



Universiteit Utrecht

'Transforming thoughts to feel better? The mediating effect of cognitive restructuring on depression symptoms in adolescents.'

Final Thesis

Master's Thesis (201600201)

University Utrecht

Master's Programme in Clinical Child, Family and Education Studies

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8 January 2018

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Prologue

This master thesis is the product of a study into one of the most widely-used interventions in the prevention and treatment of adolescent depression: cognitive behavioural therapy. The interplay of thoughts and feelings, and the extent to which they can be influenced to enable positive change, has had my interest since I started working with children and adolescents who encounter difficulties while growing up. Notably, it was the cooperation of adolescents that made this study possible. Conducting this research, allowed me to integrate my fascination for behavior in development with the expansion of personal competence.

Denise Bodden and Marieke van den Heuvel, you gave me the opportunity to participate in the STARr-project and start my master thesis at an unconventional moment. I would like to thank you both sincerely for your cooperative thinking, enthusiasm and flexibility: your substantive guidance has enabled me to continuously move forward. In addition, I would like to express my gratitude to friends and family for their encouragement and understanding, providing the necessary moments of recreation and relaxation. Finally, I would like to thank my husband and companion, for always being there, patiently, helping out, keeping me down to earth, supporting me all the way.

I am glad to present to you my master thesis, by which I complete the master 'Clinical Child, Family and Education Studies' at Utrecht University.

Sifra Elgersma- Kalkman

Kampen, January 2018

Abstract

As maladaptive cognitions are an important aspect of depression, they are major targets in both prevention and treatment of depression in adolescents. Although cognitive restructuring (CR) is one of the most applied techniques in effective cognitive behavioural treatment (CBT) programs for depression, it is still unclear if the explicit modification of maladaptive cognitions is the mechanism that ensures positive results. Therefore, this explorative study examined if CR mediates treatment outcomes of an indicated CGT-based depression prevention program; the STARr-training. Adolescents aged 11 to 17 ($M=13.82$, $SD=1.44$, $n=68$, 51,5% girls) were randomly assigned to either the CR condition ($n=18$) or one of three non-CR conditions ($n=50$). The complete program consists of four modules, each containing three group-sessions. The present study focusses on outcomes of solely the first module. Depression symptoms were assessed using the CDI-2 and cognitive errors using the CNCEQ-R, at pre- and intermediate measurements. Results showed no decrease in either depression symptoms or cognitive errors in the total group, CR group and non-CR group after completing the first three group-sessions of the program. Whereas overall, depression symptoms and cognitive errors were positively related, depression symptoms before and after the intervention did not significantly relate with change in cognitive errors. Therefore, a regression analysis was not performed. It was concluded that after three group-sessions, the intervention did not affect the level of depression symptoms and cognitive errors in participants, regardless of their treatment condition. Moreover, the hypothesis that CR evokes change in cognitive errors and thereby mediates treatment outcomes, is rejected. Possible explanations and implications for future research and clinical practice are discussed.

Keywords: Depression prevention, Cognitive restructuring, Cognitive behavioural therapy, Adolescents.

Samenvatting

Maladaptieve cognities vormen een belangrijk aspect van depressie en zijn daarom het doelwit van zowel preventie als behandeling van depressie bij adolescenten. Hoewel cognitieve herstructurering (CR) een van de meest toegepaste technieken is in effectieve cognitieve gedragstherapie (CBT) programma's voor depressie, is nog onduidelijk of de expliciete modificatie van maladaptieve cognities het mechanisme is dat verantwoordelijk is voor positieve resultaten. Deze verkennende studie onderzocht of CR de behandelresultaten medieert van een geïndiceerd CGT-depressiepreventie programma; de STARr-training. Adolescenten van 11 tot 17 jaar ($M=13.82$, $SD=1.44$, $n=68$, 51,5% girls) werden willekeurig toegewezen aan de CR conditie ($n=18$) ofwel een van de drie niet-CR condities ($n=50$). Het volledige programma bestaat uit vier modules van elk drie groepssessies. De huidige studie is gericht op uitkomsten van uitsluitend de eerste module. Depressiesymptomen werden tijdens pre- en tussentijdse metingen getoetst middels de CDI-2 en cognitieve fouten middels de CNCEQ-R. Resultaten toonden geen verandering in depressiesymptomen of cognitieve fouten in de totale groep, CR groep en niet-CR groep na het volgen van de eerste drie groepssessies. Participanten in de CR groep verschilden niet van de niet-CR groep in cognitieve fouten, noch depressieve symptomen na deelname aan drie groepssessies. Hoewel in het algemeen, depressiesymptomen en cognitieve fouten positief samenhangen, hielden depressiesymptomen voor en na de interventie geen significant verband met een verandering in cognitieve fouten. Als gevolg daarvan is een regressieanalyse niet uitgevoerd. Geconcludeerd werd dat na drie groepssessies de interventie geen invloed had op het niveau van depressiesymptomen en cognitieve fouten bij deelnemers, ongeacht hun behandelingsconditie. Bovendien is de hypothese dat CR verandering in cognitieve fouten bewerkstelligt en daarmee behandeluitkomsten medieert, verworpen. Mogelijke verklaringen en implicaties voor toekomstig onderzoek en klinische praktijk worden besproken.

Kernwoorden: Depressiepreventie, Cognitieve herstructurering, Adolescenten, Cognitieve gedragstherapie.

