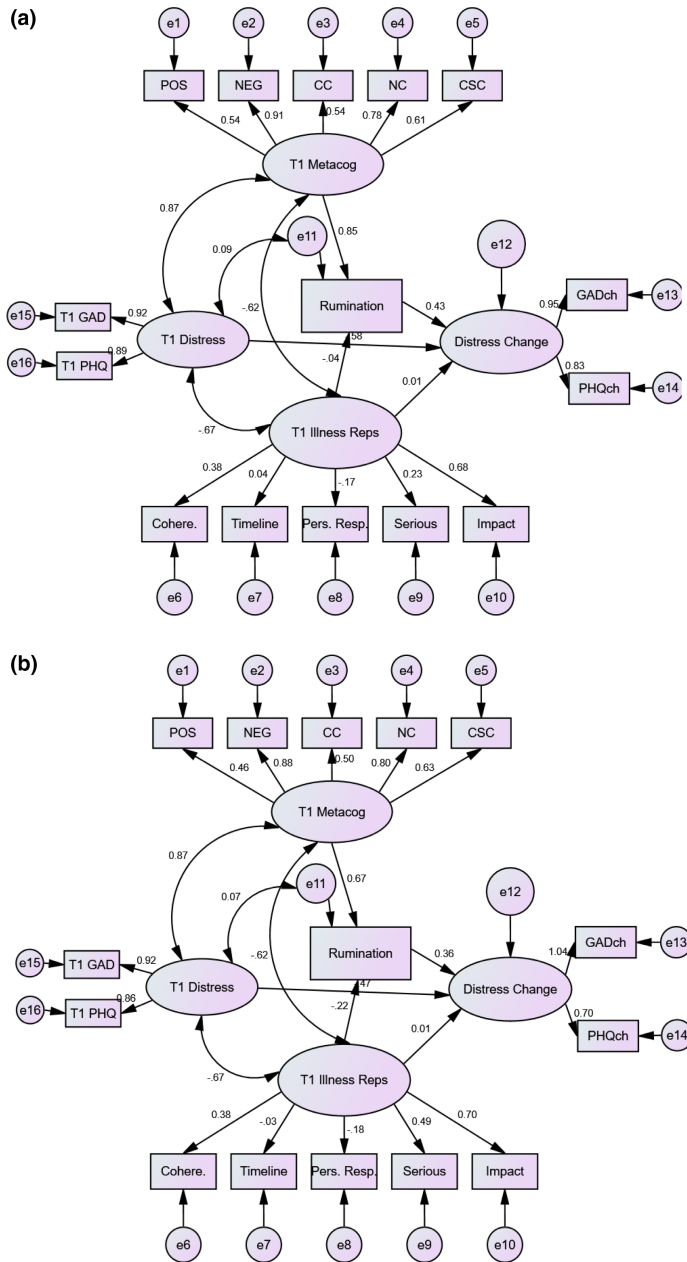
FIGURE 2 (a) Mediational structural equation model showing standardized estimates of association for Type 1 Diabetes. (b) Mediational structural equation model showing standardized estimates of association for Type 2 diabetes. Unconstrained Model Fit; CMIN = 472.53, df = 164, p < .001, RMSEA = .065 (CI = .059, .072) CSC = cognitive self-confidence metacognitive beliefs subscale; Distress Change = change in total distress score from T1 to T2; GAD = Generalized Anxiety Disorder 7 score; GADch = change in Generalized Anxiety Disorder 7 score from T1 to T2; IllnessReps = illness representations latent variable; Impact = Impact subscale; Metacog = metacognitive latent variable; NC = need for coherence metacognitive beliefs subscale; NEG = negative metacognitive beliefs subscale; PHQ = Patient Health Questionnaire 9 score; PHQch = change in Patient Health Questionnaire 9 score from T1 to T2; POS = positive metacognitive beliefs subscale; PR = Personal Responsibility subscale; Serious = Seriousness subscale; Std = distress variable; T1 = Time 1 (baseline); Time 2 = 6-month follow-up.

component of the CAS and proximal cause of distress (Wells & Mathews, 1994, 1996). It is important to note, however, that the research aim and consequent method was to show that metacognitive variables can predict distress independently of illness representations, rather than comparing the relative explanatory value of the two models.

Limitations

Links between rumination and metacognitive beliefs are cross-sectional, as both were measured at baseline. Causality of this link is therefore difficult to establish, and it is possible, but unlikely, that rumination causes maladaptive metacognitive beliefs. We did not have a measure of the full CAS, but instead used rumination as a single component of the CAS. Other CAS processes, such as worry, were not examined and these may provide additional mediators. Finally, we did not recruit a clinical sample but rather recruited via charities and the NIHR Clinical Research Network, which may have introduced bias into the sample. Further, patients were not homogenous regarding time since diagnosis of DM, and the majority did not meet cut-offs for clinical concern for anxiety or depression. Future research could examine relationships between these variables measured at multiple time points over longer periods, recruiting a sample of clinically distressed patients. This would allow more insightful analysis of model fit over time.

Implications for clinical practice

The findings of this study challenge a common assumption of practice in that thoughts about self and illness are proximal determinants of distress. Our findings assume importance because they show that a clinical focus need also be maintained on the ways that people think about, and respond to, their thoughts. This has implications for prevention and amelioration of distress; for instance, psychologists could support direct care staff to better identify patients at risk of distress (e.g., those engaging in high levels rumination, or those that endorse maladaptive metacognitive beliefs) and to intervene to change these processes before distress becomes persistent as well as offering interventions when distress is clinically significant (Cherry et al., 2019; Fisher et al., 2015, 2017, 2019; McNicol et al., 2012; Wells et al., 2021).

