



Research paper

Dysfunctional attitudes or extreme response style as predictors of depressive relapse and recurrence after mobile cognitive therapy for recurrent depression



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ABSTRACT

Background: According to previous research, dysfunctional attitudes and/or scoring extreme on the end-point anchors of questionnaires of dysfunctional thinking predict depressive relapse/recurrence. Evidence that these two methods represent a risk for depressive relapse/recurrence is however mixed, due to differential or poorly defined concepts. The current study aimed to test the two methods.

Methods: Remitted recurrently depressed patients with low residual depressive symptoms ($N = 264$) were recruited as part of a randomized controlled trial of the effectiveness of mobile Cognitive Therapy for recurrent depression versus treatment as usual. In the current secondary analysis, Cox regression models were conducted to test dysfunctional attitudes and extreme responding variables (assessed on the Dysfunctional Attitudes Scale [DAS]) as predictors of depressive relapse/recurrence within two years after randomization.

Results: Data from 255 participants were analyzed. Results showed that DAS total scores at baseline significantly predicted depressive relapse/recurrence (*Hazard Ratio [HR]* = 1.01, $p = .042$). An index that reflects endorsement of habitual relative to functional responses was a significant predictor of depressive relapse/recurrence ($HR = 2.11$, $p = .029$).

Limitations: The current study employed a single measure to identify extreme responses and dysfunctional attitudes. Secondly, various statistical analyses were performed without correcting for multiple testing, which in turn increased the likelihood to finding significant results.

Conclusions: Current study confirmed both methods: People who scored higher on the DAS or had relatively more habitual than functional responses on the extreme positive ends of the DAS had a decreased time to depressive relapse/recurrence.

1. Introduction

Major depressive disorder (MDD) is predicted to be one of the lead causes of burden by 2030 (Mathers and Loncar, 2006). The high burden attributable to depression is not only due to acute episodes of the disorder, but also due to its chronic nature. Individuals with a history of MDD have a high risk of relapse or recurrence and this risk increases with each subsequent episode (Bockting et al., 2015). Therefore, identifying variables that place individuals at risk for both acute and recurrent episodes is essential.

Based on the seminal cognitive model (Beck et al., 1979), it has been theorized that dysfunctional beliefs (e.g. as measured by the Dysfunctional Attitudes Scale [DAS]; Weissman, 1979) are important in the onset, relapse, and recurrence of MDD (Beck and Bredemeier, 2016; Beck et al., 1979), and are predictive of relapse/recurrence of MDD after cognitive behavioral therapy (CBT) treatment (Adler et al., 2015; Beck and Bredemeier, 2016; Garratt et al., 2007; Lorenzo-Luaces et al., 2015; Teasdale et al., 2001). More recently, research has shifted from the overall level of dysfunctional beliefs (i.e. the total questionnaire score) as a predictor of MDD relapse or recurrence, to the “style” of

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responding, specifically a tendency to make responses at the ends of Likert-type scales, known as ‘extreme responding’ (Beevers et al., 2003; Teasdale et al., 2001). Extreme responding is defined as the endorsement of the end of scale responses (e.g., 1’s or 7’s on a 1–7 Likert scale) (e.g. Beevers et al., 2003; Forand & DeRubeis, 2014; Teasdale et al., 2001).

In an initial study reporting this effect, Teasdale et al. (2001) found that the more extreme responses a patient gave, the higher the chance of depressive relapse within 8 weeks after the start of treatment. According to Teasdale et al. (2001), extreme responding reflected an “(.) underlying activity of mood-dependent, developmentally early, depressogenic schematic processing” (Teasdale et al., 2001, p. 354). The extreme responses would therefore be similar to information processing biases (Teasdale et al., 2001), consistent with the cognitive model (Beck & Bredemeier, 2016; Beck et al., 1979). Previous studies in other research areas for example indicated that the extreme responding reflects underlying (personality) traits, such as intolerance of uncertainty, rather than a response to the content of the items of a questionnaire, which may represent maladaptive behaviors and a higher reactivity to life events (Naemi et al., 2009; Stange et al., 2017; Wetzal et al., 2013). This in turn may increase the risk of mental disorders such as MDD (e.g. Stange et al., 2017).

