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The role of psychological flexibility in a self-help acceptance and commitment therapy intervention for psychological distress in a randomized controlled trial

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ABSTRACT

This study examined the role of psychological flexibility, as a risk factor and as a process of change, in a self-help Acceptance and Commitment Therapy (ACT) intervention for adults with mild to moderate depression and anxiety. Participants were randomized to the self-help programme with e-mail support ($n = 250$), or to a waiting list control group ($n = 126$). All participants completed measures before and after the intervention to assess depression, anxiety and psychological flexibility. Participants in the experimental condition also completed these measures during the intervention (after three and six weeks) and at a three-month follow-up. With multilevel modelling, it was shown that the effects of the intervention on psychological distress were stronger for participants with higher levels of psychological flexibility. Furthermore, our study showed that improved psychological flexibility mediated the effects of the ACT intervention. With a cross-lagged panel design, it was shown that especially improvements in psychological flexibility in the last three sessions of the intervention were important for further reductions in anxiety. To conclude, our study showed the importance of targeting psychological flexibility during an ACT intervention for a reduction in depressive and anxiety symptoms.

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Introduction

There is growing empirical support for Acceptance and Commitment Therapy (ACT) for the treatment of a variety of mental illnesses (Powers, Zum Vörde Sive Vörding, & Emmelkamp, 2009). ACT is a behaviour therapy that is mainly focused on increasing psychological flexibility. Psychological flexibility is a competence that includes two mutually dependent processes: acceptance of

experiences and value-based behaviour (Hayes, Luoma, Bond, Masuda, & Lillis, 2006). A psychologically flexible person is willing to remain in contact with unwanted private experiences, rather than trying to avoid, alter or control them. When this struggle and attempt to control or avoid these unwanted private experiences is relinquished, an individual can shift his/her energy to long-term desired qualities or values in life, even in the presence of unwanted private events. A person can then be in contact with present experiences and choose or persist in behaviour that is in line with important values and goals (Ciarrochi, Billich, & Godsell, 2010; Hayes et al., 2006). Several studies have shown that an ACT treatment can improve psychological flexibility and reduce mental illnesses, such as depression (e.g., Bohlmeijer, Fledderus, Rokx, & Pieterse, 2011; Forman, Herbert, Moitra, Yeomans, & Geller, 2007), social anxiety (e.g., Dalrymple & Herbert, 2007) and stress (e.g., Brinkborg, Michanek, Hesser, & Berglund, 2011).

Recently there is a growing interest in which role psychological flexibility plays in relation to psychological distress. At this moment

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there are two hypotheses about this role in the current literature (Ciarrochi et al., 2010). The first hypothesis is that psychological inflexibility is a precursor or a risk factor for a wide variety of mental illnesses (Biglan, Hayes, & Pistorello, 2008; Ciarrochi et al., 2010). Although many cross-sectional studies confirm that psychological inflexibility is related to diverse psychopathology (see for reviews Chawla & Ostafin, 2007; Hayes et al., 2006) only a few studies have examined whether higher levels of psychological flexibility lead to long-term beneficial effects for mental health (e.g., Bond et al., 2011; Plumb, Orsillo, & Luterek, 2004; Shallcross, Troy, Boland, & Mauss, 2010). For example, Bond et al. (2011) showed that higher levels of psychological flexibility predicted less psychological distress and less occasions of full-day work absence one year later in a sample of employees of a retail bank ($n = 583$). In an experimental study with a female community sample, it was shown that only lower levels of psychological flexibility predicted depressive symptoms in the face of elevated life stress four months later (Shallcross, Troy, Boland, & Mauss, 2010). In contrast, individuals with higher levels of psychological flexibility did not exhibit higher levels of depressive symptoms (Shallcross et al., 2010).

The second hypothesis is that psychological flexibility is an important process of change during an ACT treatment for improved mental health (Hayes et al., 2006). Various studies provided evidence for a relationship between changes over time in psychological flexibility on changes over time in the observed outcomes in ACT or acceptance-based treatments for social anxiety (Dalrymple & Herbert, 2007; Kocovski, Fleming, & Rector, 2009), generalized anxiety (Hayes, Orsillo, & Roemer, 2010), borderline personality disorder (Gratz & Gunderson, 2006) and depression (Fledderus, Bohlmeijer, Smit, & Westerhof, 2010; Forman et al., 2007; Lappalainen et al., 2007) on the observed outcomes. A few of these studies provided preliminary evidence that changes in the observed outcomes were preceded by changes in psychological flexibility. In the study of Hayes et al. (2010), it was found in a sample of 43 patients that during an acceptance-based behaviour treatment for generalized anxiety, changes in acceptance and value-based actions during treatment predicted changes in anxiety after the treatment. Two other studies with samples of 42 and 19 patients showed that during an ACT treatment for social anxiety, changes in social anxiety symptoms from mid- to post-treatment were preceded by changes in psychological flexibility from baseline to mid-treatment, even after controlling for earlier changes in social anxiety from baseline to mid-treatment (Dalrymple & Herbert, 2007; Kocovski et al., 2009).

In sum, these studies provide preliminary evidence for these two hypotheses, namely that psychological flexibility might be a protective factor for mental health and a process of change during an ACT-treatment. However, the hypothesis of that psychological inflexibility is a risk factor which is only examined with cross-sectional data or with one time-point later in time. Furthermore, the role of psychological flexibility as a process of change during an ACT treatment is examined in small samples and with not many time measurements during and after the treatment. By adding more measurements during and after the intervention and using a larger sample it will be possible to study more precisely how psychological flexibility and psychological symptoms are related during an intervention and which phase is the most important in predicting these symptoms.