In terms of treating high levels of distress, meta-analyses indicate that current psychological interventions achieve only modest and short-term effects in DM populations (Baumeister et al., 2012; Steed et al., 2003). Findings of this study provide empirical support for components of the S-REF model as independent predictors of depression and anxiety, controlling for illness representations and baseline levels of depression and anxiety. Thus, it is feasible that process-related therapeutic approaches underpinned by the S-REF model, such as MCT, may offer improvements to current content-related approaches such as cognitive behavioural therapy. Examination of the effectiveness of MCT in this patient population would be a logical next step in increasing psychological support for adults living with DM.

Conclusions

Metacognitive beliefs appear to be key drivers of rumination and consequently depression and anxiety, independent of baseline levels of depression and anxiety. Prevention and treatment of depression and anxiety in adults living with DM may be enhanced through an approach that identifies and modifies maladaptive metacognitive beliefs (i.e., MCT). Further prospective research is needed to identify potential mediating and moderating relationships between illness representations, rumination, metacognitive beliefs and depression and anxiety.

AUTHOR CONTRIBUTIONS

PF conceptualised the paper. RP collected data under the supervision of PF. SB led data analysis. MGC wrote the first draft of the paper. All authors commented on subsequent drafts.

CONFLICT OF INTEREST STATEMENT

The authors report there are no competing interests to declare.

DATA AVAILABILITY STATEMENT

Data available on request due to privacy/ethical restrictions.

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ENDNOTES

[1] To test whether structural relationships significantly differed between Types 1 and 2, we constrained structural weights, covariances and residuals to equality. This constrained model did not significantly differ from an unconstrained model, meaning that structural relationships between variables did not differ between Types 1 and 2 DM (CMIN = 10.61, df = 10, p < .389). Type 1 and 2 samples probably differed over measurement rather than structural components of the model.

[2] It may be noted that the coefficient between the illness representations latent variable and rumination is negative (although not statistically significant), whilst the individual correlations would indicate a positive coefficient. We interpret this as a suppressor effect, as the coefficient becomes positive when the illness representations latent variable is removed from the analysis. Suppressor effects are common when multicollinearity exists between predictor variables.

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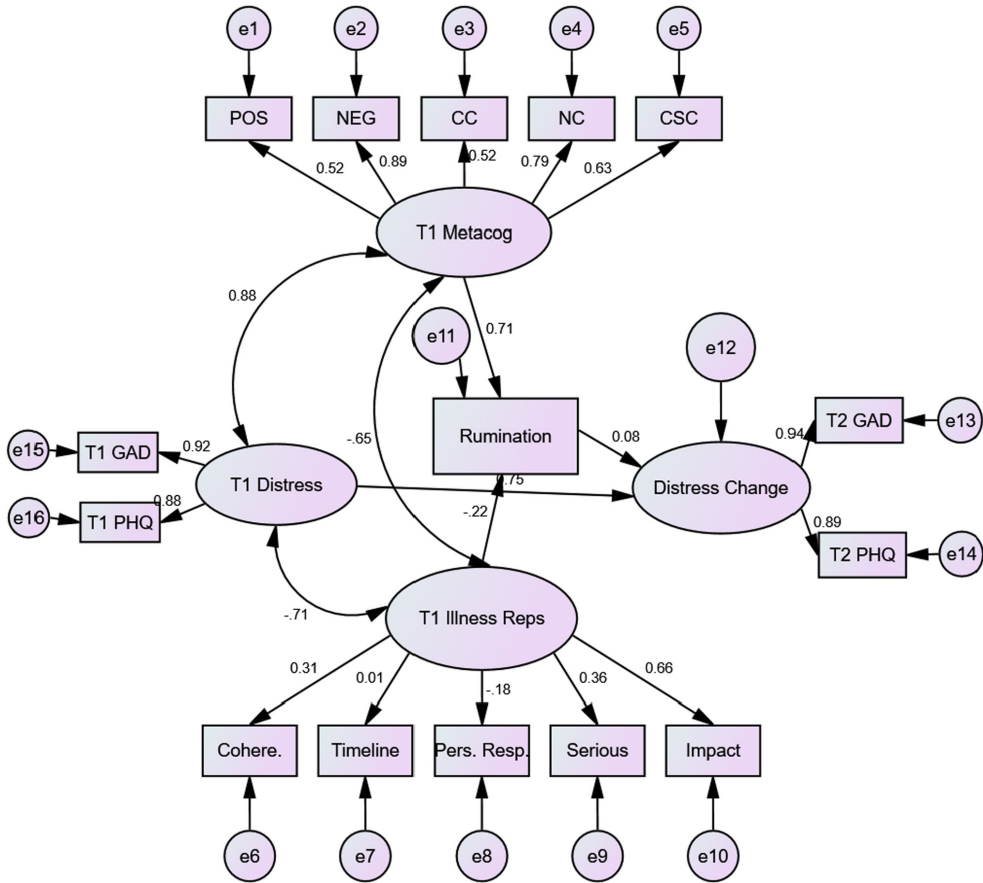
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APPENDIX 1

Initial Full-Sample Mediational Structural Equation Model showing Standardized Estimates of Association.

CMIN = 377.05, *df* = 51, CFI = .884, RMSEA = .089.