Since the initial results of Teasdale et al. (2001), several researchers (partly) confirmed the idea of extreme responding as a predictor of depressive relapse/recurrence (e.g. Beevers et al., 2003), whilst others failed to replicate the seminal findings (Ching and Dobson, 2010; Jacobs et al., 2010; Petersen et al., 2007; van Rijsbergen et al., 2013). Furthermore, a distinction can be made between *negative* and *positive* extreme responses, where a negative extreme response represents full agreement with dysfunctional items and full disagreement with functional questionnaire items. Positive extreme responses represent full agreement with functional items and full disagreement with dysfunctional questionnaire items (e.g. Forand and DeRubeis, 2014; Forand et al., 2016). Examples of positive extreme responses are: Full agreement with the statement “*It is possible to gain another person’s respect without being especially talented at anything*”; or complete disagreement with the statement “*If I fail at my work, then I am a failure as a person*”. Previous outcome studies have demonstrated that the way (i.e., positive or negative extremity) in which individuals respond to items of the DAS may provide clinical insight into who is likely to respond to therapy or be at elevated risk for later episode recurrence (e.g. Beevers et al., 2003; de Graaf et al., 2010; Forand & DeRubeis, 2014).

Evidence for the assumption that extreme or elevated, positive or negative, dysfunctional attitudes represent a risk factor for later depressive relapse/recurrence is however mixed. To make sense of the discrepant findings, Forand and DeRubeis (2014) proposed an alternative approach to conceptualize extreme responses: *Style* versus *content* positive extreme responses. These authors highlighted an important problem with the extreme responding literature that used the DAS: It is impossible to distinguish whether negative extreme responses that predict relapse/recurrence are due to the respondent possessing an “extreme response *style*” or to that person endorsing extreme levels of dysfunctional attitudes (based on the *content*). Both will predict greater rates of relapse/recurrence. These authors argued that positive extreme responding was more informative, because positive extreme responding due to an extreme response *style* is hypothesized to predict a greater rate of relapse, whereas positive extreme responding due to the presence of functional beliefs would (theoretically) predict a lower rate.

To distinguish between the two types of *positive* extreme responses, Forand and DeRubeis (2014) focused on DAS items where positive extreme responses appeared to be maladaptive. They hypothesized that individuals who responded thoughtfully to the DAS and held functional attitudes would be unlikely to provide positive extreme responses to these items, dubbed “*style*” items. On the other hand, individuals with an “extreme response *style*” would tend to make positive extreme responses indiscriminately to items, regardless of whether such responses

are rational or adaptive. Thus, an extreme response style is determined by the relative frequency of positive extreme responding to “*style*” items versus “*content*” items, or items where such responses appear rational. A greater relative rate of positive extreme responding to “*style*” versus “*content*” items would suggest the individual has an extreme response style (Forand and DeRubeis, 2014; Forand et al., 2016).

DAS- items were rated as *content* responses if it was considered functional to endorse the item at the extreme positive end. An example of a content item was: ‘*If I ask a question, it makes me look inferior*’ (in this case, to disagree fully with the statement). An example of a style item is ‘*I can find happiness without being loved by another person*’. In this case, the independent raters believed that the best answer was somewhere in the middle of the scale (Forand and DeRubeis, 2014; Forand et al., 2016).

Forand and colleagues (2014, 2016) found that MDD patients who had relatively more dysfunctional (*style*) than functional (*content*) positive extreme responses had an increased risk of depressive relapse or recurrence in responders to antidepressants (AD) and CBT in an RCT (DeRubeis et al., 2005; Hollon et al., 2005). According to Forand and colleagues (2014; 2016), a differentiation should therefore be made between extreme responses on *content* items and *style* items.

However, these findings still need to be replicated. Since all but two studies on extreme responding are from native English speaking countries (Beevers et al., 2003; Ching and Dobson, 2010; de Graaf et al., 2010; Forand and DeRubeis, 2014; Forand et al., 2016; Jacobs et al., 2010; Petersen et al., 2007; Teasdale et al., 2001; van Rijsbergen et al., 2013), possible language and cultural differences may influence extreme responding. This may be reflected in Dutch people responding less on the extreme ends of questionnaires than American people (e.g. Douma, 1991; Harzing, 2006). The procedure used by Forand and colleagues (2014, 2016) has -to our knowledge- not yet been applied to another culture and language.

Therefore, to follow-up the previous results, the current study aimed to identify whether 1) dysfunctional attitudes or 2) having relatively more *style* than *content* positive extreme responses are predictors of depressive relapse/recurrence. We investigated this by using secondary data from a RCT in a sample of remitted Dutch recurrently depressed patients randomized to receive either mobile preventive cognitive therapy (mCT) or TAU (Bockting et al., 2011; Klein et al., 2018; Kok et al., 2015). Based on previous research in the field of depression (e.g. Forand and DeRubeis, 2014; Stange et al., 2017; Teasdale et al., 2001), and in other fields of research (e.g. Naemi et al., 2009), we hypothesized that relatively more positive extreme responses on *style* items as compared to *content* items on the DAS would predict depressive relapse/recurrence.