Therefore, in the current study we examined the role of psychological flexibility, as a risk factor and as a process of change, during and after a guided self-help ACT intervention on the effects of the levels of anxiety and depression in a large sample with multiple measurements. This intervention was offered to adults with mild to moderate psychological distress ($n = 250$) and evaluated in

a randomized controlled trial with a waiting list control group ($n = 126$). All the participants (both the experimental and waiting list control group) filled in questionnaires at baseline and at post-intervention that assessed depression, anxiety and psychological flexibility. The participants who received the self-help ACT intervention also assessed these measures two times during the intervention and at a three-month follow-up. The effects are described in an earlier study (Fledderus, Bohlmeijer, Pieterse, & Schreurs, 2012). In short, compared with a waiting list, high effect sizes were found after the intervention on depression (Cohen's $d = 0.89$), anxiety (Cohen's $d = 0.86$) and psychological flexibility (Cohen's $d = 0.70$).

In the current study, we first looked more in depth to the relationship between psychological flexibility and psychological distress (anxiety and depression) over time by using multilevel analysis. For this analysis, we included all the data from the five measurements points from the participants that received the self-help intervention. With all these measurement points over time, we modelled the effect of psychological flexibility on psychological distress over time and an interaction effect between psychological flexibility and time on psychological distress. Based on earlier research (Bond et al., 2011; Shallcross et al., 2010), we expected that psychological flexibility has a relationship with psychological distress over time and that higher levels of psychological flexibility over time will influence positively the magnitude of the effect of the intervention on psychological distress.

Furthermore, we examined whether psychological flexibility is a process of change in the intervention. Therefore, we first examined whether the effects on depression and anxiety after the intervention were mediated by improvements of psychological flexibility during the intervention. Therefore, we performed mediational analyses according to the procedures outlined by Preacher and Hayes (2008) by using the baseline and post-intervention measurements of the intervention and waiting list group. Second, we examined if changes of psychological flexibility occurred during (at the begin, middle or end) the intervention and whether these changes predicted later outcomes of depression and anxiety using a cross-lagged panel design. With this design, we checked whether changes in psychological flexibility lead to a decline in clinical symptoms, rather than vice versa, which is an important condition for establishing mediation (Kazdin, 2007). Based on earlier research (e.g., Fledderus et al., 2010; Forman et al., 2007; Lappalainen et al., 2007), it is expected that psychological flexibility would mediate the effects of the intervention and that changes during the intervention on psychological flexibility would associate with later reductions in psychological distress, and not vice versa.

To conclude, in this study, we conducted in-depth analyses of the role of psychological flexibility and its relation with and effects on the levels of depression and anxiety in ACT intervention for adults with mild to moderate depression and anxiety.

Method

Participants

The data from this study are derived from a randomized controlled trial on the effects of a guided self-help ACT intervention on depression and anxiety and positive mental health (see Fledderus et al., 2012). In September 2009, participants were recruited through advertisements in Dutch newspapers. Inclusion criteria were an age of 18 years or older and mild to moderate depressive symptoms [>10 and <39 on the Center of Epidemiological Studies – depression scale (CES-D); Radloff, 1977] and anxiety symptoms [>3 and <15 on the Hospital Anxiety and Depression Scale-anxiety subscale (HADS-A); Zigmond & Snaith, 1983]. People with severe depressive symptomatology and/or anxiety (more than 1 standard deviation above the

population mean on the CES-D (cut-off score ≥ 39 ; Bouma, Ranchor, Sanderman, & van Sonderen, 1995) and/or HADS-A (cut-off score ≥ 15 ; Olsson, Mykletun, & Dahl, 2005) were excluded, because severe distress would require more intensive individual diagnostics and treatment. For the remaining participants it was checked who were still responding positively to a screener for a depressive disorder [Web Screening Questionnaire (WSQ; Donker, van Straten, Marks, & Cuijpers, 2009) Q1 = 6 and Q2 = 1]. As the WSQ yields a high number of false positives (Donker et al., 2009), those who were screened as having a depressive disorder underwent a telephone interview that employed the depressive episode module of the Mini International Neuropsychiatric Interview (MINI; Sheehan et al., 1998). People whom the MINI diagnosed as having a severe depressive episode were excluded. Other exclusion criteria were: (a) few depressive symptoms (≤ 10 on the CES-D) and/or anxiety (≤ 3 on the HADS-A); (b) receiving psychological or psychopharmacological treatment within the last 3 months; and (c) high suicide risk (Q15 = 3 on the WSQ).

Procedure

A total of 625 people responded to the advertisements and received an information sheet explaining the study and an informed consent form. This was signed by 507 people who then received a screening questionnaire comprising the CES-D, HADS-A and WSQ. First, 54 respondents were excluded because they had severe depression and/or anxiety according to their scores on CES-D and HADS-A. They were advised to contact their general practitioner. Second, 44 respondents were diagnosed by the WSQ as having a depressive disorder and subsequently underwent a telephone interview using the MINI. These interviews were conducted by Masters students of psychology who were being trained and supervised by a clinical psychologist. Of the 43 respondents (one respondent could not be contacted), two were diagnosed with a severe depressive episode and were excluded and advised to contact their general practitioner. A further 75 respondents were excluded, because they had few depression and/or anxiety symptoms ($n = 58$), did not complete the screening questionnaire ($n = 15$), could not be contacted for the interview ($n = 1$) or currently received psychological treatment ($n = 1$). Hence a total of 376 participants were randomly assigned to the following three conditions: the ACT intervention with minimal email support (ACT-M; $n = 125$), the same intervention with extensive email support (ACT-E; $n = 125$) or to a waiting list (W-L; $n = 126$). The waiting list group received the intervention after the waiting list period of 9 weeks. The effects of the two experimental conditions on depression, anxiety and psychological flexibility were similar. Therefore, in this study the two experimental conditions were analysed together as one group with all participants receiving the guided self-help ACT intervention ($n = 250$). This joint analysis has been checked on any moderating effects of the email support condition.⁵

Table 1 shows an overview of the participants' characteristics. Their mean age was 42 years (range 18–73 years). The majority was female (70%) and of Dutch origin (93%). Most of the participants had a high level of education (86%), a paid job (76%) and were not married (47%) (Table 2).

