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ORIGINAL ARTICLE

Examining the Mechanisms of Therapeutic Change in a Cognitive-Behavioral Intervention for Anxious Children: The Role of Interpretation Bias, Perceived Control, and Coping Strategies

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Abstract This study examined the role of theoretically meaningful mediators of therapeutic change—interpretation bias, perceived control, and coping strategies—in a cognitive-behavioral intervention for anxious youth. This is one of the few studies that examined the change in potential mediator and outcome variables by means of a longitudinal design that included four assessment points: pretreatment, in-treatment, post-treatment, and at 4-months follow-up. Forty-seven 8- to 12-year-old children with a principal DSM-IV diagnosis of anxiety disorder participated in the study. On each assessment point, questionnaires assessing the mediator variables and a standardized anxiety scale were administered to the children. The results showed that perceived control and interpretation bias (but not coping strategies) accounted for a significant proportion in the variability of various types of anxiety symptoms, providing a preliminary support for the notion that these cognitive dimensions' act as mechanisms of therapeutic change in cognitive-behavioral therapy for anxious children.

Keywords Cognitive-behavioral treatment · Anxiety disorders · Children · Mediators of change

Introduction

Anxiety disorders are among the most prevalent emotional problems in childhood [1] and have serious negative consequences for young people's daily functioning and quality of life [2]. In addition, longitudinal studies have indicated a temporal relationship in which childhood anxiety problems precede anxiety and depressive disorders in adulthood [3]. The high prevalence of anxiety disorders in children as well as associated individual and societal costs justify the need for research focusing on the treatment of this type of psychopathology.

The first choice intervention for childhood anxiety disorders is cognitive-behavioral therapy (CBT). Several reviews have noted that this type of treatment is clearly more efficacious as compared to a waitlist control condition and alternative psychological interventions [e.g., 4]. However, although CBT is a well-established treatment for child anxiety there is a substantial variability in treatment effect. For example, a meta-analysis conducted by Silverman et al. [5] showed that the percentages of children who are successfully treated by this type of intervention range between 46% and 79%. Therefore, we need to understand the mechanism of change underlying the efficacy of CBT and to identify specific features that can further enhance its treatment outcome. Based on cognitive-behavioral theories as well as empirical findings, the current study focused on four possible treatment mechanisms, namely (1) the reduction of cognitive biases, (2) the elimination of avoidance, (3) the enhancement of positive coping strategies, and (4) the promotion of perceived control.

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With regard to the first mechanism of cognitive biases, there is abundant evidence indicating that anxiety problems in children and adolescents are associated with distorted processing of threat-related information [6]. One of the most well-documented biases is the interpretation bias [7], which is concerned with a tendency to interpret ambiguous stimuli and situations in a threatening way. It is clear that in CBT this type of bias is directly targeted by means of cognitive restructuring techniques, which aim at the promotion of positive thoughts in anxiety-eliciting situations at the cost of negative thoughts. The mechanisms of avoidant and positive coping refer to the way anxious children handle threatening events: instead of trying to actively deal with the difficult situation using positive coping strategies, they are inclined to circumvent the problem and withdraw themselves [8]. According to traditional behavior therapists, behavioral avoidance negatively reinforces anxious arousal and cognition, thereby serving as a key mechanism in the maintenance of the anxiety problem [9]. In CBT, the avoidance behavior is addressed via exposure exercises during which the child is confronted with anxiety-eliciting situations and taught new strategies of how to handle such events more effectively. Further, positive coping behavior is promoted through the learning of other strategies, including relaxation and effective problem solving. The forth and final mechanism of perceived control has to do with children's feeling that they can adequately deal with anxiety, and has also been demonstrated to be an important correlate of anxiety disorders [10]. Research has indicated that perceived control essentially consists of two components, control over internal emotional reactions and control over external threats [11], which can also be discerned in youths [12]. There is no specific component within CBT that aims at improving children's perceived control, but because this intervention helps children to adopt a variety of strategies (e.g., applied relaxation, exposure, cognitive restructuring, problem-solving) that help them to deal with feelings of fear and anxiety, it may well be that perceived control increases after CBT and represents an important mechanism of change.

So far, only few studies have actually examined potential mechanisms of change operating during CBT for children with anxiety disorders. A first investigation by Treadwell and Kendall [13] examined the role of the cognitive variable of self-talk as a mediator of positive outcome in 71 clinically referred children aged 8–13 years who had been diagnosed with anxiety problems and were treated with a protocolized individual CBT program. The results of this study showed that negative self-talk and the ratio of negative to positive self-talk were significant mediators of therapeutic change, whereas positive and depressive self-talk were not. A follow-up study by the same authors [14] obtained highly similar results, although it should be noted the observed changes in self-talk only explained a small percentage of the positive effects produced by the intervention.

Another investigation by Muris et al. [15] explored whether negative automatic thoughts and perceived control predicted treatment outcomes produced by a group CBT in a selected sample of 45 high anxious school children aged 9–12 years. The results indicated that the reduction in anxiety symptoms was significantly associated with a decrease in negative automatic thoughts and an increase of perceived control, although these supposed mediators only explained between 17 and 30% of the variance in the change of anxiety disorders symptoms. Interestingly, the influence of these variables appeared to differ across various types of anxiety disorder symptoms. That is, regression analyses showed that change in perceived control was a unique predictor of change in symptoms of social phobia, change in negative automatic thoughts uniquely predicted change in symptoms of separation anxiety disorder, whereas change in both variables accounted for a significant proportion in the change of generalized anxiety disorder symptoms.