Introduction

Depression amongst adolescents is a considerable health concern which is getting more attention in the public debate. Major depression disorder (MDD) is one of the most prevalent psychiatric problems amongst youths (Avenevoli, Swendsen, He, Burstein, & Merikangas, 2015; Merikangas et al., 2010) and is featured by a high risk of recurrence (Curry et al., 2011; Pettit, Hartley, Lewinsohn, Seeley, & Klein, 2013). Both longitudinal and cross-sectional research has shown that depression in early adolescence is related to negative outcomes in late adolescence and adulthood, including suicidality, comorbidity, interpersonal and social problems, poor academic functioning, substance abuse, unemployment and delinquency (Fergusson & Woodward, 2002; Klein, Torpey, & Bufferd, 2008; McLeod, Horwood, & Fergusson, 2016; Verboom, Sijtsema, Verhulst, Penninx, & Ormel, 2014). Even adolescents reporting relevant depression symptoms without meeting the full diagnostic criteria for MDD, are more likely to develop MDD and are at risk for adverse outcomes (Bertha & Balázs, 2013; Seeley, Stice, & Rohde, 2009). Therefore, it is important that adolescent depression is identified and prevented at an early stage.

Thoughts are an important aspect in the etiology of depression (Beck, 1967). Negative cognitive style has proven to increase the risk to develop a depression (Bohon, Stice, Burton, Fudell, & Nolen-Hoeksema, 2008). Also, maladaptive cognitions are highly present in adolescents with depression (Hankin, 2006; Schwartz & Maric, 2015). Moreover, adolescents with relevant depression symptoms report cognitive problems similar to adolescents with MDD, but different from those without depression (Bertha & Balázs, 2013; Stewart et al., 2002; Thapar, Collishaw, Pine, & Thapar, 2012). However, more insight is needed in the influence of explicit modification of maladaptive cognitions on depression symptoms and negative automatic thoughts in adolescents (Stice, Shaw, Bohon, Marti, & Rohde, 2009). Hence, the present study examines whether cognitive restructuring (CR) mediates treatment outcomes in an indicated depression prevention program.

Treatment and prevention of depression

As maladaptive cognitions are central to the construct of depression, they are important targets in both prevention and treatment of depression in adolescents (Horowitz & Garber, 2006; Stice et al., 2009). The most frequently used psychotherapeutic intervention for adolescent depression is cognitive behavioural therapy (CBT), based on the assumption that mental disorders are maintained by interacting cognitive and behavioural factors (Hofmann, Asnaani, Vonk, Sawyer, & Fang, 2012; Powell, Abreu, Oliveira, & Sudak, 2008). The empirical support for this intervention is substantial; CBT has found to prevent and treat adolescent depression effectively (Calear & Christensen, 2010; Horowitz & Garber, 2006; Hofmann et al., 2012; Stice et al., 2009). Some CBT-interventions even reduced the incidence of future MDD (Bertha & Balázs, 2013; Garber et al., 2009; Stice, Rohde, Gau, & Wade, 2010a).

Various factors complicate the interpretation of the current body of research on CBT-programs. In particular, the role of explicit modification of maladaptive cognitions is still unclear. Firstly, CBT refers to a combination of different techniques (Hofmann et al., 2012; Powell et al., 2008). Besides CR, relaxation, problem-solving and behavioural activation are most frequently used in intervention programs for adolescent depression (Weersing, Rozenman, Maher-Bridge, & Campo, 2012). Because these techniques are often applied at the same time, it is not possible to determine their individual effects on positive treatment outcomes (Horowitz & Garber, 2006). Secondly, cognitive and behavioural interventions separately have been found to result in similar treatment outcomes, suggesting that a focus on reducing cognitive errors may not be essential to reduce depression symptoms (Longmore & Worrell, 2007; Tindall et al., 2017; Weersing et al., 2012). However, content of CBT prevention programs for adolescent depression - such as changing cognitions or problem-solving - is not yet related to effect sizes (Stice et al., 2009). To clarify the role of CR, a focus on the cognitive component of CBT is required.

Cognitive restructuring and negative cognitions

Notably, CBT is founded on the idea that positive change is uniquely related to explicit cognitive interventions (Beck, 1979; Longmore & Worrell, 2007). Beck's cognitive theory (1967) emphasized the role of maladaptive cognitions, hypothesizing that depressive mood and behaviour are preceded and maintained by negative automatic thoughts, arising from ingrained and distorted beliefs about the self, the world and the future (Hofmann et al., 2012). CR is the process by which adolescents learn to identify personal, dysfunctional beliefs and their corresponding emotional, behavioural and physiological reactions (Beck, 1979; Powell et al., 2008). The accuracy of these cognitions is evaluated in order to modify them and generate more realistic and functional thoughts.

Previous research comparing CR to other CBT-treatment components suggest there is limited evidence that CR increases the effectiveness of CBT-interventions (Dimidjian et al., 2006; Gortner, Gollan, Dobson, & Jacobson, 1998; Jacobsen et al., 1996). However, these studies included solely adults with MDD. Unlike in adults, the cognitive capacities of adolescents are still evolving and more flexible (Thapar et al., 2012). From a developmental perspective, it can be argued that applying CR before negative thinking patterns become ingrained has a different, preventing impact on adolescents (Hankin, 2006). Moreover, the content of cognitive and behavioural conditions in these studies somewhat overlapped (Longmore & Worrell, 2007). Studies including adolescents show mixed results; some found that adding CR in treatment of posttraumatic stress disorder (PTSD) did not affect depression symptoms in participants (Foa et al., 2005), whereas others reported significant decrease in both PTSD- and depression symptoms after treatment with CR compared to treatment without CR (Bryant et al., 2008). The influence of solely CR in the prevention of adolescent depression remains unexplored.