Table 1
Characteristics of participants.

Characteristic (in %)	ACT ($n = 250$)	Waiting list ($n = 126$)
Gender		
Female	69.6	69.8
Male	30.4	30.2
Age (M, SD)	42.50 (11.00)	42.47 (11.29)
Marital status		
Married	43.0	45.2
Divorced	8.8	7.9
Widowed	1.6	0
Unmarried	46.5	46.9
Race		
Dutch	93.2	92.1
Other	6.8	7.9
Education		
High	85.2	88.9
Middle	12.8	13.3
Low	2.0	0.8
Daily activities		
Paid job	74.3	79.4
No job	25.7	20.6

Note. ACT = Acceptance and Commitment Therapy.

Measures

All participants ($n = 376$) completed measures on two occasions: at baseline (T0; pre-intervention) and at post-intervention at 9 weeks (T3; directly after the intervention). The experimental condition ($n = 250$) also completed measures at early-intervention (T1; three weeks after baseline), mid-intervention (T2; 6 weeks after baseline) and at the three-month follow-up (T3; 5 months after baseline). All questionnaires were administered online. Fig. 1 provides information about how much data was available at each time measurement.

Center of epidemiological studies-depression scale (CES-D)

The CES-D (Radloff, 1977) is a 20-item questionnaire that measures depressive symptoms in the general population. Respondents rate on a 4-point scale ranging from hardly ever (less than 1 day) (0) to predominantly (5–7 days) (3) to what extent they had experienced depressive symptoms in the previous week. Summation of the scores results in a total score ranging from 0 to 60. The Dutch translation showed good psychometric properties in a group of elderly people (Haringsma, Engels, Beekman, & Spinhoven, 2004). The scale showed high internal consistency in this study ($\alpha = 0.78, T0$).

Hospital anxiety and depression scale-anxiety subscale (HADS-A)

The HADS-A (Zigmond & Snaith, 1983) is a 7-item questionnaire that assesses the presence and severity of anxious symptoms. Respondents rate on a 4-point scale ranging from not at all (0) to often (3) to what extent they had experienced anxiety symptoms in the previous week. The total HADS-A scores range from 0 to 21. The Dutch translation showed good psychometric properties (Spinhoven et al., 1997). The scale showed low internal consistency in this study at T0 ($\alpha = 0.56$). However, the internal consistency at the other measurements at T1–T3 were satisfactory with alphas between 0.72 and 0.81.

Acceptance and action questionnaire-II (AAQ-II)

The AAQ-II (Bond et al., 2011) is a 10-item measure of psychological flexibility. The AAQ-II assesses on a 7-point scale ranging

⁵ To evaluate possible moderating effects of the email support condition (minimal email support and extensive email support), for each condition-specific data set, a separate hierarchical linear modelling analysis was performed. The results were similar to the joint analysis results. For depression and anxiety, we performed joint analyses where the email support condition acted as a moderator. In none of the models the email support condition led to a statistically significant effect, either as a single effect or as an interaction effect.

Table 2
Means and standard deviations of depression (CES-D), anxiety (HADS-A), and psychological flexibility (AAQ-II).

Outcome	Group	Pre (T0)		Early (T1)		Mid (T2)		Post (T3)		Follow-up (T4)	
		M	SD	M	SD	M	SD	M	SD	M	SD
CES-D	ACT	22.79	6.57	17.71	7.77	15.64	8.30	13.33	7.28	13.71	8.20
	WL	22.45	6.68					19.76	8.48		
HADS-A	ACT	9.52	2.58	7.80	3.02	6.85	3.17	6.12	2.96	5.91	3.12
	WL	9.33	2.34					8.69	3.19		
AAQ-II	ACT	40.71	8.47	44.04	8.84	48.88	8.95	49.29	9.08	50.87	9.72
	WL	40.86	8.83					43.00	10.27		

Note. ACT = Acceptance and Commitment Therapy, WL = waiting list control group, CES-D = Center for Epidemiologic Studies-Depression Scale, HADS-A = Hospital Anxiety and Depression Scale-Anxiety subscale, AAQ-II = Acceptance and Action Questionnaire-II.

from never true (1) to always true (7) the subject's willingness to be in contact with negative private events, the acceptance of these events, and whether they can live according to their values. Summation of the scores results in a total score ranging from 10 to 70, whereby a higher score indicates more psychological flexibility. The Dutch AAQ-II showed good psychometric properties (Fledderus, Oude Voshaar, ten Klooster, & Bohlmeijer, 2012; Jacobs, Kleen, de Groot, & A-Tjak, 2008) and good internal consistency in the current study ($\alpha = 0.85$, T0)

Intervention and email support

Participants of the experimental conditions received the self-help book 'Living to the full' (Bohlmeijer & Hulsbergen, 2008) by regular mail. The book comprises 9 modules, divided into three parts. The participants were instructed to complete one module per week. The modules are based on six core processes of ACT that together promote psychological flexibility: acceptance (active and aware embracement of aversive internal experiences), cognitive