Although these studies provided first information on the candidate mediators of positive change during CBT for children with anxiety disorders, it is clear that this research suffered from some serious shortcomings. First of all, these investigations only focused on mediators that are cognitive in nature, thereby neglecting mechanisms that are concerned with the behavioral and coping changes produced by CBT. Second, in these studies, mediating effects were examined by including only two time points (i.e., at pre- and post-treatment) on which anxiety disorders symptoms as the main outcome measure and the hypothesized mediators were assessed. Several scholars have noted that such a procedure obscures the temporal relationship between the change in the proposed mediator variables and the change in outcome [e.g., 16], implying that not only statistical mediation but also temporal precedence must be demonstrated in order to really establish a variable as a mediator of therapeutic change.

It is good to note that more recently studies have started to appear in the literature that investigated the mechanisms of change underlying CBT in anxious children in a more satisfactory way. For example, Hogendoorn et al. [17] examined the role of a wide range of potential cognitive and behavioral mediators in the reduction of anxiety symptoms during and after a cognitive-behavioral intervention. A sample of 145 anxiety disordered youth aged between 8 and 18 years participated in 12 individual, weekly sessions of CBT. Mediators (i.e., positive and negative thoughts, perceived control, and various coping strategies as reported by the child) and outcome variables (i.e., anxiety symptoms as reported by mother and child) were measured on four assessment points: pretreatment, in-treatment

(after eight sessions), post-treatment (after 12 sessions), and at 3-months follow-up. Structural equation modeling was employed to demonstrate that an increase of positive thoughts preceded symptom reduction as reported by children, whereas an increase of coping strategies such as problem solving, cognitive restructuring, and distraction preceded symptom reduction as reported by parents. Note that these results indicated that the decrease of avoidant coping did not precede a decrease in child- or parent-reported anxiety, but instead that a decrease of child-reported anxiety predicted the decrease in avoidant coping. With regard to perceived control, the results indicated a reciprocal effect between the change in this cognitive factor and the change in anxiety symptoms.

In another study by Kendall et al. [18], it was examined whether coping efficacy and anxious self-talk mediated treatment gains in 7- to 17-year-old youths with anxiety disorders who were randomly assigned to four intervention conditions: individual CBT ($n=139$), sertraline only ($n=133$), their combination ($n=140$), or placebo medication ($n=76$). The study included assessments of the hypothesized mediators (as reported by children and parents) at post-treatment and 3-months follow-up and a measurement of anxiety symptoms as reported by the clinician at baseline and follow-up. The mediation analysis, again performed by means of structural equation modeling, revealed that an increase in coping efficacy (as reported by children and parents), but not anxious self-talk, acted as a significant mediator of positive therapy outcome in all three active treatment conditions.

Without doubt, the Hogendoorn et al. [17] and the Kendall et al. [18] studies should be regarded as an advancement over the earlier research exploring the mechanisms of change underlying CBT for children with anxiety disorders. However, more research is certainly required in this area. For example, it would be worthwhile to explore cognitive bias as a mediator of therapeutic change. This seems highly relevant given the presumed role of this variable in the maintenance of anxiety problems, which has recently led to the development of new interventions that specifically target this cognitive factor (i.e., bias modification training) and have also been successfully applied to children with anxiety disorders [e.g., 19]. In addition, it would be interesting to further explore Muris et al. [15] finding that change in different types of anxiety symptoms would be associated by different mediators of change. To address these two gaps in the literature, the present study further explored mediators of therapeutic change produced by CBT for children with anxiety disorders. Forty-seven children aged 8 to 12 years with anxiety disorders were treated with a group CBT intervention. At four points-in-time—pre-treatment, in-treatment, post-treatment, and at a 4-months follow-up—the four mediator variables of cognitive bias, avoidant and positive coping, and perceived control as well as four dimensions of anxiety symptoms (generalized anxiety, separation anxiety, social phobia and specific phobia) were assessed. We hypothesized that there will be a significant decrease of cognitive bias and avoidant coping and a significant increase in positive coping and perceived control, and that such changes would explain for a significant proportion in the variability of different types of anxiety symptom. Following Muris et al. [15], we expected that the four mediators would play a differential role in the reductions observed for various types of anxiety symptoms.

Method

Participants

Forty-seven children with a DSM-IV diagnosis of a childhood anxiety disorder and their parents were recruited from a community sample. The children were between 8 and 12 years old, with a mean age of 9.64 years ($SD=1.13$). The sample had a balanced gender distribution, with 51% girls and 49% boys. The majority of the children lived with both parents (66%), and their families' socio-economic status (estimated on the basis of the educational and occupational levels of the parents) was qualified as low (32%), medium (38%), or medium–high to high (30%). Only four participants were non-Caucasian.

The primary anxiety disorder diagnoses of the children were separation anxiety disorder ($n=9$), social anxiety disorder ($n=16$), generalized anxiety disorder ($n=13$), and specific phobia ($n=9$), and these were assessed by means of a semi-structured clinical interview. It is important to note that comorbidity was a common phenomenon in this sample. That is, the percentage (number) of children with only one anxiety disorder was 28% ($n=13$). Other children (in total: 72%) were diagnosed with two anxiety disorders ($n=17$), three ($n=11$), four ($n=5$), or even five anxiety disorders ($n=1$). In addition, besides their anxiety problem(s), children were diagnosed with a comorbid major depression disorder ($n=1$), attention-deficit and hyperactivity disorder ($n=9$), and oppositional-defiant disorder ($n=2$). A substantial proportion of the children (i.e., 44.7%) had previously sought professional help for their mental health problems.