Consistent with Beck's theory (1967), maladaptive cognitions have been found to predict depression in adolescents (Bohon et al., 2008; Kingery et al., 2009; Maric, Heyne, Widenfelt, & Westenberg, 2011). Some specific cognitive errors even are uniquely linked to depression (Schwartz & Maric, 2015). Moreover, cognitive errors proved to moderate treatment-outcomes of a CBT-intervention for adolescent depression (Curry et al., 2006; March, Silva, & Vitiello, 2006); adolescents with higher levels of cognitive distortions, were more likely to benefit from treatment with medication and CBT, compared to treatment without CBT. These findings subscribe the interplay of maladaptive cognitions and depression symptoms in adolescents. Although their negative association appears well-established, recent findings state that negative cognitive style was not unambiguous predictive of depression symptoms and a CBT-intervention did not affect cognitive style in adolescents (Kindt, Kleinjan, Janssens, & Scholte, 2016). From this it can be deduced that change in negative cognitive style did not influence treatment outcomes. However, this study involved a non-clinical sample with a high proportion of adolescents from low-income areas. Also, they implemented universal prevention, which is known to be less effective than indicated prevention (Stice et al., 2009; Wijnhoven, Creemers, Vermulst, Scholte, & Engels, 2014).

Evidently, it is not clear whether the effectiveness of depression interventions depends on decreased cognitive errors. Although examination of the mediating role of negative automatic thoughts is scarce, various studies observed that decline of depression symptoms was accompanied by decline of negative cognitions after CBT-intervention for adolescent depression (Horowitz, Garber, Ciesla, Young, & Mufson, 2007; Stice, Rohde, Seeley, & Gau, 2010). Also, negative cognitive style partly mediated the positive effect of CBT on depression symptoms (Horowitz et al., 2007). These findings cautiously support the hypothesis that decrease in cognitive errors is an active ingredient for change in depression symptoms in adolescents. As CR aims to be effective by changing these underlying maladaptive cognitions this CBT-technique may mediate treatment outcomes of a prevention program for adolescent depression.

The present study

In conclusion, CR is highly present in effective depression prevention programs for adolescents, but it remains unclear if CR successfully reduces negative automatic thoughts and whether the decrease of negative cognitions is the mechanism that ensures positive results. The present study builds on recommendations from meta-analytical studies on CBT, by investigating the mediating effect of CR on depression symptoms in adolescents after an indicated prevention program. It is expected that preventive treatment will result in decreased depression symptoms and cognitive errors, and depression symptoms will be mediated by change in cognitive errors. More specifically, is hypothesized that the decrease in cognitive errors accounts for reduced depression symptoms in participants exposed to CR compared to those not exposed to CR.

Method

Participants

Schools across the Netherlands were approached and invited to participate. After passive consent, 2326 students of three secondary schools were screened on depression symptoms using the Children's Depression Inventory-2 (CDI-2; Bodden, Braet, & Stikkelbroek, 2016). Inclusion criteria were the proficiency of the Dutch language and (sub)clinical level of depression symptoms, meaning a score above the 76th percentile. Exclusion criteria were the absence of active consent, the presence of severe and acute suicide risk or current treatment for psychological problems. In total, 176 students who did not complete the questionnaire and 19 students aged 20 years or older were excluded. Of the remaining 2131 adolescents, 519 reported relevant depression symptoms and were therefore eligible for participation. Of these, 26 reported suicide ideations on the CDI-2 and were screened using the 'Vragen over Zelfdoding en Zelfbeschadiging' (VOZZ; Huisman, Smits, & Kerkhof, 2015), consequently 13 adolescents with increased suicidal thoughts or intentions were excluded and referred to mental healthcare. Moreover, 57 adolescents who were undergoing treatment were excluded. Also, 17 adolescents declared not to prioritize participation and 205 participants did not identify with the screening outcome. Finally, 159 did not report their reason not to participate. After obtaining active consent of both parents and adolescents, 68 adolescents participated in this study. Age ranged from 11 to 17 years ($M = 13.82$, $SD = 1.44$). The sample consisted of 35 girls (51%) and 33 boys (49%) of predominantly Dutch nationality. Educational levels ranged from high (44%, VWO, HAVO/VWO) and middle (40%, HAVO, VMBO-TL/HAVO) to low (16%, VMBO-BB, -KB, -GL, -TL). 16 adolescents (24%) reported learning difficulties, including attention deficit disorders, autism spectrum disorder and dyslexia.

Procedure

This explorative study is part of a larger research project, aiming to examine the effect of four commonly used CBT-elements on adolescent depression; CR, relaxation, problem-solving and behavioural activation. Adolescents take part in a depression prevention program in which these four elements are introduced separately in four different orders. The study is designed as a parallel-group randomized controlled trial, where participants are randomly assigned to one of the four distinct conditions. After the screening procedure and baseline assessment, randomization was performed at school level. Every condition started with a different CBT-element; 18 participants (26,47%) started with 'Think', the only condition involving CR. Simultaneously, 17 participants (25%) started with 'Act', 19 (27,94%) with 'Solve' and 14 (20,59%) with 'Relax'. The complete training consisted of four modules, each containing three sessions (12 sessions in total). The present study focusses on treatment outcomes after participants are exposed to solely one of the four CBT-elements, which is after the first module. This is shown in Figure 1.