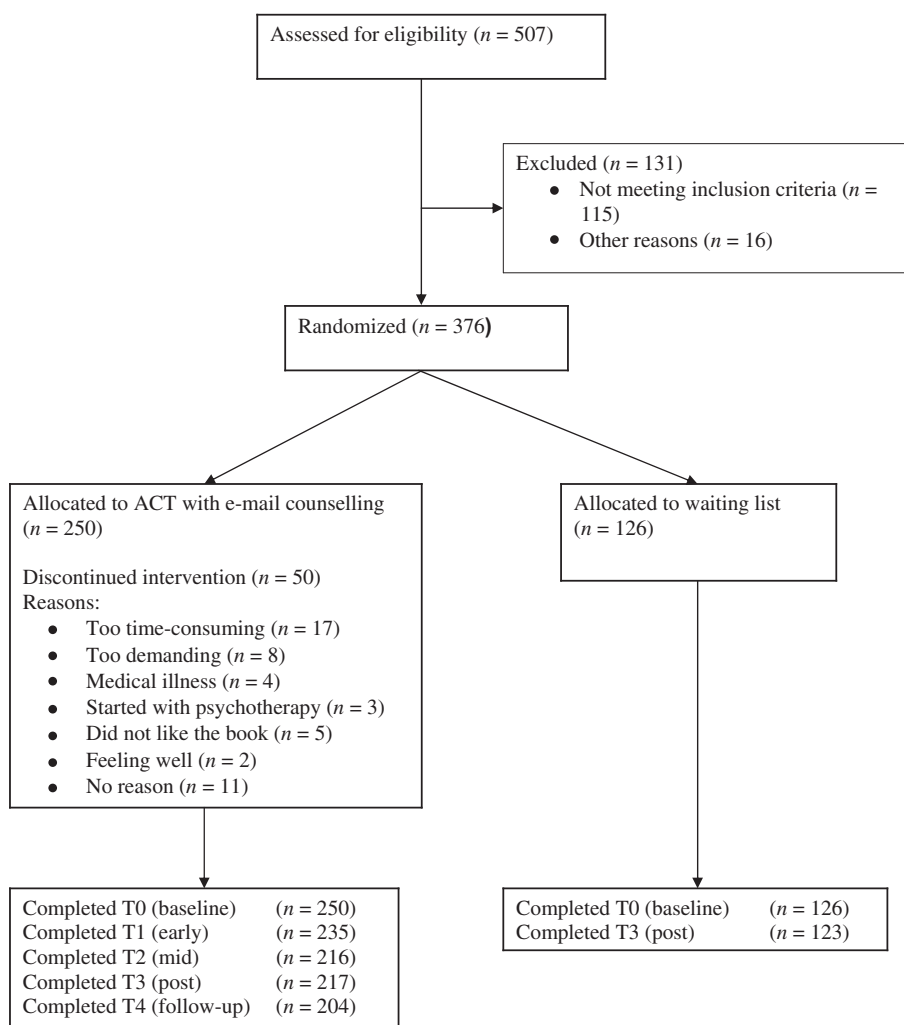


Fig. 1. Participant flow.

defusion (creating a context in which undesirable functions of thoughts disappear), contact with the present moment, self as context (experiencing that one is more than one's thoughts, feelings and experiences), choosing values in different life domains, and commitment to choices on the basis of these values (Hayes et al., 2006).

The first and second parts of the book are based on acceptance and mindfulness processes. In the first part, participants reflect on their avoidance and control strategies and whether these are effective in the long run. In the second part, participants learn how to come into contact with their present experiences without trying to avoid or control them. Cognitive defusion and experiencing self as context are practised. This last part of the book is based on commitment and behaviour processes, with the focus on becoming aware of the most important personal values on various life domains and making decisions based on these values. Each module uses experiential exercises and metaphors for illustrating the processes of ACT. Furthermore, the participants were asked to do daily mindfulness exercises, based on mindfulness-based stress reduction (Kabat-Zinn, 1990, 1994). The mindfulness exercises lasted on average 10–15 min and were on an audio-CD which was provided with the book.

The intervention was supported with email counselling provided by five psychology Master students of the University of Twente who were supervised by a clinical psychologist. The participants received a standardized email from the counsellors every week on the same day concerning the module that they had carried out in the previous week. Participants were expected to respond within two days, after which they received a feedback email from the counsellor. Participants assigned to the waiting list received the self-help book by regular mail after the post-intervention assessment. Email counselling was not provided.

Statistical analyses

First, the relationship between changes in psychological flexibility and changes in depression and anxiety over time were examined using the hierarchical linear modelling framework. Multilevel analysis has the advantage that it can handle missing data. For this analysis the data from the experimental group with the five measurements points (baseline, after 3 and 6 weeks, post-intervention and follow-up) were used. It is expected that measurements over time from the same participants are more alike than measurements from different participants. The repeated measurements are nested within participants, which supports the use of multilevel models. The multilevel modelling approach makes it possible to treat the participant as a random factor and the repeated measurements are assumed to be independently distributed given the level of the random factor or random effect. This way, within-subject variation over time and between-subject variation in depression and anxiety can be modelled. The time-specific repeated measurements of psychological flexibility can be related to depression and anxiety at the (lower) observation level (level 1) of the model, controlling for the within-subject dependency over time through a random subject effect. The between-subject differences are modelled at a higher level (level 2), where between-subject variances and time-invariant participant characteristics can be defined. In longitudinal data and repeated measurements studies, the lower-level unexplained residuals are often still correlated given the random subject effect. The estimated effects of psychological flexibility on depression and anxiety can be biased when the level-1 residuals are not properly modelled. Therefore, the multilevel analyses of repeated measurements of depression and anxiety on psychological flexibility require careful specification of the covariance structure of the unexplained level-1 residuals.

In PASW 18, the mixed models routine was used to fit various (linear) multilevel models with continuous repeated measures for depression and anxiety. In a first multilevel analysis, the variance components at the level of observations and the level of participants were estimated for each outcome variable. The time in weeks was used as an explanatory variable such that a linear growth model for the outcome measure was defined at level 1. Furthermore, different covariance structures at level 1 were evaluated to capture the correlation structure given the linear trend including a random subject effect.

In a second multilevel analysis, the effect of psychological flexibility on depression and anxiety was estimated given the linear trend through the time variable and the random intercept across subjects. Psychological flexibility was incorporated as a time-dependent measure such that the relationship with depression and anxiety was analysed over time.