Assessment

Anxiety Symptoms and Disorders

The Anxiety Disorders Interview Schedule—Child and Parent version (ADIS-C/P; [20]) is a semi-structured diagnostic interview which assesses anxiety disorders and frequent

comorbid disorders in terms of the criteria as listed in the DSM-IV. The interview is divided into different sections, each covering a specific disorder. Within each section, the key symptoms of the pertinent disorder are checked, and in case sufficient symptoms are present, child and parent are questioned about the degree to which the symptoms interfere with the child's daily functioning. This interference is rated on a scale ranging from 0 (no interference) to 8 (very high interference), with a score of 4 or higher defining a clinical diagnosis. The reliability and validity of ADIS-C/P are well-established [21, 22]. The present study employed the procedure as described by Khanna and Kendall [23], during which parents and children were interviewed together. Disagreements between parent and child in response to an item were resolved following the recommendations of Grills and Ollendick [24], implying that the "OR" rule is used to make decisions regarding the presence of a symptom or diagnosis. In the present study, the interviews conducted in a subsample of 27 children and parents were also scored by a second independent rater. Results showed that the inter-rater reliability for different anxiety disorder diagnoses was high, with all kappa values being 0.89 or higher.

The Screen for Child Anxiety Related Emotional Disorders-Revised (SCARED-R; [25]) is a 69-item questionnaire that measures symptoms of all anxiety disorders that according to the DSM-IV can occur in children. These include separation anxiety disorder (eight items; e.g., "I follow my mother and father wherever they go"), generalized anxiety disorder (nine items; e.g., "People tell me I worry too much"), social anxiety disorder (seven items; e.g. "It is hard for me to talk with people I don't know well"), specific phobias (15 items; e.g., "I am afraid of the dentist"), panic disorder (13 items; e.g., "When I feel frightened, it is hard to breathe"), obsessive–compulsive disorder (nine items; e.g., "I have thoughts that frighten me"), traumatic stress disorder (four items; e.g., "I have frightening dreams about a very aversive event"), and school phobia (four items; e.g., "I am scared to go to school"). There are two versions of the questionnaire, one to be completed by the child and the other to be filled in by the parent. In the present study, both the child and the parent-versions were used for the selection of the sample (see procedure), but only the child report version was used for the main data analysis. Respondents are asked to rate the frequency of each symptom experienced by the child on a scale ranging from 0 (never or almost never) to 2 (often). By summing the ratings on relevant items, a subscale score can be obtained for each type of anxiety disorder as well as a total anxiety score, with higher scores reflecting higher levels of anxiety symptoms. Research has indicated that the SCARED-R total scale and subscales possess satisfactory internal consistency and test–retest stability as well as good convergent and discriminant validity [26–29]. Previous studies also documented good sensitivity to treatment effects [27, 30]. In the present study, we used the total score and the scores on the four subscales that measured the symptoms of children's primary anxiety disorder diagnoses, namely generalized anxiety disorder, separation anxiety disorder, social anxiety disorder, and specific phobia. The Cronbach's alphas for the various SCARED-R scales of both the child and the parent version were all in the good to excellent range (i.e., between 0.72 and 0.93).

Mediators of Therapeutic Change

Perceived control was measured by means of the shortened version of Anxiety Control Questionnaire for Children (ACQ-C; [31]), which consists of ten items assessing control beliefs over external (e.g., "I can usually deal with hard problems") and internal (e.g., "I can take charge and control my feelings") anxiety-related stimuli. Children are asked to indicate how much each item applies to them, using a rating scale ranging from 0 (none) to 4 (very much). A total score of perceived control can be obtained by summing the ratings across the ten items, with higher scores reflecting higher levels of perceived control. The scale presents adequate psychometric properties, with good internal consistency, test–retest reliability, and factorial and discriminant validity [12, 17, 32, 33]. A previous study has also shows that ACQ-C scores increase (indicating higher levels of control) following treatment [17]. In the present study, Cronbach's alphas for the scale on each of the four time points appeared to be good, ranging between 0.77 and 0.92.

The Ambiguous Situations Questionnaire for Children (ASQ-C; [34]) is a self-report questionnaire that was employed to measure cognitive (i.e., interpretation) bias and coping strategies. The scale was based on the ambiguous situations interview as developed by Barrett et al. [35], and consisted of six ambiguous situations, with two scenarios representing a specific domain of threat (i.e., social, physical, and separation). Children were asked to score the applicability of all interpretations instead of only choosing one outcome. Thus, for each scenario (e.g., "Your mother said that she would pick you up at school at 5:00 pm. It is 5:15 pm and she has still not arrived"), children were asked to indicate the applicability of three possible interpretations, with two being threatening (e.g., "She is late because she may be involved in an accident") and one being non-threatening in nature (e.g., "She is delayed because there is too much traffic"), using a 5-point Likert scale ranging from 1 (not at all) to 5 (very much). A total interpretation bias score can be obtained by summing children's ratings to the threatening interpretations (range 12–60), with higher scores indicating a stronger tendency to display this

cognitive bias. Research by Waters et al. [36] has demonstrated that interpretation bias measures like the ASQ-C are susceptible to change following a cognitive-behavioral intervention. In the current study, Cronbach's alpha of the total score of threat interpretations was satisfactory, ranging between 0.73 and 0.83 on the various assessment points.

To measure avoidant and positive coping, children had to write down how they would react in each of the situations described in the ASQ-C. Two categories of coping strategies were considered: (1) positive coping, which included the strategies of problem solving, information seeking, and support seeking, and (2) avoidance. For both categories, a frequency score was obtained, representing the number of times the child mentioned the pertinent coping strategy in relation to the six ambiguous situations. The categorization of children's coping responses was performed independently by two researchers who obtained a good percentage of agreement (i.e., positive coping: $k = 0.87$, avoidance: $k = 1.00$).