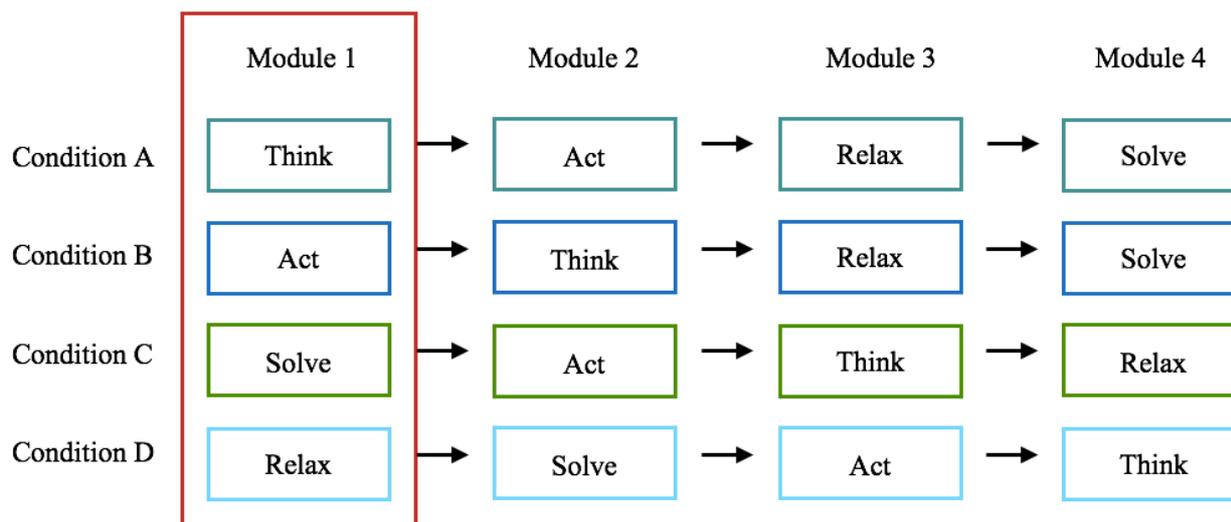


Figure 1. Chart parallel-group study design.

CBT depression prevention program.

All adolescents participated in the ‘STARr-training’, a CBT based prevention program consisting of four modules: ‘Solve’, ‘Think’, ‘Act’ and ‘Relax’. Each module contained three group sessions and additional homework assignments, which focussed on learning, practicing and applying the skills corresponding with the CBT-element that is central to the module. The content of the modules was founded upon current Dutch CBT-protocols and on the Modular Approach to Therapy for Children with Anxiety, Depression, Trauma or Conduct Problems (MATCH-ADTC; Chorpita & Weisz, 2009). Group-sessions of approximately one hour were held weekly at school and were provided by qualified alumni pedagogy and psychology, who were trained and supervised by qualified CBT-therapists. All same-sex groups consisted of six to eight adolescents.

Measuring Instruments

Depression symptoms. Depression symptoms were assessed using the CDI-2 (Bodden et al., 2016), a revised version of the CDI (Kovacs, 1992) which measures self-reported depression symptoms in children and adolescents aged 8 to 21. A digital version of the CDI-2 was filled out by adolescents. Items like ‘I am feeling sad’ and ‘I have trouble sleeping’ are measured on a 3-point scale (0 = ‘absent symptom’, 1 = mild symptom, 2 = ‘definite symptom’). Before the STARr-training, participants completed the full version of the CDI-2, which consists of 28 items and divides these in two high order subscales; ‘emotional problems’ and ‘functional problems’. After the first module, they completed the short version of the CDI-2, consisting of 12 items. For the use in a non-clinical population the CDI-2 has a good internal consistency, test-retest reliability and convergent validity (Bodden et al., 2016). Consistently, the 12-item CDI-2 showed a good reliability in the present study ($\alpha=.76$).

Negative automatic thoughts. Negative automatic thoughts were assessed using the Children’s Negative Cognitive Errors Questionnaire – Revised (CNCEQ-R; Maric et al., 2011), a revised version of the CNCEQ (Leitenberg, Yost, & Carroll-Wilson, 1986) which measures self-reported distorted cognitive processing in children and adolescents aged 9 to 18. A digital version of the CNCEQ-R was filled out by adolescents. Items like ‘If I had been smarter, we would not have lost’ are measured on a 5-point scale ranging from ‘not at all like I would think’ to ‘almost exactly like I would think’. Participants completed the CNCEQ-R before and after the first module of the STARr-training, which consists of 16 items and is divided in 5 subscales; ‘overgeneralizing’, ‘underestimating the ability to cope’, ‘personalizing without mind reading’, ‘mind reading’ and ‘selective abstraction’. For the use in a non-clinical population the CNCEQ-R has a good internal consistency and test-retest reliability for the total score (Maric et al., 2011; Stevanovic et al., 2016). Consistently, the CNCEQ-R showed a good reliability in the present study ($\alpha=.88$).