2. Methods

2.1. Participants

Study participants were derived from an RCT of the effectiveness of mobile PCT for recurrent depression (mCT). Participant characteristics, study design, measures, and primary and secondary outcomes have been reported in previous articles (Kok et al., 2015; Klein et al., 2018). The trial protocol was approved by the Medical Ethical Committee of the University Medical Centre Groningen. All participants provided written informed consent prior to participation.

At start of the trial, 264 participants between 18 and 65 years old (mean age = 46; 74.6% female) were in remission or recovery from recurrent MDD, as defined by the structured clinical interview for DSM axis-I disorders (SCID-I, DSM-IV-TR; First et al., 2002). To be included in the trial, participants needed to have experienced at least two depressive episodes, as defined by the SCID-I, and the duration of the remission or recovery stage was not allowed to be shorter than two months, or longer than two years. Furthermore, participants had a score of 10 or lower on the Hamilton Rating Scale for Depression (HRSD-17

Table 1
Baseline randomized participant characteristics.

	mCT (n = 132)	TAU (n = 132)
Mean age in years (SD)	45.6 (10.9)	47.1 (10.7)
Gender female (%)	105 (79.5)	92 (69.7)
Born in the Netherlands (%)	116 (88.5)	121 (92.4)
Marital status		
Single (%)	39 (29.8)	32 (24.2)
Married or cohabiting (%)	81 (62.3)	87 (65.9)
Divorced or Widowed (%)	10 (7.7)	13 (9.9)
Education		
Primary school or Secondary education (%)	7 (5.3)	13 (9.9)
Vocational or Pre-university education (%)	41 (31.1)	43 (32.6)
Higher education (%)	57 (43.2)	52 (39.4)
University (%)	26 (20.5)	25 (18.2)
Treatment as Usual (TAU), %		
No treatment	46 (34.8)	39 (30)
General practitioner	34 (25.8)	43 (33.1)
Specialized mental health (after)care	52 (39.4)	48 (36.9)
Antidepressants usage (%)	50 (41.4)	62 (53)
Mean HRSD-17 score (SD)	3.7 (3.1)	3.4 (2.9)
Severity last depressive episode		
Minor (%)	37 (28)	25 (18.9)
Moderate (%)	73 (55.3)	71 (53.8)
Severe (%)	22 (16.7)	36 (27.3)
Average previous MDD episodes (SD)	4.3 (2.5)	4.5 (2.7)

Note: mCT = mobile preventive cognitive therapy; TAU = treatment as usual, HRSD-17 = Hamilton Rating Scale for Depression – 17 items; MDD = major depressive disorder.

items; Hamilton, 1960) prior to randomization. Exclusion criteria were predominant anxiety disorder; current or past (hypo) mania, current alcohol or drug abuse, and past or present psychosis. Other exclusion criteria were no mastery of Dutch language, organic brain damage, and recent electroconvulsive therapy. Participant characteristics are reported in Table 1.

2.2. Treatment

Eligible participants were randomly allocated to either mCT or TAU. The mCT was based on preventive cognitive therapy (Bockting et al., 2011), and was primarily delivered via the Internet. In addition, participants were offered minimal therapist support. Mobile CT consisted of 8 online modules, of which the participants were advised to complete one module per week. Full description of the program and the individual modules can be found in Bockting et al. (2011) and Kok et al. (2015).

TAU consisted of usual care for remitted patients in the Netherlands. This included medication treatment such as antidepressants, psychotherapy, or no treatment at all. Assessments were equal in both the mCT and TAU group.

2.3. Measures

2.3.1. Hamilton rating scale for depression (HRSD; Hamilton, 1960)

The HRSD is a 17-item semi-structured interview to measure severity of depressive symptoms. In the original trial, the HRSD was used as a telephonic interview, administered by trained researchers and psychologists. Total HRSD scores can range from 0 (no symptoms) to 52 (all depressive symptoms; Hamilton, 1960). Internal consistency of HRSD in the current study was good ($\alpha = 0.82$). Threshold for depressive symptoms on the HRSD was set on a score of 10 or below (Bockting et al., 2011).