Furthermore, the interaction effect of time with psychological flexibility was incorporated to test whether the effect of psychological flexibility on depression and anxiety varied across time. In a subsequent analysis the effect of psychological flexibility and the interaction effect with time were modelled as random to test whether their effects varied across participants. Therefore, the subject-specific effects of psychological flexibility on depression and anxiety were estimated and it was tested whether the corresponding between-subject variance was significantly different from zero. Furthermore, the between-subject variance of the random interaction effect was tested to be significantly different from zero. Restricted maximum likelihood estimates were computed and Student's *t*-test was used to test the significance of fixed effects parameters. The Wald test was used to test the significance of variance components.

Second, the mediational analyses and the cross-lagged regressions were done using PASW 18 and using intention-to-treat analyses. Therefore, all missing data on the measurements (from T0 to T3) were imputed with the use of SPSS Missing Value Analysis with the expectation-maximization method. This method computes missing values based on maximum likelihood estimates using observed data in an iterative process (Dempster, Laird, & Rubin, 1977). The total percentage of missing data was 9.36% due to unanswered items (.64%) or incomplete assessments (8.72%). A comparison of results based on the imputed intention-to-treat sample versus the observed data revealed similar outcomes. Therefore, only the results from the intention-to-treat analyses are reported. We examined psychological flexibility as a mediator of the treatment effect. The outcome was psychological distress at post-intervention. The predictor variable of the mediation model was a dummy coded variable representing treatment condition (1 = experimental condition, 0 = control), and the mediator consisted of a change score computed by subtracting the post-intervention score of psychological flexibility (T3) from the pre-intervention score of psychological flexibility (T0). We tested the significance of mediation by examining the significance of the indirect path from the dummy coded treatment variable to the outcome through psychological flexibility with bootstrapping procedures ($n = 5000$ bootstrap resamples) using the SPSS macro designed by Preacher and Hayes (2004). An indirect effect was considered significant in the case zero was not contained in the 95% bias-corrected confidence interval.

To examine whether changes in psychological flexibility during treatment predicted changes in anxiety and depression after the intervention, cross-lagged regressions were performed (e.g. Burns, Kubitius, Bruehl, & Harden, 2003; Evon & Burns, 2004; Spinhoven, Dycx, Giesen-Bloo, Kooiman, & Arntz, 2007). Residual changes scores for three changes in time during treatment for all variables were calculated by regression: the early-intervention score on the pre-intervention score (T0–T1), the mid-intervention score on the

early-intervention score (T1–T2), post-intervention on the mid-intervention (T2–T3), and follow-up on the post-intervention scores (T3–T4). Cross-lagged correlations among these residual change scores were computed. When a correlation from the pre- to post-intervention changes in psychological flexibility (the scores between T0–T3) were statistically significant with post- to follow-up scores on the outcome variables, cross-lagged regressions were performed. In these regressions it is assessed whether early changes in psychological still predict later changes in the outcome variables after controlling for autocorrelation (i.e. the correlations between changes during treatment and late changes from post- to follow-up in psychological flexibility) and for synchronous correlation (i.e. the correlations between changes during treatment in psychological flexibility and the changes during treatment in the outcome variables). With regression analyses the inverse association was also examined.

Results

Relationship between psychological flexibility and depression over time

With the repeated measures for depression as the outcome variable, a multilevel model was estimated, where time was a fixed level-1 predictor and the intercept varied randomly across participants. A first-order antedependent covariance structure was chosen to model the level-1 residuals (Zimmerman & Núñez-Antón, 2009). This covariance structure consists of time-dependent heterogeneous variances and covariances between adjacent level-1 residuals. Each time-dependent covariance element is constructed from a time-dependent covariance parameter and time-dependent variances. Information criteria (REML and AIC) were used to fit the most appropriate covariance structure for the unexplained level-1 residuals.

In Table 3 (model 1), it can be seen that the average depression (CES-D) level at the baseline (T0) is around 21.09 for participants with a random subject effect of zero. The average effect of time is –0.38 and significantly different from zero, which means that in the population the depression level decreases about 0.38 points in one week. The variance of the random (subject) intercept is significant and around 12.01 such that there is much variation in depression levels between participants at the baseline. The estimates of the time-dependent variance parameters show that the residual variation increases till the mid-intervention from 34.78 to 72.86, and decreases after the mid-intervention from 72.86 to 60.57, conditional on the negative linear trend. The linear decreasing trend cannot explain all variation in the time-dependent depression levels and the residual variation is relatively high after the mid-intervention. The correlation between level-1 residuals, conditional on measurements from the same subject over time, also increases from 0.14 to 0.68 and then decreases to 0.48. This means that given the linear decreasing trend of depression the subsequent unexplained residuals within a participant become more correlated over time and reduce slightly at the three month follow-up. It can be concluded with the increasing residual variance that, besides the linear trend, there is an unexplained common individual pattern in depression levels. This pattern is characterized by an increasing within-subject variance and increasing correlated within-subject measurements.

In the second multilevel analysis, the linear trend was replaced by a curvilinear trend by including the squared time variable as a level-1 predictor. Furthermore, the time-dependent measurement for psychological flexibility (AAQ-II) and its interaction with time were included in the model. The average level of psychological flexibility equals zero due to the fact that the measurement was grand-mean centred. From Table 3 (model 2), it follows that the average level of depression equals 19.80 for the participants with an average level of psychological flexibility at the baseline. The decline

Table 3
Multilevel analysis with depression (CES-D), anxiety (HADS-A) and psychological flexibility (AAQ-II).