Analysis plan

First, paired sample t-testing will be used to assess whether both depression symptoms and cognitive errors have decreased in the total sample, the CR group (those participating in the module ‘Think’) and the non-CR group (those participating in the modules ‘Act’, ‘Solve’ and ‘Relax’). Second, AN(C)OVA analysis will be conducted to test for differences between group-outcomes, comparing the CR and non-CR group. If needed, corrections will be made for covariates. Thirdly, correlations between study variables will be computed. Lastly - if correlations between main study variables are established -, a regression analysis will be conducted to test for a mediating effect of automatic negative thoughts as shown in Figure 2. This will be done for the total sample, the CR group and the non-CR group. Due to the small sample size, calculations will be made with solely the total scores on the CDI-2 and CNCEQ-R. In addition, two new variables were composed to reflect the difference in depression symptoms and cognitive errors before and after treatment, by subtracting the total scores on pre- and post-intervention.

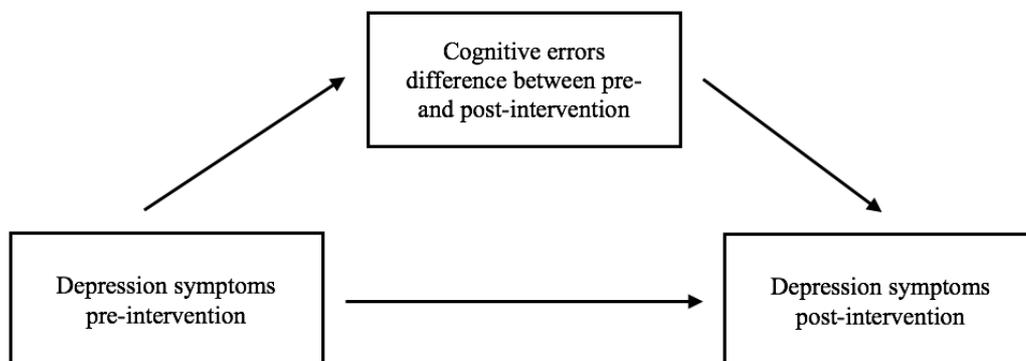


Figure 2. Chart mediation analysis.

Prior to the statistical analyses, the dataset was inspected for missing values and outliers. As a result, 14 out of 68 participants (20,59%) who did not fill out all questionnaires or left more than 20% of the items unanswered, were excluded from the analyses ($n=54$). Extreme scores have not been found to be the result of coding errors and therefore were not excluded from the analyses. Most study variables met the assumption of normality, linearity and homoscedasticity. However, the normality assumption for age was violated, $W(54)=.93$, $p<.01$. In addition, the relationship between depression symptoms on both pre- and post-intervention and the difference score on cognitive errors was not linear. Therefore, instead of using Pearson correlation, Kendall's tau-b was computed, as it is preferred over Spearman's rho for better estimating the true population correlation (Allen, Bennett, & Heritage, 2014) and more appropriate for relative small sample sizes (Field, 2014). A non-significant Levene's test confirmed that the assumption of homogeneity of variances was met for depression symptoms, $F(1,52)=0.35$, $p=.56$, and cognitive errors, $F(1, 52)=0.2$, $p=.66$, when comparing groups. All assumptions for paired sample t -tests, AN(C)OVA-, correlation- and regression analyses were met. Tests were performed at a significance level of .05.

Results

Primary analysis

Pre-intervention differences. The total group ($n=54$) consisted of 11- to 17-year-old adolescents ($M=13.83$, $SD=1.45$), 25 boys (46,30%) and 29 girls (53,70%). A chi-square test indicated significant group differences; the CR group consisted of more boys ($n=10$, 76,9%) than the non-CR group ($n=15$, 36,6%), $p=.01$. Therefore, gender was included as a covariate. Girls reported significantly more depression symptoms pre-intervention ($M=0.78$, $SD=0.28$) than boys ($MD=0.51$, $SD=0.31$), $F(1)=11.56$, $p=.001$, $\eta^2=.18$, indicating a small effect. However, they did not report more cognitive errors than boys, $F(1)=1.82$, $p=.18$. The CR group and non-CR group did not differ in terms of age, $F(1)=1.66$, $p=.20$, pre-intervention depression symptoms, $F(1)=3.24$, $p=.08$ and cognitive errors $F(1)=3.82$, $p=.06$.

Pre- and post-intervention differences. Paired sample t -tests were conducted to compare depression symptoms and cognitive errors pre- and post-intervention. Results indicated there was no significant decrease of depression symptoms in the total group, $t(53)=0.18$, $p=.86$, $d=0.02$. More specifically, no significant decrease of depression symptoms was found in the CR group, $t(12)=-1.45$, $p=.17$, $d=0.40$, and non-CR group, $t(40)=1.09$, $p=.28$, $d=0.17$. Similarly, cognitive errors were unchanged in the total group, $t(53)=0.55$, $p=.58$, $d=0.08$, as well as in the CR group, $t(12)=-0.66$, $p=.52$, $d=0.18$, and the non-CR group, $t(40)=1.03$, $p=.31$, $d=0.16$. Table 1 presents the scores on the main study variables. In contrast to the non-CR group, the CR group showed a non-significant increase of average scores between pre- and post-intervention on both depression symptoms and

cognitive errors. Overall, it was concluded that there are no significant effects on depression symptoms or cognitive errors.

