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Cognitive Biases in Childhood Anxiety Disorders: Do Interpretive and Judgment Biases Distinguish Anxious Youth from their Non-anxious Peers?

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Abstract

The purpose of this study was to compare interpretive biases (i.e., the tendency to interpret neutral stimuli in a negative way) and judgment biases (i.e., a lowered estimate of one's ability to cope with a threatening situation) in clinically anxious youth (n = 24) with a demographically matched group of non-referred youth (n = 48). Interpretive biases were assessed with the Children's Negative Cognitive Error Questionnaire (CNCEQ) and judgment biases were assessed with the Anxiety Control Questionnaire—child form (ACQ-C). Results indicated that (1) children in the clinic sample exhibited significantly more negative interpretive biases and less positive judgment biases relative to the control sample, (2) the ACQ-C demonstrated incremental validity over the CNCEQ in predicting diagnostic status, (3) the ACQ-C predicted diagnostic status while controlling for Generalized Anxiety Disorder symptoms and parent-reported internalizing and externalizing symptoms, (4) the relationship between the CNCEQ and diagnostic status was moderated by age and gender. Implications of the findings for theory and practice are discussed to highlight suggestions for future research and clinical practice.

Keywords

Cognitive Biases; Anxiety Control; Youth; Childhood Anxiety Disorders

Anxiety disorders are among the most common forms of emotional problems in youth, with estimates as high as 20% (Albano, Chorpita, & Barlow, 1996; Costello, Egger, & Angold, 2004). Theoretical models of development and maintenance of anxiety problems in childhood have suggested a need to better understand the cognitive dimension of anxiety among youth anxiety disorders (Alfano, Beidel, & Turner, 2002; Chorpita & Barlow, 1998; Vasey & Dadds, 2001). Cognitive and information processing models focus on the way that youth process information including attention toward threatening stimuli, the recall of past experiences, the interpretation of stimuli and situations, and the judgment of coping ability (Beck, 1976; Chorpita & Barlow, 1998; Ellis, 1962; Vasey & Dadds, 2001; Weems & Stickle, 2005; Weems & Silverman, 2006).

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Cognitive biases can be seen as broadly falling into one of four categories, namely, biased interpretation, biased judgment, biased memory and selective attention (see e.g., Vasey & MacLeod, 2001; Weems, Costa, Watts, Taylor, & Cannon, 2007; Weems & Watts, 2005). In this paper, the focus is on two types of cognitive biases—judgment biases (e.g., lowered estimates of the ability to control external threats and/or anxiety-related sensations) and interpretation biases (e.g., catastrophizing, overgeneralizing). In particular, anxious children are theorized to *interpret* ambiguous stimuli, situations and past experiences in a negative way (Barrett et al., 1996; Bogels & Zigterman, 2000; Spence, Donovan, & Brechman-Toussaint, 1999), and to have lowered *judgments* of their ability to deal with threatening/ negative events (e.g., see Chorpita & Barlow, 1998; Weems & Silverman, 2006).

In terms of interpretation biases, existing research has fairly consistently found that interpretive biases are correlated with anxiety symptoms in youth (Barrett, Rapee, Dadds, & Ryan, 1996; Chorpita et al., 1996; Epkins, 1996; Leitenberg, Yost, & Carroll-Wilson, 1986; Taghavi, Moradi, Neshat-Doost, Yule, & Dalgleish, 2000; Weems et al., 2001; Weems et al., 2007). The Children's Negative Cognitive Error Questionnaire [CNCEQ; Leitenberg et al., 1986] has been one of the most common ways to assess interpretation biases as cognitive errors—such as, catastrophizing (e.g., interpreting an event or situation in the worst possible manner) and overgeneralization (e.g., interpreting one negative event as indicative of all future similar events). Results from several studies have indicated that interpretive biases are significantly associated with self-reported anxiety symptoms (Epkins, 1996; Leitenberg et al., 1986; Weems et al., 2001; 2007). However, while there is some evidence that children meeting diagnostic criteria and non-anxious comparison youth do differ in interpretation biases using various methods (Barrett et al., 1996; Bogels & Zigterman, 2000; Spence et al., 1999) the ability of the CNCEQ to discriminate anxiety disordered youth from non-anxious youth has not yet been tested. Moreover, reviews of the literature have called for additional evidence that interpretive biases can serve to differentiate these youth from non-anxious youth (Alfano et al., 2002).