Previous studies conducted with Portuguese samples have demonstrated that the scale has adequate psychometric properties, with good internal consistency and discriminant validity [37, 38] as well as adequate treatment sensitivity [30].

Procedure

The present data were collected within the context of a larger study. Children were recruited from eight public and private schools from urban and semi-urban area near Lisbon, Portugal. To select participants a two-stage screening procedure was conducted (Fig. 1). During the first stage, all children who were authorized by their parents to participate in the study ($N = 1065$ children, i.e., 74% of the children who were invited) completed the SCARED-R during regular school classes, while their mothers filled out the parent version of this questionnaire at home. The second stage of the screening procedure was only conducted with children who scored above the 95th percentile on the total scale of SCARED-R and/or the subscales of generalized anxiety disorder, separation anxiety disorder and social phobia, according to the report of either the child or the mother ($n = 275$). Eventually, 180 of these children and their mothers continued participation and conducted the clinical interview (ADIS-C/P) assessing the presence of clinically significant anxiety disorders. The interview was conducted by clinical psychologists previously trained in the administration of ADIS-C/P. In case the interview revealed an anxiety disorder as the primary diagnosis, children and their mothers were invited to participate in the intervention part of the study ($n = 72$). Fifty of these children fully conducted the treatment program (see flowchart in Fig. 1 for reasons of dropout), but for three of them not all measurements were completed. The analyses were conducted with the 47 children who participated in the intervention and also completed all measurements.

Self-report measures to assess the potential mediators—threat interpretations (ASQ-C), positive and avoidant coping strategies (ASQ-C), and perceived control (ACQ-C)—and the outcome measures—child-reported anxiety symptoms (SCARED-R)—were administered at the four-time assessment points (at pretreatment, in-treatment between the 5th and 6th session, at post-treatment, and at a 4-months follow-up).

Group CBT Intervention

The FRIENDS for Life Program [39] is a CBT group intervention for anxious children. The program contained ten sessions for the children, two sessions for the parents, and one joint session for children and parents. There was also one extra booster session for the children, which took place 2 weeks after the completion of the regular program. The Portuguese version of FRIENDS for Life has been used in previous trials and generally produced positive results [30]. During the program, children receive psycho-education about anxiety, learn to recognize anxious feelings, and are then taught various skills to deal more effectively with such feelings, including relaxation and deep breathing, cognitive restructuring, problem solving, seeking social support, and exposure to anxiety-eliciting situations. The participating children received a Book of Activities, describing homework activities to be completed between sessions. The treatment sessions for parents were aimed at psycho-education and stimulation of involvement (i.e., helping the child to create an exposure hierarchy and to provide support during the exposure tasks that had to be carried out at home). In case the child did not attend a session, the facilitator provided a possibility for an individual catch-up session before the next group session took place.

The treatment was conducted in the school setting by four trained clinical psychologists, with a minimum experience of 1 year in the delivery of the FRIENDS for Life program. There were 11 groups that consisted of 3–7 children. All sessions were reviewed in weekly supervision meetings by a senior clinical psychologist (the first author, AIP). To assess the integrity of the implementation of the intervention protocol, all trainers were asked to fill out a checklist after each session indicating the contents/activities performed by the group. In this way, it was established that more than 80% of the session's activities were fully performed in agreement with the manual's guidelines.

The timing of the assessment points was made taking into consideration the various components of CBT delivered during the intervention: pre-treatment, in-treatment (halfway through the intervention after delivering the