Table 1

Pre- and post-measurement average scores and effect sizes on main study variables

	Total group (n=54)			CR group (n=13)			Non-CR group (n=41)		
	M ± SD	<i>t</i>	<i>d</i>	M ± SD	<i>t</i>	<i>d</i>	M ± SD	<i>t</i>	<i>d</i>
Depression symptoms									
Pre-intervention	0.66 ± 0.32	0.18	0.02	0.52 ± 0.34	-1.45	0.40	0.70 ± 0.31	1.09	0.17
Post-intervention	0.65 ± 0.31			0.60 ± 0.36			0.69 ± 0.29		
Cognitive errors									
Pre-intervention	2.34 ± 0.76	0.55	0.08	1.99 ± 0.53	0.66	0.18	2.45 ± 0.80	1.03	0.16
Post-intervention	2.31 ± 0.68			2.06 ± 0.57			2.39 ± 0.70		

Note. Theoretical minimum for depression symptoms = 0, theoretical maximum = 2. Theoretical minimum for cognitive errors = 1, theoretical maximum = 5.

Differences between groups. ANCOVA analysis were conducted to compare the CR group and non-CR group on post-intervention depression symptoms and cognitive errors. When corrected for both age and pre-intervention scores, no difference between groups was found with regard to depression symptoms $F(1)=1.66$, $p=.2$, $\eta^2=.03$, and cognitive errors, $F(1)=0.58$, $p=.45$, $\eta^2=.02$, indicating non-significant and small effect sizes. It was concluded that there is no effect of the treatment conditions on depression symptoms and cognitive errors.

Correlations. Table 2 presents the correlations between the main study variables for the total group. In order to test for a mediating effect of CR, a new variable was computed which reflects the difference in the number of cognitive errors between pre- and post-intervention. Depression symptoms pre- and post-intervention correlated positively and strong $\tau=.68$, $p<.001$, as did cognitive errors pre- and post-intervention, $\tau=.69$, $p<.001$. In addition, depression symptoms pre-intervention correlated with cognitive errors pre- intervention, $\tau=.49$, $p<.001$, and post-intervention $\tau=.4$, $p<.001$, indicating that these constructs are positively and moderately related. This also applied to depression symptoms post-intervention and cognitive errors pre-intervention, $\tau=.41$, $p<.001$, and post-intervention, $\tau=.4$, $p<.001$, indicating that participants reporting higher levels of depression symptoms, tend to report higher levels of cognitive errors, both before and after the intervention. However, difference in cognitive errors solely correlated

significantly with cognitive errors pre-intervention, $\tau=.26$, $p=.007$, not with depression symptoms pre-and post-intervention.

Table 2

Kendall's tau-b correlations between main study variables for the total group

	1	2	3	4	5
1. Depression symptoms pre-intervention	-	.68**	.49**	.40**	.17
2. Depression symptoms post-intervention		-	.41**	.40**	.05
3. Cognitive errors pre- intervention			-	.69**	.26**
4. Cognitive errors post- intervention				-	-.08
5. Difference cognitive errors					-

Note. ** $p < .01$. * $p < .05$, two tailed, $n=54$.

Correlations between the main study variables, calculated separately for the CR group and non-CR group, are shown in Table 3. In the non-CR group, correlations were consistent with those in the total group. However, in the CR group depression symptoms pre- and post-intervention did not correlate with cognitive errors post-intervention. Also, depression symptoms post-intervention did not correlate with cognitive errors pre-intervention. Here again, difference in cognitive errors solely correlated with cognitive errors pre-intervention in the non-CR group, $\tau=.28$, $p=.012$. In the CR group, no correlations were found between difference in cognitive errors and other study variables.

Table 3

Kendall's tau-b correlations between main study variables separately for the CR group and non-CR group

	1	2	3	4	5
1 Depression symptoms pre-intervention		.66**	.60**	.23	.40
2 Depression symptoms post-intervention	.68**		.35	.15	.07
3 Cognitive errors pre-intervention	.44**	.44**		.55**	.19
4 Cognitive errors post-intervention	.46**	.48**	.74**		-.29
5 Difference cognitive errors	.08	.01	.28*	-.01	

Note. ** $p < .01$. * $p < .05$, two tailed, CR group ($n=13$) = above diagonal, non-CR group ($n=41$) = below diagonal.

Mediation. In the absence of a significant relation between depression symptoms pre- and post-intervention with the mediating variable in all groups, a regression analysis to test for the mediating effect of CR could not be performed.

Secondary analysis

In face of the unexpected outcomes of the primary analyses, secondary analyses were conducted to test several possible explanations for the current findings. Theoretical background for these analyses will be provided in the discussion, and additional assumptions were ensured. First, in order to gain more insight in the effect of the intervention on depression symptoms and cognitive errors in the control condition, paired sample *t*-tests were conducted separately for each treatment condition in the non-CR group ($n=41$); ‘Act’ ($n=13$), ‘Solve’ ($n=16$) and ‘Relax’ ($n=12$). The groups did not differ in terms of gender ($p=.09$), age, $F(2)=1.77$, $p=.17$, pre-intervention depression symptoms, $F(2)=1.49$, $p=.23$ and cognitive errors $F(2)=2.25$, $p=.09$. However, Again, no significant decrease of depression symptoms was found in the ‘Act’ group, $t(12)=-1.32$, $p=.21$, ‘Solve’ group, $t(15)=1.51$, $p=.15$, and ‘Relax’ group, $t(11)=0.73$, $p=.48$. Neither did the cognitive errors decrease in the ‘Act’ group, $t(12)=-.57$, $p=.14$, ‘Solve’ group, $t(15)=-1.07$, $p=.3$, and ‘Relax’ group, $t(11)=1.18$, $p=.26$. These findings indicate that the intervention was equally ineffective with regard to depression symptoms and cognitive errors, in all four treatment conditions.