2.3.2. Dysfunctional attitudes scale (DAS; Douma, 1991; Weissman, 1979)

The 40-item DAS was used to identify dysfunctional attitudes on a 7-point Likert scale ranging from ‘completely disagree’ to ‘completely agree’. A higher DAS score indicates more dysfunctional attitudes. The

DAS has good psychometric properties ($\alpha = 0.86$; Dozois et al., 2003). Cronbach's alpha in the current study was 0.93, indicating good internal consistency.

2.3.3. Extreme responding

Total extreme responding (ER-Total) on the DAS was calculated as the total number of extreme (i.e., ‘1’ and ‘7’) responses. Positive extreme responding (PER) was calculated by summing all ‘1’ scores on normal keyed items, and ‘7’ scores on reversed keyed items. The same process was used to calculate negative extreme responding (NER), but then by summing all ‘1’ scores on reversed keyed items, and ‘7’ scores on normal keyed items.

2.3.4. Defining content vs. style items

The exact procedure of Forand and DeRubeis (2014) was followed to acquire and calculate the extreme responding variables. This included a short pilot study among clinicians to identify healthy responses on the DAS. Using the DAS, content and style items were identified and used to calculate positive extreme style responding (style-PER) and positive extreme content responding (content-PER).

The clinical perspective on Dutch ‘healthy responses’ was acquired in a separate pilot study to account for the different questions in the Dutch DAS (Douma, 1991) and possible cultural differences in responding on the DAS. The aim was to identify ‘optimal’ healthy responses on all questionnaire items, to discriminate content from style responses. In this pilot study, 14 Dutch independent clinicians were asked to rate ‘optimal’ responses on the DAS. The clinicians had an average work experience of 6.4 ($SD = 7.2$) years (range 1 - 20 years) in clinical field and/or with CBT. Instructions of Forand and DeRubeis (2014) were first translated into Dutch, as well as back-translated into English by an independent researcher to assure proper translation of the original instructions¹.

In the pilot survey, clinicians rated the optimal responses for each questionnaire by using the original instruments’ item scales. The intraclass correlation for the DAS was 0.94; hence the raters were in agreement on optimal responses for the questionnaire.

The averages for each item on the Dutch DAS were not consistent with US sample of Forand and DeRubeis (2014).¹ In Forand and DeRubeis’ study, content items were the items on which the clinicians’ mean score was below 1.5 or above 6.5. Other items were defined as style items. Using this criterion in the present effort, only two items would be identified as content items, whereas Forand and DeRubeis found 17 content items. Since it was important to make a clear distinction between style and content items, the threshold for items being content or style, was changed² into a threshold below 2 or above 6 to identify content items. This is in line with the idea that Dutch people in general respond less on the extreme ends of questionnaires (Harzing, 2006).

Style and content positive extreme responses were calculated by counting the number of extreme responses on DAS items that were identified as style items (for style-PER) and content items (for content-PER) in the pilot study. Total positive extremity (PER-T) was calculated with the average scores of the standardized content items and style items (average of standardized style responses plus standardized content responses). Total positive extremity hence represents the shared variance between style and content items. The unshared term, style versus content positive extreme responding (S/C-PER), was calculated by taking the half difference score (average of the standardized style

¹ An overview document is available upon request.

² Style items were Dutch item numbers: 2, 3, 4, 14, 18, 19, 20, 21, 22, 23, 25, 27, 28, 30, 31, 32, 34, 35, 36, 38, 39, 40. Content items were Dutch item numbers: 1, 5, 6, 7, 8, 9, 10, 12, 13, 15, 16, 17, 24, 26, 29, 33, 37. USA Style items were numbers 2, 3, 7, 11, 12, 17, 18, 19, 23, 24, 27, 28, 29, 30, 31, 32, 33, 34, 35, 37, 38, 39, and 40. USA Content items were numbers 1, 4, 5, 6, 8, 9, 10, 13, 14, 15, 16, 20, 21, 22, 25, 26, and 36.

Table 2
Descriptive statistics and change scores for extreme responding.