Parameter	Depression				Anxiety				
	Model 1		Model 2		Model 1		Model 2		
	Est.	SE	Est.	SE	Est.	SE	Est.	SE	
Fixed effects									
Intercept	21.09	0.39	19.80	0.43	8.57	0.17	8.67	0.18	
Time	–0.38	0.03	–0.99	0.10	–0.19	0.01	–0.35	0.04	
Time squared			0.04	0.004			0.01	0.002	
Psychological flexibility			–0.35	0.03			–0.13	0.01	
Psychological flexibility squared			0.005	0.002					
Time * Psychological flexibility			–0.02	0.02			–0.005	0.001	
Random effects									
Intercept (Subject)	12.01	4.45	7.04	2.05	4.48	0.53	2.58	0.39	
Residual variance									
Repeated measures									
Baseline = 1	34.79	5.73	30.19	3.59	5.56	0.68	4.25	0.51	
Time = 2	52.06	7.19	32.15	4.11	4.38	0.52	4.00	0.51	
Time = 3	72.87	9.04	35.64	4.66	4.72	0.61	3.59	0.49	
Time = 4	69.11	9.00	23.59	3.38	4.81	0.62	2.84	0.42	
Time = 5	60.57	7.63	21.63	3.14	7.61	0.99	4.25	0.54	
First-order AD 1	0.14	0.11	0.06	0.09			0.13	0.06	
First-order AD 2	0.48	0.07	0.26	0.09					
First-order AD 3	0.68	0.05	0.40	0.09					
First-order AD 4	0.48	0.08	0.33	0.09					
Information criteria									
–2LogLikelihood (REML)	7133.24		6689.16		5234.85		4862.95		
AIC	7153.24		6711.62		5246.85		4878.95		

Note. CES-D = Center for Epidemiologic Studies Depression Scale; HADS-A = Hospital Anxiety and Depression Scale-Anxiety subscale; AAQ-II = Acceptance and Action Questionnaire-II.

in depression is about 0.99 points per week conditional on the acceptance level but the significant positive quadratic time component leads to a decelerating negative trend of depression over time. This means that the individual depression changes negatively and almost linearly after the baseline but decelerates after a few weeks. The decreasing trend in depression flattens out and the depression level of participants with an average psychological flexibility level over time will increase after 12.4 weeks. The effect of psychological flexibility is negative and around -0.35 but its squared term is significantly positive and around 0.04 . This means that effect of psychological flexibility on depression also follows a decelerating trend, where the negative slope flattens out due to the quadratic component. The average linear effect of psychological flexibility is around -0.35 but the effect of psychological flexibility on depression varies across participants, where the between-subject variance is 0.023 and significantly different from zero. Besides the decelerating negative relationship over time of psychological flexibility on depression, a significant negative interaction effect of psychological flexibility with time was estimated. This time-specific interaction effect is around -0.018 and indicates that the subjects with above average psychological flexibility levels will have depression levels below the established decelerating negative relationship.

The estimates of the first-order antedependent parameters show that conditional on the mean structure including a random intercept and a random slope effect for psychological flexibility the residual variation is more constant over time. This means that the decelerating negative trend and the decelerating negative relationship between psychological flexibility and depression explain most of the changes in depression across time. Note that the unexplained variance in the depression at the baseline is for both multilevel models almost the same. It can also be seen that the unexplained correlation between time-dependent residuals is much lower. The correlation between the within-subject depression measurements is much better explained due to the psychological flexibility and time variables. Furthermore, the information criteria supported the conclusions about the model improvement.

Relationship between psychological flexibility and anxiety over time

A multilevel model was estimated using the repeated measures for anxiety (HADS-A) as an outcome variable and time as a fixed level-1 predictor. The intercept varied randomly across participants to allow between-subject variation in anxiety. The average anxiety level at the baseline (T0) is around 8.57 for subjects with a random subject effect of zero. The average effect of time is -0.18 , which means that in the population the anxiety level decreases about 0.18 points in one week. The participants' average anxiety levels differ, since the between-subject variance in anxiety levels is around 4.48. The fitted residual covariance matrix consisted of time-specific variances. The residual variance estimates at the baseline and at the three-month follow-up are higher than the between-subject variation. At these points in time there is more variation in anxiety between individuals than expected from the between-subject differences. There was no significant correlation between measurements from the same participant given the negative linear trend.

In a second multilevel analysis, the linear trend of time was extended with the squared time variable to define a curvilinear trend over time of anxiety. The time-dependent measurement for psychological flexibility (grand-mean centred) was included and its interaction effect with time to explore their effects on anxiety. It follows from Table 3 that the negative linear trend of -0.35 is decelerated by a positive effect of the squared time variable. For participants with a random effect of zero and an average

psychological flexibility level, after more than 25 weeks the anxiety level will be above the baseline level.

Psychological flexibility has a significant negative effect on anxiety but this effect varies slightly across participants. The between-subject variation in psychological flexibility is around 0.004. There is a significant interaction effect of psychological flexibility with time. A high psychological flexibility level at the end of the study leads to a lower anxiety level than at the beginning of the study. Therefore, it can be concluded that the relationship between psychological flexibility and anxiety can be characterized by an accelerating negative slope.

The between-subject variation, given the curvilinear trend of time and the psychological flexibility level, decreased from 4.48 to 2.58. Although the unexplained residual variation is smaller, there is still above-average residual variation at the baseline and at the three-month follow-up. Furthermore, a common significant within-subject auto-regressive correlation was found over time. It can be seen that the within-subject residuals are positively correlated.

Mediation of psychological flexibility during the intervention

The results of the mediational analysis are presented in Table 4. The first step of the regression analyses showed that the ACT intervention significantly predicted the change scores of depression and anxiety. In the second step, the change scores of psychological flexibility were also entered in the regression analyses. This step showed that the change scores of psychological flexibility significantly reduced depression and anxiety. Moreover, the intervention effect is reduced by 32% for both depression and anxiety. The bias-corrected bootstrapping values were between -2.93 and -1.46 for depression and -1.17 and -0.56 for anxiety, indicating a mediating effect of psychological flexibility.