In terms of judgment biases, *control* involves a judgment of one's coping abilities and has often been used as a way to measure judgment biases (see Weems et al., 2007 for an expanded discussion of conceptual distinctions). Barlow's (1988; 2002) model of anxiety proposes that an individual's judgment that they lack control over external threats (i.e., events, objects, or situations that are fear producing) and/or negative, internal emotional and bodily reactions is a major part of why anxiety is a "problem". Weems and colleagues (2003) developed the Anxiety Control Questionnaire for Children (i.e., the ACQ-C modified version of the adult questionnaire ACQ; Rapee et al., 1996) to test Barlow's theory and found that clinically anxious children had lower perceived control over anxiety compared to non-anxious children. Additionally, the authors found that anxiety control beliefs predicted anxiety disorder status while controlling for another measure of control (i.e., the Nowicki-Strickland Locus of Control Scale (NSLOC; Nowicki & Strickland, 1973)). In another study, Weems and colleagues (2007) have found that judgment biases (measured by the ACQ-C) were significantly associated with self-reported anxiety levels while controlling for CNCEQ scores in a community sample of youth. However, the incremental validity of the ACQ-C and CNCEQ in predicting anxiety disorder status could not be assessed.

In sum, there is evidence to suggest that both interpretive biases (measured with the CNCEQ) and judgment biases (measured with the ACQ-C) are related to levels of self-reported anxiety symptoms in youth (Epkins, 1996; Leitenberg et al., 1986; Leung & Wong, 1998; Watts & Weems, 2006; Weems et al., 2001; Weems et al., 2003; Weems et al., 2007). However, it is unclear if CNCEQ scores and limited evidence that ACQ-C scores discriminate clinically anxious youth from non-anxious youth. Theoretically, the two are distinct cognitive features of anxiety disorders (Beck, 1976; Barlow, 2002; Weems & Watts,

2005) and evidence suggests that they each incrementally predict self-reported anxious symptoms in youth (Weems et al., 2007). However, research is needed to examine if CNCEQ scores and ACQ-C scores independently discriminate clinically anxious youth from non-anxious youth, as predicted by theory (Barlow, 2002; Beck, 1976; Weems & Watts, 2005).

Research has found evidence for age moderating the association between anxiety and CNCEQ scores (Weems et al., 2001). Research comparing youth meeting diagnostic criteria for anxiety disorders with non-referred youth may help clarify if (and how) age and gender influence the association between CNCEQ and ACQ-C scores and anxiety. Age and gender differences were examined in the original study in which the CNCEQ was developed (Leitenberg et al., 1986). While there were no differences for gender, younger children (fourth graders) scored significantly higher on the CNCEQ compared to both sixth graders and eighth graders. In addition, there is some evidence that age may play a role in the association between CNCEQ scores and anxiety. For example, Weems et al. (2001) examined whether age and gender moderated the association between interpretive biases (as measured by the CNCEQ) and anxiety (as measured by the Revised Children's Manifest Anxiety Scale (RCMAS; Reynolds & Richmond, 1978) and the State Trait Anxiety Inventory for Children—Trait Version (STAIC-T; Spielberger, 1973). Overall, cognitive errors were more strongly related to anxiety levels in older youth. However, they did not find that gender moderated the link between self-reported anxiety and CNCEQ scores. Age and gender have not been found to moderate associations between the ACQ-C and anxiety.

It was hypothesized that (1) CNCEQ and ACQ-C scores will show that youth with anxiety disorders will have a greater tendency toward interpretive biases and lower perceived anxiety-related control (judgment biases) compared to the control sample. That is, youth meeting diagnostic criteria for anxiety disorders should, theoretically, have a significantly higher mean score on the CNCEQ and a significantly lower mean score on the ACQ-C relative to the control sample. It is also hypothesized that (2) CNCEQ scores and ACQ-C scores will each demonstrate incremental validity over each other in predicting diagnostic status given the theoretical uniqueness of the two constructs. Next, analyses tested if the CNCEQ and ACQ-C would predict diagnostic status beyond measures of general anxiety and externalizing symptoms to control for possible confounding of findings due to comorbidity patterns. Lastly, (4) analyses will test whether age and gender moderate the associations between diagnostic status and the two cognitive biases.