	mCT (n = 132)			TAU (n = 132)			Change T0 to T2 (n = 255)				Change T2 to T9 (n = 162)		
	T0	T2	T9	T0	T2	T9	Overall at T0	Overall at T2	Z	p**	Overall at T9	Z	p
Mean DAS (SD)	133.1 (30.5)	135.8 (31.4)	129.1 (37.0)	129.7 (31.9)	131.0 (34.5)	116.9 (34.8)	131.4 (31.2)	133.3 (33)			122.5 (36.2)		
Median Total ER	4	3	3	4	2	4	4	2.5	-3.912	<0.001	4	-2.442	.015
Median ER-N	0	0	0	0	0	0	0	0	-1.767	.077	0	-1.400	.161
Median PER	2	1	2	3	1	2	3	1	-3.766	<0.001	2	-2.928	.003
Median Content-PER*	2	1	1	2	1	1	2	1	-4.360	<0.001	1	-2.441	.015
Median Style-PER*	0	0	1	1	0	0	1	0	-1.804	.071	1	-2.631	.009
Median PER-T*	-0.43	-0.43	-0.42	-0.34	-0.43	-0.42	3	1	-0.717	.473	2	-1.301	.193
S/C PER (Median)*	.05	.1	.1	.1	.1	.02	.08	.1	-0.571	.568	.11	-0.930	.352

Note: mCT = mobile cognitive therapy; TAU = treatment as usual; T0 = baseline measurement; T2 = 3 months' follow-up measurement; T9 = 24 months' follow-up measurements; DAS = Dysfunctional attitudes scale; Total ER = total score of extreme responding; ER-N = negative extreme responding; PER = positive extreme responding; content-PER = positive extreme content responding; style-PER = positive extreme style responding; PER-T = total positive extremity; S/C PER = style versus content extremity.

* These variables are standardized values.

** Wilcoxon Signed Ranks Test.

responses minus standardized content responses). Higher levels of S/C-PER indicate having more style extreme responses than content ones.

2.3.5. Relapse/recurrence of MDD

For the current analyses, the outcome was relapse/recurrence of MDD within 24 months after randomization. Relapse/recurrence was assessed via clinician-administered diagnostic telephonic interviews of the SCID-I (First et al., 2002). Relapse/recurrence was assessed at three, 12, and 24 months post-randomization, and could be detected at any time. Time to relapse/recurrence was measured in days (see Table 2).

2.4. Data analysis

The data analysis plan as described by Forand and DeRubeis (2014) was closely followed since the aim was to investigate the extreme response variables that were identified as predictors previously (Forand and DeRubeis, 2014; Forand et al., 2016). Outcomes and difference scores at baseline, and at the three-month and 24-month follow-up were calculated for DAS and extreme responses variables. To compare the two proposed methods, the model evaluated the predictive value of DAS scores and extreme response style scores collected at baseline. Withdrawals, failure to adhere to treatment, or loss-to-follow-up were treated as censored cases at the time of the event. Separate Cox proportional hazard models were conducted for the baseline model, DAS, and extreme responding variables. The baseline model for the Cox regressions included treatment allocation (mCT vs. TAU), type of TAU (no care, active care, or mental health care), number of previous depressive episodes, and HRSD-17 at baseline. All extreme responding variables were then analyzed in separate Cox regression models with the baseline model. Hence each extreme responding variable was controlled for treatment allocation, number of previous depressive episodes, and depressive symptoms at baseline. The hypothesis was that greater relative style versus content responses (higher S/C-PER scores), predicted an increased rate of relapse/recurrence. See supplement I for model descriptions. All analyses were performed with SPSS 24.

3. Results

At the start of the trial, 255 participants completed the DAS. At 24-months follow-up, relapse rates and DAS measurements for 235 participants were available for the current analyses (drop-out rate 11%). Table 2 includes the descriptive statistics of the DAS at baseline, 3 and

24-months follow-up. During a three-month period during which a part of the participants received mCT or TAU, 89 out of 132 participants (67.9%) completed at least five modules out of the total 8 modules of mCT. Extreme responding variables were, as expected, right-skewed. However, log-transformation did not improve the distribution. Therefore, and in line with the procedure of Forand and DeRubeis (2014), the extreme responding variables were entered untransformed into the analyses.

Based on *t*-tests, there was no significant difference between the TAU and mCT group on the DAS total score at baseline (T0; *M*difference = -3.39, *t* = -0.867, *p* = .387), or three-month follow-up (T2; *M*difference = -4.81, *t* = -0.927, *p* = .355). There was a non-significant higher DAS total score in the TAU group as compared to the mCT group at 24-month follow-up (T9; *M*difference = -12.22, *t* = -1.788, *p* = .077). Mann-Whitney-U showed no significant differences on extreme responding variables between groups at T0, T2, and T9. Although there was no significant difference between mCT and TAU, there was an overall difference across groups between different measurement times on the positive extreme responding variables and total extreme responding, but not on negative extreme responding variables. Table 2 displays the outcomes on the Wilcoxon Signed Rank Tests. The Wilcoxon Signed Rank Tests indicates that there was a significant decrease from T0 to T2, and T2 to T9 in total extreme responding, positive extreme responding, and content-PER. From T2 to T9, style-PER likewise significantly decreased. There were no significant differences between the two groups at T0, T2, and T9 on the HRSD-17. Paired samples *t*-test showed a significant change on HRSD-17 scores from T0 to T2 (*M* = -1.20, *SD* = 5.69, *t* = 3.19, *p* = .002), and from T2 to T9 (*M* = -0.90, *SD* = 6.5, *t* = -1.97, *p* = .05).