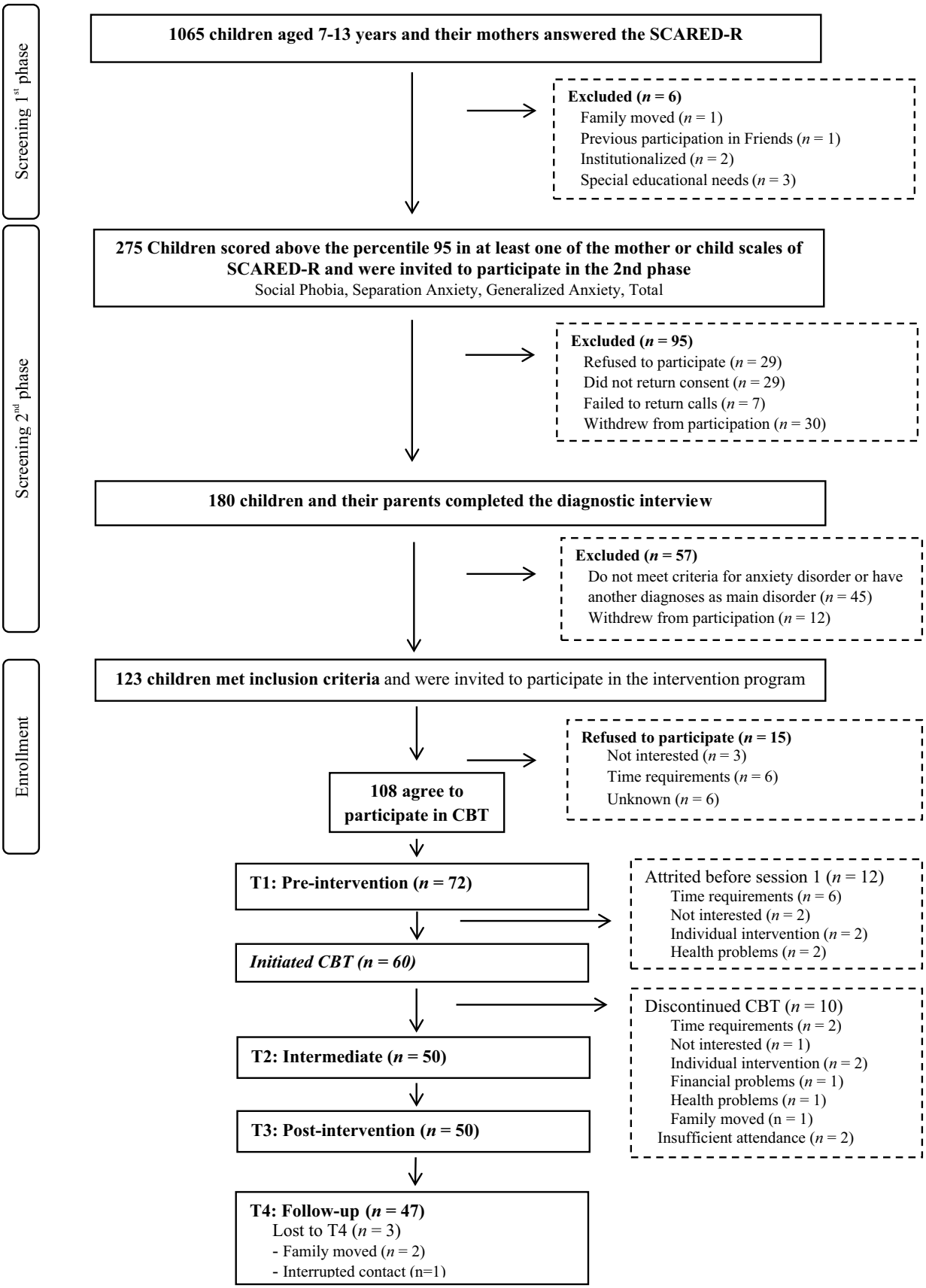

Fig. 1 Flow-chart of inclusion and attrition of the participants in this study

components of psychoeducation, relaxation, and cognitive restructuring, but before the exposure component), at the end of intervention (after the exposure component) and at 4-months follow-up. It was expected that these four assessment points would be sufficient to capture changes in all of the candidate mediators.

Data Analysis

Preliminary Analyses

As noted earlier, only individuals who completed all data points were considered for the data analysis. With regard to missing items in the questionnaires (<5%), the following rule was applied: we imputed these missing values by the individuals' subscale means. None of the participants delivered a survey with more than one missing value per scale. A series of Chi square and Mann–Whitney tests were used to compare completers and drop-outs on a variety of participant and demographic variables. Then, analyses of variance (ANOVAs) with repeated measures were used to analyze change in the hypothesized mediators and anxiety symptoms over time. These analyses were performed using SPSS version 23 (SPSS Inc, Chicago, IL).

Hierarchical Linear Modeling

Based on the hierarchical structure of the data, exploratory multilevel models were tested using repeated measures (level 1) nested in children (level 2). Hierarchical linear modeling procedures started with the testing of empty models that included no covariates for each outcome measure. This starting point is relevant to check variance at both structural levels and estimate the intraclass correlation (ICC) to assess the percentage of the total variance in our outcomes that is due to nesting repeated measures in our level-2 unit. Variances close to zero and small ICC values are perceived as a sign of independence [e.g., 40], meaning that a lower level unit is independent from a higher level one. Four multilevel hierarchical linear models were estimated, one for each outcome (i.e., generalized anxiety disorder, separation anxiety disorder, social phobia, and specific phobia). By running these models, we intended to identify which variables significantly contributed to explain anxiety symptoms. Because all models included predictors measured at level 1: time and each of the hypothesized mediators: perceived control, perceived bias, avoidance, and positive coping we estimated lower level mediation models (1-1-1). A schematic representation of our mediation models is depicted in Fig. 2. The R environment [41] and lme4 package for mixed models [42] were used to test the hierarchical linear models.

Results

Preliminary Analysis

No differences between completers and dropouts were observed with regard to child age, gender, and SES of the family. In addition, neither child and mother reports of anxiety symptomatology nor scores on mediator variables prior to the intervention differed significantly between those who completed and those who dropped out of this intervention study.

Table 1 presents the mean scores (standard deviations) on scales measuring relevant anxiety symptoms (i.e., generalized anxiety, separation anxiety, specific phobia, and

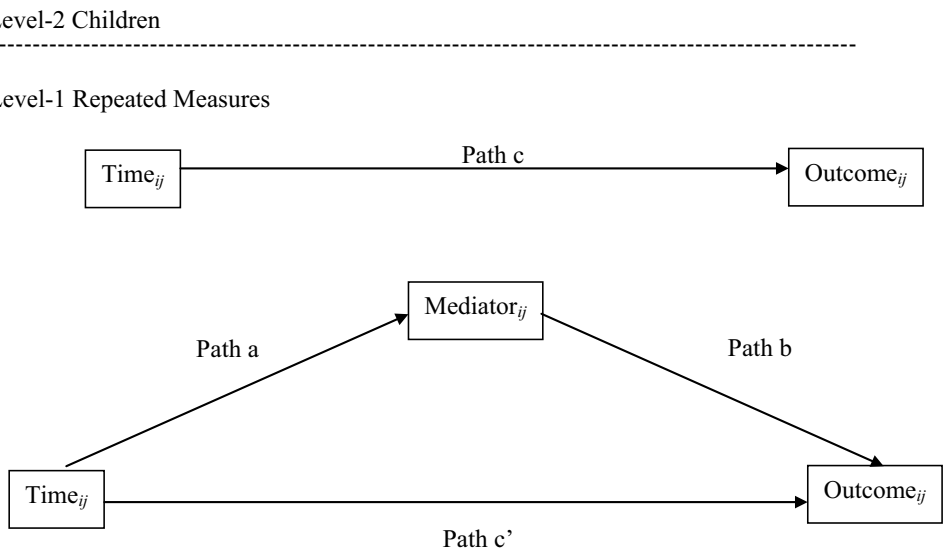

Fig. 2 Schematic representation of mediation models

Table 1 Mean scores (standard deviations) on relevant anxiety symptoms scales and hypothesized mediating variables for the 47 children on the four assessment time points and results of the repeated measures ANOVAs performed on these data