Second, closer observation of individual scores indicated that a noteworthy proportion of participants ($n=22$, 40,74%), reported pre-intervention depression symptoms within the average range. Therefore, paired sample *t*-tests were conducted, only including those scoring above the 60th percentile ($n=32$). The CR group ($n=4$) and non-CR ($n=28$) group did not differ in terms of gender ($p=.39$), age, $F(1)=0.52$, $p=.48$, pre-intervention depression symptoms, $F(1)=0.87$, $p=.36$ and cognitive errors $F(1)=0.99$, $p=.33$. However, it is important to note that the size of the CR group is very small, whereby results should be interpreted with caution. No decrease was found in depression symptoms, $t(31)=1.35$, $p=.19$, or cognitive errors, $t(31)=1.14$, $p=.27$ in the total group. Also, no change was found in depression symptoms in the CR group, $t(3)=-0.38$, $p=.73$, and non-CR group, $t(27)=1.72$, $p=.1$ or cognitive errors in the CR group, $t(3)=1.37$, $p=.26$, and non-CR group, $t(27)=0.72$, $p=.48$. Thus, the program did not affect depression symptoms or cognitive errors of participants in any treatment condition, even when an adjusted threshold value was applied.

Lastly, the sample was further analyzed - not using average scores - but by focusing on individual raw scores, aiming to identify possible subgroups for which the intervention may have resulted in either decreased or increased depression symptoms and cognitive errors. This was done using the reliable change index (RCI), a statistical measure to assess the significance of individual change over time. Chronbach’s Alpha was used as reliability score, and standard deviations were computed for each separate treatment condition in both the CR group and non-CR group; ‘Think’,

‘Act’, ‘Solve’ and ‘Relax’. When the difference scores of participants exceeded the RCI in either a positive or negative direction, it was considered a significant improvement or impairment. Table 4 presents the number of participants when observing change in depression symptoms and cognitive errors, outlining that none of the adolescents showed significant change in depression symptoms, regardless of their treatment condition. In contrast to depression symptoms, cognitive errors did change in some participants, suggesting that although cognitive errors changed, depression symptoms remained stable. Both significant improvement and impairment occurred in the CR group. Although more improvements versus impairments are evident, both were equally present in girls and boys. There is insufficient evidence of a trend in which specific condition seems to work more or less effectively for a specific group.

Table 4

Observed individual change of depression symptoms and cognitive errors in participants

	CR group (n=13)						Non-CR group (n=41)						
	Think			Act			Solve			Relax			
	n	SD	RCI	n	SD	RCI	n	SD	RCI	n	SD	RCI	
Depression symptoms													
Significant improvement	0						0			0			
No significant change	13	0.34	0.				2	16	0.33	0.45	12	0.27	0.37
Significant impairment	0						0			0			
Cognitive errors													
Significant improvement	1			0			1			0			
No significant change	10	0.57	0.55	11	0.78	0.75	15	0.69	0.66	12	0.66	0.63	
Significant impairment	2			2			0			0			

Note. Change was considered significant at a level of .05, if individual difference score exceeded the RCI.

Discussion

The objective of this explorative study was to examine the mediating role of CR in an indicated depression prevention program for adolescents, as it is a broadly applied technique in CBT-based programs. In order to confirm the hypothesis that explicit modification of maladaptive cognitions is the mechanism by which CBT is effective, cognitive errors and depression symptoms should be decreased after applying CR. Also, it had to be evident that decrease in depression symptoms was explained by decrease in cognitive errors. As opposed to the expectations, results indicated that the intervention did not affect depression symptoms nor cognitive errors in

participants, regardless of their treatment condition. Moreover, depression symptoms pre- and post-intervention did not significantly relate with the difference in cognitive errors before and after the intervention. Thus, it was concluded that CR did not successfully prevent depression in adolescents by reducing cognitive errors, and did not mediate treatment outcomes.

These findings are largely in contrast with a substantial body of research upon which the study assumptions were based; indicated depression prevention programs for adolescents who resulted in reduced depression symptoms (Garber et al., 2009; Horowitz & Garber, 2006; Stice et al., 2009; Stice et al., 2010a; Wijnhoven et al., 2014) and negative cognitions (Horowitz et al., 2007; Stice et al., 2010b). Maladaptive cognitions did however prove to positively relate to depression in adolescents; those reporting higher levels of depression symptoms reported higher levels of cognitive errors. This is in line with most previous findings (Bohon et al., 2008; Kingery et al., 2009; Maric, et al., 2011; Schwartz & Maric, 2015) and again endorses the role of cognitive errors as an apparent mediator. Several explanations for the current findings are discussed.

First, while decline of depression symptoms often occurs early (Stice et al., 2010b) it is possible that the duration of the intervention influenced treatment outcomes. Whereas the complete prevention program consisted of four modules of each three group-sessions, the present study solely focussed on outcomes after the first module of three group-sessions. This is substantially less than the number of group-sessions in several effective CBT-programs (Stice et al., 2009). It may take more time for change in cognitive errors and depression symptoms to manifest (Gortner et al., 1998; Horowitz et al., 2007; Stice et al., 2010b). Second, the content of effective prevention programs is characterized by a mixture of CBT-elements (Hofmann et al., 2012; Weersing et al., 2012). Although not directly targeting maladaptive cognitions, behavioural activation, problem-solving and relaxation may have individual impacts on cognitive errors and also reduce depression by changing maladaptive thoughts (Horowitz & Garber, 2006; Longmore & Worrell, 2007). However, secondary analyses confirmed that when tested separately, the three CBT-techniques did not result in changed cognitive errors or depression symptoms either. Thus, both CR- and non-CR-techniques did not prove to be effective by altering cognitions. This may imply the combination of CBT-elements is an essential factor, which contributes to favourable outcomes of current programs. Also, these conclusions give rise to possibility that the absence of decline in cognitive errors is explanatory for the absence of decline in depression symptoms in both treatment conditions.