3.1. Prediction of depressive relapse

Outcomes of the analyses are reported in Table 3. The baseline model was tested in each Cox regression analysis, but it appears only once in the table. Mobile CT, baseline depressive symptoms, and the number of previous episodes were collectively predictive of depressive relapse/recurrence during the trial ($\chi^2 = 32.74$, -2 log likelihood = 946.07, *p* < .001). Within the overall model, mobile CT extended the time to relapse/recurrence, whilst the number of depressive symptoms and number of previous episodes shortened the time to depressive relapse/recurrence.

Having a higher score on the DAS prior to treatment ($\chi^2 = 33.91$, *p* < .001, *HR* = 1.007, *p* = 0.042) or having relatively more style than

Table 3
Results of the Cox regression analyses.

Model	Parameter	Wald	p	Hazard Ratio	95% CI	
					Lower	Upper
1	mCT vs. TAU ^a	7.870	.005	1.807	1.195	2.732
	TAU no care	.433	.805	n.a.	n.a.	n.a.
	TAU active care	.045	.832	1.052	.660	1.675
	TAU specialized ^b	.215	.643	.883	.523	1.493
	HRSD	15.9	<0.001	1.139	1.069	1.215
2	Previous episodes	7.054	.008	1.094	1.024	1.170
	DAS	4.149	.042	1.007	1.000	1.014
3	DAS	4.267	.030	1.008	1.000	1.016
	Style-PER	.352	.553	1.034	.927	1.153
4	DAS	1.119	.290	1.006	.999	1.014
	Content-PER	.227	.634	.790	.481	3.329
5	PER-T	2.538	.111	.817	.638	1.048
	S/C PER	4.751	.029	2.109	1.078	4.125

Note: mCT = mobile cognitive therapy; TAU = treatment as usual; T0 = baseline measurement; DAS = Dysfunctional attitudes scale; Total ER = total score of extreme responding; PER = positive extreme responding; content-PER = positive extreme content responding; style-PER = positive extreme style responding; PER-T = total positive extremity; S/C extreme = style versus content extremity; CI = 95% confidence interval for hazard ratio. All models include the terms from the baseline model. *a*: The variable ‘treatment’ was dummy coded with TAU = 1, mCT = 0, mCT being the reference group. *b*: Treatment as usual specialized mental health (after)care.

content extreme responses ($\chi^2 = 34.74$, $p < .001$, Hazard Ratio [HR] = 2.11, $p = .029$), significantly decreased the length of time to depressive relapse/recurrence. Contrary to our hypothesis, the frequency of style extreme responding did not enhance the ability of the DAS to predict relapse/recurrence. However, the amount of content positive extreme responses did reduce the ability of the DAS to predict rate of relapse/recurrence ($\chi^2 = 34.26$, $p < .001$), making this variable nonsignificant (Wald = 1.12, HR = 1.005, $p = .290$). These results suggest that *content* but not *style* extreme positive responses were related to the endorsement of functional attitudes on the DAS.

3.2. Post-hoc testing a pragmatic DAS scoring algorithm

The method described in this paper and developed by Forand and DeRubeis (2014) and Forand et al. (2016) predicts relapse/recurrence in study samples. However, the method is impractical for determining relapse risk for individuals in practice because it requires a sample of DAS scores to calculate. Therefore, we present a post-hoc exploratory analysis of a brief pragmatic method for rescoring a DAS to account for any style and content extreme responses. The exact method is described in the supplement I.

The pragmatic DAS score (DAS-S/C) was analyzed in a separate cox regression in the same statistical way as the previous models. DAS-S/C was a significant predictor of relapse rate, with higher scores indicating a greater rate of relapse. Of note, in comparison with the standard DAS score tested in Model 2, DAS-S/C resulted in an higher Wald (6.78 vs. 4.15) and corresponding *p*-value ($p = .009$ vs. $p = .042$), while retaining a similar hazard ratio (HR = 1.007, 95% CI. 1.002, 1.011 vs. HR = 1.007, 95% CI. 1.000, 1.014). The model also yielded a lower -2 log likelihood compared to Model 2 (907.771 vs. 910.679), indicating a better fit to the data.³

³ These models have identical degrees of freedom, so testing whether the model fit is improved by using DAS-S/C is not possible using a standard likelihood ratio test. However, the improvements in Wald scores and -2 log likelihood indicate a better fitting model with the modified DAS score.