Variable	T1 Pre	T2 In	T3 Post	T4 FU	$F(3,44)$
SCARED-R					
Generalized anxiety	10.81 (3.46)[a]	8.43 (4.25)[b]	7.17 (3.89)[b]	6.89 (4.30)[b]	11.18***
Separation anxiety	8.85 (3.78)[a]	6.02 (3.29)[b]	4.96 (3.62)[b,c]	4.66 (3.46)[c]	14.48***
Specific phobia	11.60 (6.12)[a]	8.47 (5.43)[b]	7.15 (4.88)[b,c]	6.34 (4.47)[c]	16.24***
Social phobia	7.89 (3.13)[a]	6.87 (3.34)[a,b]	6.11 (3.45)[b]	5.70 (3.27)[b]	5.63**
ACQ-C-SF					
Perceived control	14.94 (7.04)[b]	19.96 (9.70)[a,b]	21.89 (9.32)[a]	21.74 (8.25)[a]	3.58*
ASQ-C					
Interpretation bias	30.45 (9.69)[a]	27.06 (10.26)[b]	24.51 (9.85)[b,c]	21.49 (8.92)[c]	14.04***
Avoidance	0.87 (0.74)[a]	0.45 (0.58)[b]	0.49 (0.59)[b]	0.38 (0.53)[b]	6.10***
Positive coping	4.68 (1.66)	4.60 (1.74)	4.53 (1.99)	4.21 (1.06)	1.58

Means not sharing similar superscripts differ at $p < 0.05$

SCARED- R screen of child anxiety related emotional disorders-revised, *ASQ-C* ambiguous situation questionnaire for children, *ACQ-C-SF* anxiety control questionnaire for children, short form

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

social phobia) and hypothesized mediating variables (i.e., threat interpretation, perceived control, avoidance, and positive coping) of the 47 children on the four assessment time points. The results of repeated measures ANOVAs showed that all anxiety outcome measures and most of the hypothesized mediators (except for positive coping strategies) changed over time at the group level. More specifically, post-hoc tests revealed that anxiety symptoms decreased and mediators showed the expected changes as a result of the CBT intervention, and that these treatment gains were consolidated at the 4-months follow-up. Note also that in the case of generalized anxiety the decline in symptom levels mainly occurred from pre-treatment to in-treatment, whereas for other anxiety symptoms significant decreases in symptoms could be observed until the end of intervention (social phobia) and the follow-up assessment (separation anxiety and specific phobia). For the mediators, the post-hoc tests revealed that the significant changes in perceived control occurred between the pre-treatment and post-treatment assessment, that interpretation bias continued to change until the follow-up measurement, whereas avoidance only showed a significant reduction from pre-treatment to the middle of the intervention (see Table 1).

Hierarchical Linear Modeling

Departing from the variance information retrieved by the estimation of the null models for each anxiety symptom our nested structure analyses indicate large differences occurring over time with substantial differences also occuring between children (generalized anxiety: ICC = 0.63 for level 1, 0.33 for level 2; separation anxiety: ICC = 0.70 for level 1, 0.30 for level 2; social phobia: ICC = 0.52 for level 1, 0.49 for level 2; and specific phobia: ICC = 0.52 for level 1, 0.48 for level 2).

Results of the multilevel analyses are presented in Table 2. Estimates for fixed effects indicated a significant decrease in symptoms of generalized anxiety, separation anxiety, specific phobia and social phobia from pre-treatment to follow-up reflecting the effect of the intervention over time. With regard to the hypothesized mediators only perceived control and interpretation bias revealed significant estimates when explaining anxiety symptoms. Specifically, the higher the perception of control the lower the symptoms of generalized anxiety, social anxiety, and specific phobia. For interpretation bias, higher scores were associated with higher symptom levels of all types of anxiety symptoms. Estimates for the other two mediators, avoidance and positive coping, did not reach statistical significance.

The results pertaining to the random part of the multilevel analyses revealed that the intra-individual variability was greater than the variability between children, which is consistent with the results from the null models revealing that the largest differences were concentrated within individuals. Because level 1 variance decreased from baseline testing (generalized anxiety: $\sigma^2 = 11.43$; separation anxiety: $\sigma^2 = 10.66$; social anxiety: $\sigma^2 = 6.00$; specific phobia: $\sigma^2 = 16.43$), it can be argued that the mediator variables included in our multilevel models account for the variability of anxiety symptoms over time.