Cross-lagged correlations between psychological flexibility, depression and anxiety

Pearson's correlations were calculated between all the residual change scores (T0–T1, T1–T2, T2–T3, T3–T4) of psychological flexibility, depression and anxiety. Synchronous correlations showed that the changes in psychological flexibility during and after the intervention were significantly related to the changes in depression and anxiety during and after the intervention. Autocorrelations showed that pre-early and mid-post psychological flexibility were significantly related to post-follow-up psychological flexibility. Furthermore, pre-early depression was significantly associated with post-follow-up depression and mid-post anxiety was significantly related to post-follow-up anxiety. Cross-lagged correlations showed that mid-post psychological flexibility was significantly correlated with post-follow-up depression, whereas

Table 4
Regression analysis of depression (CES-D) and anxiety (HADS-A) at follow-up on intervention and improvement of psychological flexibility (AAQ-II) between baseline and post-treatment.

	Step 1	Step 2	Adjusted R ²
	Beta	Beta	
Depression			
ACT intervention (comp: control group)	-0.37^{***}	-0.25^{***}	0.13
Improvement in psychological flexibility		-0.34^{***}	0.23 ^{***a}
Anxiety			
ACT intervention (comp: control group)	-0.37^{***}	-0.25^{***}	0.14
Improvement in psychological flexibility		-0.34^{***}	0.37 ^{***a}

Note. a = significant improvement in R² change ($p < 0.05$); $***p < 0.001$.

mid-post depression was not significantly related to post-follow-up psychological flexibility. Furthermore, mid-post psychological flexibility was significantly correlated with post-follow-up anxiety, and the converse correlation was also significant. Pre-early depression was significantly associated with post-follow-up psychological flexibility. The converse correlation was not significant.

Testing cross-lagged correlations with multiple regressions

With the significant cross-lagged correlations, multiple regressions were performed to check whether psychological flexibility remained a predictor for the outcome variables when controlling for autocorrelations and synchronous correlations. To illustrate, in the first step with post-follow-up depression as dependent variable, mid-post depression and post-follow-up psychological flexibility were entered in the regression analyses. In step two, mid-post psychological flexibility was added. To test the converse cross-lagged correlation, mid-post psychological flexibility and post-follow-up depression were entered in the regression analyses with post-follow-up psychological flexibility as dependent variable. Mid-post depression was entered in the second step. Results in Table 5 shows that mid-post psychological flexibility significantly predicted post-follow-up depression. When testing the converse, results showed that mid-post depression significantly predicted post-follow-up psychological flexibility. Pre-early depression no longer significantly predicted post-follow-up psychological flexibility in the regression analyses. The converse association was also not significant. Furthermore, regression analyses showed that mid-post psychological flexibility significantly predicted post-follow-up anxiety. The converse association was not significant.

Discussion

In this study, we examined the role of psychological flexibility and its effects on psychological distress during and after a guided self-help ACT intervention. The evaluation of this intervention in a previous study showed that the intervention significantly

improved psychological flexibility and reduced depression and anxiety after the intervention. At the three-month follow-up these results were maintained (see Fledderus et al., 2012). This study had two aims for examining the role of psychological flexibility.

The first aim of study was to examine whether psychological inflexibility is a risk factor for developing psychological distress. Therefore, a multilevel growth model was defined with psychological flexibility and psychological distress using the five time measurements of the participants who received the guided self-help programme ($n = 250$). In line with the previous study of Fledderus et al. (2012), results showed that both depression and anxiety decreased over time. When psychological flexibility was included in the model, it was shown that right from the beginning of the intervention, psychological flexibility had positive effects on the levels of depression and anxiety. This positive effect of psychological flexibility on anxiety continued over time, indicating that even after the intervention psychological flexibility had long-term positive effects on further reductions of anxiety. The effect of psychological flexibility on depression flattened out over time, indicating that over time this effect was becoming less strong. This suggests that over the long-term the effects of psychological flexibility on depression remain stable. Furthermore, an interaction effect between psychological flexibility and time on psychological distress was found, indicating that individuals with higher levels of psychological flexibility showed a larger decrease in the levels of depression and anxiety over time. This means that the effect of the intervention on psychological distress is stronger for participants with higher levels of psychological flexibility over time. This is the first study that showed with several points of measurements over time in a large sample that psychological flexibility is a competence that is important to develop for long-term effects on the reduction of psychological distress. Earlier studies already showed that higher levels psychological flexibility predicted mental health outcomes, but they only used cross-sectional data or one time-point for measuring later in time (e.g., Bond et al., 2011; Shallcross et al., 2010). Our findings underscore the importance of targeting psychological flexibility during an ACT intervention for a reduction

Table 5
Cross-lagged regressions for psychological flexibility.

Variable	B	SE B	Adjusted R ²	B	SE B	Adjusted R ²	
T3–T4 CES-D			T3–T4 AAQ-II				
Step 1			Step 1				
T2–T3 CES-D	–0.09	0.05	0.29***	T2–T3 AAQ-II	–0.30	0.05	
T3–T4 AAQ-II	–0.54	0.05		T3–T4 CES-D	–0.59	0.05	0.37***
Step 2				Step 2			
T2–T3 AAQ-II	–0.45	0.06	0.44***	T2–T3 CES-D	–0.29	0.06	0.43***
T3–T4 HADS-A			T3–T4 AAQ-II				
Step 1			Step 1				
T2–T3 HADS-A	–0.09	0.06	0.23***	T2–T3 AAQ-II	–0.27	0.07	
T3–T4 AAQ-II	–0.49	0.06		T3–T4 HADS-A	–0.56	0.07	0.30***
Step 2				Step 2			
T2–T3 AAQ-II	–0.36	0.06	0.33***	T2–T3 HADS-A	–0.09	0.06	0.30
T3–T4 CES-D			T3–T4 AAQ-II				
Step 1			Step 1				
T0–T1 CES-D	–0.06	0.05	0.28***	T0–T1 AAQ-II	0.13	0.05	
T3–T4 AAQ-II	–0.53	0.05		T3–T4 CES-D	–0.53	0.05	0.30***
Step 2				Step 2			
T0–T1 AAQ-II	–0.07	0.06	0.29	T0–T1 CES-D	–0.01	0.06	0.30