4. Discussion

Due to inconsistent findings and varying methods to identify whether and how dysfunctional attitudes predict MDD, the current study aimed to investigate two different methods from previous research on this topic. Results of the current study confirmed both approaches. Both a standard index of dysfunctional attitudes *and* an index reflecting relatively more *style* than *content* positive extreme responses during remission predicted depressive relapse within 24 months in a group of remitted recurrently depressed patients. In line with the findings of Forand and colleagues (2014; 2016), this may indicate that people who had a more habitual than thoughtful response style on the extreme positive ends of the Dysfunctional Attitudes Scale, had an increased risk of depressive relapse. In contrast, extreme positive responding based on *content* items of the DAS may afford a protective or prophylactic benefit against depressive relapse.

Several aspects of these findings are notable. First, the original scoring of the DAS, on which a higher score has, in previous research, indicated higher risk of depressive relapse (e.g. Cristea et al., 2015), was found to predict time to depressive relapse in the present sample. Second, our findings suggest that items on the DAS can be reliably distinguished as content or style items across the English and Dutch versions of the DAS. Third, the distinction between style and content items on the DAS appears to be a meaningful one, in that it, too, predicts relapse, even though the items it is based on all contribute to lower, ostensibly healthier scores.

As previous research points out, dysfunctional attitudes are not only traits, but are also state-dependent and influenced by depressive symptoms (Adler et al., 2015; Beck and Bredemeier, 2016; Lorenzo-Luaces et al., 2015; Teasdale et al., 2001; van Rijsbergen et al., 2013). The current study included a relatively homogeneous group of remitted recurrently depressed patients with low levels of residual depressive symptoms (roughly half taking antidepressant medication), but with overall higher levels of dysfunctional attitudes. Mobile CT (relative to TAU), levels of residual depressive symptoms, and number of previous depressive disorders all significantly predicted depressive relapse or recurrence within two years after study entry. In this sample, irrespective of whether treatment was with mCT or TAU, we observed a lower proportion of extreme responses, relative to rates obtained in past research (Forand and DeRubeis, 2014; Forand et al., 2016). The number of extreme responses of all types decreased from baseline to post-treatment, and then increased up to 24-months post-randomization. This may be related to the fact that the current study focused on remitted recurrently depressed patients, who by definition were not acutely depressed. The inconsistent results reported in previous studies may be the result of the amount of (residual) depressive symptomatology a person experienced at that moment of measuring the DAS and the related extreme responses, or due to how extreme responding was calculated.

Despite the timing in terms of level of symptomatology, yet consistent with previous literature (e.g. Cristea et al., 2015), more dysfunctional beliefs as measured on the DAS at baseline resulted in a higher risk of depressive relapse after recovery or remission. The predictive value of the pretreatment DAS was, however, diminished when controlling for content extreme positive responses. Having more style positive extreme responses on the other hand did not influence the relationship between DAS and risk of MDD relapse or recurrence. This finding supports the validity of the method used to distinguish content and style responses. Content responses are presumed to indicate a healthy denial of dysfunctional attitudes. Therefore, covarying the number of “healthy” extreme positive responses was predicted to reduce the ability of the DAS to predict relapse, because the DAS scores in this model would provide less information about those with a lower risk. The implication of our findings is that total scores on the DAS contain discernible information that goes beyond respondents’ levels of dysfunctional thinking.

We introduced and presented an exploratory test of a pragmatic method for rescoring an individual's DAS score to account for the influence of style and content responses. This index, which takes account of the endorsement of healthy attitudes as well as habitual positive responding, may be more useful as a means of determining a patient's resilience following cognitive therapy. Close attention could be paid when a remitted patient responds more often on the extreme positive ends of items identified as *style* items. Replying with total disagreement to statements such as '*I should be upset if I make a mistake*' or total agreement with '*It is possible for a person to be scolded and not get upset*' represent an additional risk factor for relapse/recurrence of depression. On the other hand, the exact mechanism of why extreme responding and depressive relapse/recurrence are related remains unclear (Forand et al., 2016). A hypothesized explanation -originated from other fields of research- is that the extreme responding style rather than content-wise response indicates that the person also shows this kind of behavior in daily life, and therefore imposes a risk for dysfunctional behaviors and depressive relapse/recurrence (e.g. Naemi et al., 2009; Stange et al., 2017).