Table 2 Results from the lower level mediation models (level 1 = 180 observations, level 2 = 47 children) investigating treatment effects on anxiety outcomes

Effects	Standardized estimates for outcome variables (SE)			
	Generalized anxiety	Separation anxiety	Social phobia	Specific phobia
Fixed part				
Path c (X -> Y)				
Time	−1.30***	−1.36***	−0.73***	−1.71***
	(0.19)	(0.18)	(0.15)	(0.22)
Path a (X -> M)				
Perceived control	1.65***	1.65***	1.65***	1.65***
	(0.47)	(0.47)	(0.47)	(0.47)
Interpretation bias	−3.08***	−3.08***	−3.08***	−3.08***
	(0.42)	(0.42)	(0.42)	(0.42)
Avoidance	−0.15	−0.15	−0.15	−0.15
	(0.04)	(0.04)	(0.04)	(0.04)
Positive coping	−0.14	−0.14	−0.14	−0.14
	(0.09)	(0.09)	(0.09)	(0.09)
Paths b and c' (X -> M -> Y)				
Time	−0.76***	−1.00***	−0.42*	−1.07***
	(0.21)	(0.21)	(0.17)	(0.25)
Perceived control	−0.11***	−0.04	−0.07**	−0.11**
	(0.03)	(0.03)	(0.02)	(0.04)
Interpretation bias	0.15***	0.07*	0.07**	0.12**
	(0.03)	(0.03)	(0.03)	(0.04)
Avoidance	−0.63	0.28	−0.25	0.60
	(0.41)	(0.40)	(0.34)	(0.51)
Positive coping	0.01	0.19	0.09	-0.10
	(0.15)	(0.15)	(0.13)	(0.19)
Random part				
Children (level 2)	4.945	4.169	4.623	11.05
Repeated measures (level 1)	7.665	7.550	4.932	11.17
Indirect effects (95% CI)-				
Perceived control	−0.18	–	−0.12	−0.19
	(−0.34, −0.06)		(−0.24, −0.03)	(−0.38, −0.05)
Interpretation bias	−0.46	−0.22	−0.22	−0.37
	(−0.70, −0.26)	(−0.43, −0.05)	(−0.39, −0.07)	(−0.63, −0.1)

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Discussion

Although research has begun to examine the processes underlying therapeutic change produced by CBT in youth with anxiety disorders, the amount of studies on this important topic is still limited [5, 16, 18]. The present investigation examined the role of four possible mediators of therapeutic change, namely perceived control, coping strategies, and interpretation bias, in a cognitive-behavioral intervention for school aged children with anxiety disorders A longitudinal design was employed to examine the changes in these potential mediator variables as well as in the outcome variables (i.e., SCARED-R subscales). We were particularly interested whether the proposed mediators would play a differential role in distinct dimensions of anxiety symptoms, as suggested by Muris et al. [15].

The results first of all indicated that the group CBT intervention produced significant decreases in all types of children's anxiety disorders symptoms as well as robust changes in most of the hypothesized mediators (with positive coping being the exception). The observed significant changes in the mediators were in the expected direction: that is, perceived control was found to increase during the course of the intervention, while avoidant coping and interpretation bias decreased. The time patterns in the change of symptoms during the CBT intervention revealed that generalized anxiety disorder was only significantly reduced during the first half of the intervention, which suggests that the exposure component (which was added during the second

half of the treatment) had little effect on this type of anxiety symptom. All other anxiety dimensions continued to change significantly until the end of the intervention (social phobia) or even the follow-up (separation anxiety and specific phobia), that can suggest that exposure did yield an extra treatment effect in the case of these symptoms. These results make sense because the symptoms of generalized anxiety are more cognitive in nature, whereas the other anxiety symptoms also have a more clear-cut behavioral component. With regard to patterns in change of mediator variables, an interesting finding was documented: whereas perceived control and interpretation bias decreased over the full course of the intervention and even beyond, avoidance only displayed a reduction from pre-treatment to in-treatment, after which no longer significant change in this mediator variable was noted. Thus, the exposure component, which as noted earlier was only introduced in the second part of the intervention appeared to have little impact on the (further elimination of) avoidance behavior. This is in keeping with the notion that exposure mainly operates via cognitive processes [e.g., 43] and less by directly changing behavior.

Second and most importantly, multilevel analyses provided evidence for a model in which perceived control and interpretation bias accounted for the variability of most types of anxiety symptoms over time. By and large, these results are consistent with the findings of previous studies [14, 15, 17, 18] and also support theoretical models [6, 44] that emphasize the role of cognitive vulnerability in (childhood) anxiety. Of course, the clinical implication of this finding would be that promoting perceived control and correcting cognitive biases are important ingredients of CBT interventions for children with different anxiety problems.

Contrary to our hypotheses coping strategies did not emerge as significant mediators of anxiety symptoms over time. The result regarding avoidance is partly in line with Hogendoorn et al. [17] who noted that a decline in avoidant coping did not precede a decrease in anxiety symptoms, but rather the other way around, namely that a reduction in child-reported anxiety symptoms occurred *before* the decrease in avoidant coping. All these results are difficult to reconcile with the notion that the elimination of avoidance behavior by means of exposure tasks is an particularly important in CBT for children with anxiety disorders [18], and hence could lead to the impression that cognitive change is more vital during this type of intervention than behavioral change. However, before accepting this conclusion, we need to first consider other reasons for why avoidance in the studies conducted so far did not emerge as a mediator of therapeutic change produced by CBT. The most likely explanation has to do with the way avoidance has been measured in this research. That is, the Hogendoorn et al. [17] relied on a questionnaire measuring global avoidance tendencies, while the present study explored children's coping reactions in response to hypothetical scenarios. It seems preferable to employ a measure for assessing children's actual avoidance behavior in response to the specific stimuli that they fear. Therefore, the mediating role of avoidance during CBT should be further explored by means of more objective measures of avoidance (i.e., observations, idiosyncratic scale; [9]).

Our results also indicated that positive coping did not act as a significant mediator of anxiety symptoms over time, which is in contrast with Hogendoorn et al. [17] who did show that an increase in positive coping strategies preceded a reduction in anxiety symptoms. Again, assessment issues may have played an important role here. That is, the descriptive analysis revealed that the children in the present study at the beginning of the therapy already reported a high frequency of positive coping strategies in response to the hypothetical ambiguous situations described in the ASQ-C. In fact, initial levels of positive coping were so high that this variable was the only one that did not show improvement over the course of the CBT intervention, but rather displayed a (non-significant) decline. In the absence of variation and significant improvement in positive coping, it was of course not possible to demonstrate a mediation effect for this variable.