Note. CES-D = Center for Epidemiologic Studies Depression Scale; HADS-A = Hospital Anxiety and Depression Scale-Anxiety subscale; AAQ-II = Acceptance and Action Questionnaire-II.

in depressive and anxiety symptoms over time. It also suggests that it is relevant to include people with low levels of psychological flexibility in ACT interventions, because they might have a higher risk of developing more psychological distress. These people especially might benefit from an ACT intervention. However, with these analyses, we still not know which phase of the intervention is the most important in predicting clinical symptoms.

Therefore, the second aim was to examine the role of psychological flexibility as a process of change during the ACT intervention on depression and anxiety after the intervention. First, we examined whether psychological flexibility mediated the effects of the intervention on psychological distress. It was found that improved psychological flexibility during the intervention mediated the effects of the ACT intervention on reduced depression and anxiety after the intervention. Previous studies support this finding (e.g. Forman et al., 2007; Lappalainen et al., 2007). Second, we examined whether changes in depression and anxiety after the intervention were preceded by changes in psychological flexibility during the intervention. Results from the cross-lagged panel design showed that changes in psychological flexibility at the end of the intervention predicted later changes in anxiety and not vice versa. This suggests that the improvement of psychological flexibility in the last three sessions of intervention is important for further reductions in anxiety. In these sessions participants were encouraged to choose important values and act upon them even in the face of unpleasant thoughts or emotions. This requires a more regular application of the various skills the participants learn in the ACT intervention, such as acceptance, cognitive defusion and mindfulness. Our study suggests that when persons are able to incorporate these skills in daily life, they will experience less anxiety. Earlier research already has shown that improved value-based actions at the end of an ACT treatment for chronic pain patients were associated with less pain and depression after the treatment (Vowles & McCracken, 2008).

Results for depression were less clear. The cross-lagged panel design showed that mid-post changes in psychological flexibility predicted post-follow-up changes in depression, but also vice versa. This suggests that these changes are more circular; more psychological flexibility at the end of the intervention may result in less depression after the intervention, but the reverse was also true. Taken together, the results of the cross-lagged panel design showed that especially improvements of psychological flexibility at the end of the intervention had beneficial effects for further reductions in depression and anxiety after the intervention.

For a further validation of the ACT treatment model, it is important to determine which role psychological flexibility plays, namely as a risk factor or as a process of change, during an ACT-intervention. We did find an indicator that psychological flexibility might play a protective role for mental health over time; we found that the effects of the intervention on psychological distress were stronger for participants with higher levels of psychological flexibility. However, more research is needed with more and longer follow-ups to further examine this. Although we found that psychological flexibility was a mediator of the intervention on psychological distress, we also found that the changes in psychological flexibility and changes in psychological distress in the same time lags were all related. Furthermore, no significant cross-lagged associations between pre-early and early-post intervention changes in psychological flexibility and post-follow-up changes in psychological distress were found. The results also showed that psychological flexibility had right from the start of the intervention a positive effect on the levels of psychological distress. An important condition for having a process of change is that changes in the mediator occur before changes in the outcome variable occur (Kazdin, 2007). Overall, the results might indicate that the changes

between psychological flexibility and psychological distress are more circular and occur simultaneously in the same time lags.

More research is needed to study the precise role of psychological flexibility by using more time measurements, for example after each ACT session. Another suggestion for future research is the use of other advanced analyses, for example by using nonlinear spline functions in the hierarchical linear modelling to improve the statistical fit of the model and model predictions. Nonlinear spline functions represent a much broader class of higher-degree polynomial functions, which can be used to describe more accurately the development of the outcome variable over time. Moreover, the use of nonlinear splines in a piecewise regression method can be used to construct a smooth function describing in a very flexible way any nonlinear trend. Furthermore, future studies could include other possible processes of change, such as value-based behaviour or mindfulness skills.

There are several limitations in this study. First, there was no control group in the hierarchical linear modelling analyses and cross-lagged analyses, so it is not clear whether the changes in the mediator and outcomes were attributable to the ACT intervention. However, this limitation can be mitigated. At baseline the participants showed clinically relevant symptoms of anxiety and depression. The post-intervention measurement included a control group and showed high between-effects sizes between the experimental group and the control condition and the effects at the follow-up were sustained. Moreover, large improvements were also found in other domains such as positive mental health, mindfulness and fatigue (see Fledderus et al., 2012). Therefore, it can be presumed that these results were unlikely to occur without an intervention. A second limitation is that a relatively short follow-up period was used in this study. Future studies could include a longer follow-up period. Third, the cross-lagged panel design only uses correlations, so conclusions about causality cannot be strictly drawn from this design. Fourth, we relied solely on self-reported measurements, also observations from a clinical therapist would have strengthened the design. Finally, although it was the first time that underlying processes of psychological flexibility was assessed in a sample with mild to moderate depressive and anxiety symptoms, generalization to other samples (e.g., major depression) have to be made with care.

To conclude, this study is the first that examined in a large sample of people, beside the mediating role of psychological flexibility, also with in-depth analysis in which phase of the ACT intervention changes in psychological flexibility occurred. Our study showed that higher levels of psychological flexibility during and after a guided ACT intervention had a stronger effect on the reduction of psychological distress. It seems that especially at the end of the ACT intervention changes in psychological flexibility are important for larger reductions in anxiety.

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