Results from the current and previous studies (Forand and DeRubeis, 2014; Forand et al., 2016) are not consistent with the theory that depressed individuals react in extreme styles due to a dichotomous, automatic, thinking style that is active specifically during depressive episodes (Teasdale et al., 2001). Instead, the extreme responding seems to reflect an avoidant coping style, or intolerance of ambiguity (e.g. Naemi et al., 2009). Results of the current study support the argument of Forand and colleagues (2014; 2016) that depressed individuals might provide style positive extreme responses as a means of avoiding the content of the questions, which might be painful to contemplate. The ratio of style versus content positive extreme responses would hence represent the tendency to avoid the content of the dysfunctional attitudes.

Lastly, in the current study we tested if the strategy of calculating positive extreme variables was also applicable to a Dutch sample, given that cultural and language differences may affect the assessment or meaning of extreme responses. Despite different questions in the Dutch DAS and different coding system for content and style items, the results were a partial replication to the results found in the United States (Forand et al., 2016; Forand and DeRubeis, 2014). Although the current results are only partly in accordance with previous results from Dutch trials (de Graaf et al., 2010; van Rijsbergen et al., 2013), this may be due to different methods to define and identify extreme responses.

5. Limitations

In interpreting the results, some limitations should be noted. As in previous research, the current study employed a single measure to identify extreme responses and dysfunctional attitudes. The Dutch dysfunctional attitudes scale is different with regard to some items, yet still confirms the importance of extreme responding. Secondly, various statistical analyses were performed without correcting for multiple testing, which in turn increased the likelihood to finding significant results (Type-I error). However, the exact same procedure was followed as in previous studies, with equivalent results.

6. Conclusion

To conclude, results of the current study not only indicate that the level of dysfunctional attitudes during remission or recovery are predictive of relapse, but also indicate that relative positive extreme responses on style versus content are predictive of relapse. Future research should therefore focus on processes of change in relation to dysfunctional attitudes, positive extreme responses, and depressive symptoms. In clinical practice, positive extreme responding could be measured using the proposed pragmatic calculations to help identify those most at risk of relapse or recurrence, rather than the DAS total score.

Author statement

All authors have seen and approved the final article.

Contributors

CLB designed the initial study and study protocol, NF and RD initially designed the statistical plan, MEB, NF, RD undertook the statistical analyses, MEB and ADW wrote the initial draft of the manuscript, and all authors critically revised the article and approved the current version. All authors have approved the final manuscript.

Declarations of interest

None.

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Appendix I

Models and hypotheses

The series of models and hypotheses are as follows. Model 1 is the main (baseline) model. Model 2 tests the standard DAS score in order to test the hypothesis that the score on the DAS predicts depressive relapse/recurrence. Model 3 tests the DAS score in conjunction with Style-PER (higher score indicating high levels of style responses). Controlling for this variable will improve the ability of the DAS to predict relapse/recurrence, given that Style-PER is intended to reflect unhealthy responding to the DAS, but given that they are positive, they contribute to lower (ostensibly more functional) DAS scores. In Model 4 the DAS score is tested in conjunction with Content-PER (higher score indicating high levels of content responses). It was hypothesized that the inclusion of this variable in the model will reduce the significance of the DAS total score in predicting relapse/recurrence since Content-PER, like the overall DAS score, is intended to reflect healthy responding to the DAS. In Model 5 we test the PER-T (the shared variance of the style and content items) and S/C PER (the unshared variance). The hypothesis was that higher S/C PER scores, indicating greater relative style versus content responses, will predict an increased rate of relapse/recurrence.

Post-hoc testing procedure

The post-hoc procedure consisted of the following steps: Subtract the total number of content-PERs and from the total number of style-PERs, such that high positive scores represent a preponderance of style-PER, relative to content-PER, and high negative scores reflect a preponderance of content-PER relative to style-PER. Multiply this number by 10, and add it to the original DAS score. Insofar as content responses are "good" and style responses are "bad," this method will tend to increase (worsen) the DAS score for those with a preponderance of style

responses and decrease (improve) the DAS score for those with a preponderance of content scores. It will have little or no effect on the scores of patients who either gave no PER responses, or who gave a similar number of content and style PERs. In this way, the influences of the two types of positive extreme responding are combined with the standard DAS score. The DAS-S/C variable was added in a separate Cox regression model together with baseline Model 1.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jad.2018.09.002.

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