No evidence was found for the idea four mediators would play a differential role in the reductions observed for various types of anxiety symptoms, as was suggested by Muris et al. [15]. Instead, evidence was obtained that the various anxiety symptoms were all associated with the same mediator variables, namely perceived control and interpretation bias. In a sense, this result is hardly surprising given the high comorbidity rates among anxiety disorders that were observed in the present investigation. As a final attempt to test this 'specific mediator hypothesis', it might be worthwhile to conduct a comparable study in a clinical population, where comorbidity is of course also present but principal anxiety disorder symptoms might be more pronounced.

It should be acknowledged that the current study suffers from a number of limitations. First, although the study supports the existence of statistical effects for some of the proposed mediator variables, such evidence does not provide conclusive support regarding mechanisms of therapeutic change. Kazdin and Nock [45] argued that at least four criteria need to be fulfilled to consider a variable as a mechanism of change in psychotherapy: (a) there should be a strong association between the psychotherapeutic intervention and the hypothesized mechanism of change; (b) demonstration of the specificity of the association between the intervention, the proposed mechanism, and the outcome; (c) experimental work should be conducted to show that manipulation of the proposed causal agent is actually

associated with a change in the outcome of interest; and (d) the occurrence of change in the proposed mechanism should precede the change in the outcome. In a similar, Maric et al. [16] noted there are different levels on the mediation evidence ladder, and the findings obtained in the present study are situated at the lower, more initial level. In particular, the absence of a control group prevents the conclusion that the observed changes in the mediator and outcome variables are due to successful treatment. Although unlikely (as there are many studies showing that CBT is more effective than a waiting list control condition; [4]), the possibility cannot be ruled out that the positive effects merely reflect spontaneous recovery with the passage of time.

Second, although a longitudinal design with several assessment points was employed, the relatively small sample size limited the use of more sophisticated statistical analysis to examine temporal relationship between the change in proposed mediator variables and the change in outcome. Third, the mediators and outcomes measures were completed by children themselves. Although the child is generally considered as an important informant in the case of internalizing symptoms and cognitions, data may be biased due to shared method variance. This problem could be tackled in future research by using multiple informants as well as multiple indicators of mediating and outcome variables. Fourth, treatment integrity was only checked by means of clinician report. It would have been better if we had conducted a more objective assessment of the treatment integrity as this would have given the reader a better impression of the quality of the CBT intervention. Fifth, only a selected number of mediator variables were tested in this research, and so future studies need to explore other potential mechanisms that may underlie CBT, such as self-efficacy, other types of cognitive biases and so on. Sixth and finally, the sample was composed of non-treatment seeking children recruited via schools. Although they were all diagnosed with an anxiety disorder and displayed considerable comorbidity, it is not clear to what extent findings can be generalized to a clinical population.

In terms of clinical implications, this study is consistent with the results of previous studies that underline the importance of targeting cognitions in the intervention for children with anxiety disorders. Current CBT interventions (including the FRIENDS program) are aiming to correct cognitive biases by means of a Socratic dialogue (in older children) or self-instructional training (in younger children), and more recently bias modification trainings have been developed that specifically aim to decrease this anxiety-promoting cognitive variable [46–48]. The present findings suggest that it may be worthwhile to explore new therapeutic strategies that are effective to increase children's perceptions of control. CBT interventions indirectly promote perceived control by learning children a wide range of strategies that they can use in case they become anxious (e.g., relaxation, cognitive restructuring, problem solving), but there might also be ways to directly enhance this cognitive variable. Future research should be focused on how the effects of CBT for children with anxiety disorders can be promoted by giving more emphasis to the treatment components that produce more change in the mechanisms that are responsible for the observed treatment effects.

Summary

There is a strong evidence that CBT is an efficacious treatment for anxiety in treatment, although research studying the mechanisms of change that underlie these positive outcomes is still scarce. This study explored the role of four potential cognitive and behavioral mediators of therapeutic change in a cognitive-behavioral intervention for school-aged children with anxiety disorders. The change in mediators - interpretation bias, perceived control, avoidance and positive coping strategies - and outcome variables - generalized anxiety disorder, separation anxiety disorder, social anxiety disorder, and specific phobia—was analyzed through a longitudinal design with four assessment points: pretreatment, in-treatment, post-treatment, and at 4-months follow-up. The sample consisted of 47 children (8- to 12-year-old) with a principal DSM-IV diagnosis of an anxiety disorder that participated in a group cognitive-behavioral intervention. On each assessment point, self-report measures to assess the potential mediators—threat interpretations (ASQ-C), positive and avoidant coping strategies (ASQ-C), and perceived control (ACQ-C)—and the outcome measures—child-reported anxiety symptoms (SCARED-R)—were administered to the children. The results show that anxiety symptoms decreased and mediators showed the expected changes between the pre-treatment and post-treatment assessment, that is, perceived control increased during the course of the intervention, while avoidant coping and interpretation bias decreased. The results also showed that only the cognitive potential mediators (perceived control and interpretation bias), but not coping strategies (avoidance and positive coping strategies) explained a significant proportion in the variability of various types of anxiety symptoms. These results, although preliminary, support for the notion that these cognitive dimensions' can act as mechanisms of therapeutic change and that the promotion of perceived control and the reduction of cognitive biases are important targets of CBT interventions for children with various anxiety problems.

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Compliance with Ethical Standards

Ethical Approval All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation.

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

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