In addition, whereas participants reported depression symptoms above the clinical cutoff during screenings procedure, a substantial part of them did not report similar levels pre-intervention; 85,19% scored beneath the 76th percentile, 40,74% even scored within the average range, suggesting considerable decrease of depression symptoms over time. Some studies describe similar developments, where improvement in depression precedes the actual intervention

(Longmore & Worrell, 2007). Possibly, recognition of depression and prospect of treatment in itself has had a positive effect on depression symptoms in participants. Still, this finding may partly explain the marginal effect on depression symptoms, since interventions are more likely to be beneficial for adolescents with high depression levels (Horowitz et al., 2007; Stice et al., 2009). However, secondary analysis in which participants who scored within the average range were excluded, also did not show favourable effects of the intervention. Alternatively, as a consequence of excluding participants, the sample size used in the secondary analysis was relatively small.

Moreover, the CR group consisted of more boys who, although non-significant, showed less cognitive errors than girls. This may be compliant with gender differences with regard to depression, in such a way that girls are known to ruminate more than boys and experience more negative cognitions (Hyde, Mezulis, & Abramson, 2008; Mezulis, Funasaki, Charbonneau, & Hyde, 2010). In addition, it has been argued that CR requires specific, 'school-like' skills, whereby the type of treatment is possibly less appealing to boys (Pössel, Seemann, & Hautzinger, 2008; Stice et al., 2009). Even an adverse effect is suggested; boys who participated in a school-based prevention program have been found to report increased depression symptoms, compared to stable depression symptoms of boys in the non-intervention control condition. Girls however did profit from the intervention, their depression symptoms decreased (Pössel et al., 2008). This may partly explain the absence of positive results in the CR group, as well as the observed non-significant increase in average depression symptoms and cognitive errors. Based on this assumption, it would be expected that secondary analyses supported that girls did benefit from CR, by showing significant individual improvements. However, observation of individual changes in participants did not confirm that the intervention was more effective for girls than for boys.

Complementary to the interpretations of the recent findings, the present study was subject to a number of methodological limitations. First, this explorative study included a relative small sample size, whereby the statistical power of analyses and alternative compositions of groups was limited (Field, 2014). This formed the main constraint of this research, as it may have prevented significant results from being found. Second, to ensure equal and comparable pre- and post-intervention total scores on depression symptoms, both were computed using only the items and cutoff-scores of the short version of the CDI-2 (Bodden et al., 2016). While this instrument provides a reliable qualification of depression symptoms in adolescents, it possibly impacted the pre-intervention scores, as these were originally measured with the full version of the CDI-2. Moreover, this study lacked data from additional informants or diagnostic classification using the DSM-V (APA, 2013). Although it is advised to assess internalising problems through self-report instruments (Carr, 2016), outcomes potentially concern a 'snapshot', reflecting feelings of participants on that particular moment which in turn may partly explain the present findings.

Furthermore, the parallel-group research design did not allow comparison between those who received CR, to those who did not receive any form of treatment. Hence, it is not possible to draw conclusions about the difference in course of depression symptoms and cognitive errors over time. Although prevention programs mostly result in decreased depression symptoms, some studies describe prevention effects as the absence of increased depression symptoms (Horowitz & Garber, 2006; Stice et al., 2009). More specifically, stabilization of depression symptoms in intervention groups compared to growth of depression symptoms in control groups, leads to the conclusion of a preventing effect. As such, it may be that the stabilisation of depression symptoms as observed in this study are the result of the preventive effect of the intervention. Because data on adolescents who were not treated was not within the scope of this study, no statement can be made about this.

The strength of the present study is that for the first time, key CBT-elements are applied separately, enabling assessment of their individual effects as accurately as possible and distinguish which intervention techniques successfully influence the underlying mechanisms of depression. Therefore, it is advised that current findings are replicated including a larger sample of adolescents reporting clinical relevant depression symptoms, as well as integrating diagnostic classifications. Follow-up measurements are recommended, as the effect of changes in underlying cognitions could reveal itself after a longer period of time (Horowitz et al., 2007; Stice et al., 2010b). Also, it can be valuable to focus future research on the specific cognitive errors that uniquely link to depression symptoms (Schwartz & Maric, 2015), as it may be more complementary to the distinct cognitive process that characterise adolescent depression. Lastly, the differential effect of CR on boys and girls requires consideration (Pössel et al., 2008; Stice et al., 2009), given the various gender differences with regard to depression and cognitions.

In conclusion, the present findings did not provide evidence for the mediating role of CR; CR did not affect depression symptoms nor cognitive errors in adolescents. Although the positive relation between depression symptoms and cognitive errors was established, change in negative errors was not found to explain change in depression symptoms. It may be that an effect of both CR- and non-CR interventions on depression in adolescents was not found due to methodical issues. Moreover, although CR did not outperform non-CR interventions and current findings failed to support the idea that decreased cognitive errors are an active ingredient for changed depression symptoms, is it possible that the absence of decline in cognitive errors is explanatory for the absence of decline in depression symptoms in both treatment conditions. Therefore, clarifying the role of CR remains essential to the improvement of the current clinical practice.

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