Method

Participants

Children in the clinic sample were referred from various sources including area schools and mental health clinics and from screenings conducted in the research laboratory. From this subject pool, 24 participants met criteria to comprise the anxiety disorder group. These children each met criteria for an anxiety disorder as assessed by the Anxiety Disorders Interview Schedule for DSM-IV (ADIS see below). That is, each diagnosed disorder is given a "Clinician Severity Rating," which is based on the interviewer's clinical judgment and the information obtained from the child and parent, and most of these youth (75%) have an anxiety disorder considered the most clinically "severe," relative to other diagnoses (Albano & Silverman, 1996). Six children (25%) had an anxiety disorder and an externalizing disorder with equal severity ratings.[1] Diagnoses of the clinic sample are

[1]These 6 youth did not differ from other youth in the clinic sample on any of the measures used in the present study (i.e., CNCEQ, ACQ-C, RCADS-GAD, CBCL internalizing and externalizing scales), and the pattern of results from the main analyses of the study remained the same if they were excluded from the analyses.

delineated in Table 1. All but one child in the clinic sample had comorbid diagnoses. The average number of anxiety disorders met was 3. The first half of Table 1 classifies all clinic youth (n = 24) in terms of clusters of diagnoses (i.e., anxiety disorders, externalizing disorders, affective disorders). The second half of Table 1 lists the number of clinic youth who met criteria for each disorder evaluated by the ADIS.

Each child in the clinic sample (n = 24) was matched with two controls, thus the control sample is comprised of 48 participants. Youth in the control sample were recruited for a study on youth feelings and emotions (e.g., Weems & Costa, 2005; Cannon & Weems, 2006). Participants received a small monetary reward as compensation for participating in the research study. Children were excluded if parents indicated that the child had a history of one or more of the following diagnoses—all pervasive developmental disorders, mental retardation, selective mutism, organic mental disorders, schizophrenia, and other psychotic disorders, or were at risk for harm to self or others. Furthermore, in order to be included in the control sample for the present study, youth had to have scores on the internalizing and externalizing scales of the Child Behavior Checklist (CBCL; Achenbach, 1991) in the non-clinical range.

Variables used to match participants were age, gender, ethnicity, and family income level. Both samples are comprised of children ages 7-17 and one parent for each child (father or mother). The mean age of the clinic sample is 11 years and of the control sample is 11 years. The demographics of each sample are described in Table 2. As shown, matching produced very homogeneous groups in terms of demographics with only slight variation in income; no differences approached statistical significance.

Measures

The Anxiety Disorders Interview Schedule for DSM-IV: Child and Parent versions (ADIS-C and ADIS-P, respectively; Silverman & Albano, 1996) was administered to all children and parents in the clinic sample to determine diagnostic status. The ADIS-C and ADIS-P are semi-structured interviews focused on the anxiety disorders, but do allow for the assessment and diagnosis of other major childhood disorders, including the externalizing and affective disorders, according to DSM-IV criteria (American Psychiatric Association, 1994). The authors of the ADIS recommend administration of both the child and parent interviews in order to obtain a composite diagnosis (Albano & Silverman, 1996). The interviewer assesses diagnostic criteria of each disorder as well as an “interference” rating, in which the interviewee rates the level of functional impairment that the disorder is presently causing on a scale from 0 (the disorder has not interfered in the child’s life) to 8 (the disorder has interfered very, very much). For each of the diagnoses met, the interviewer assigns a “Clinician Severity Rating” on the same scale from 0 to 8 based on clinical judgment and the degree of interference. As recommended in the ADIS manual (Albano & Silverman, 1996) the higher of the two (parent and child) reporters’ ratings were used to assign diagnoses. In this sample, parents and children agreed that the child had an anxiety disorder on 18 of the 24 anxiety disorder cases (for 4 cases only the ADIS child interview met diagnostic criteria and in 2 cases only the ADIS parent interview met).

Diagnostic interviews were conducted by either a post-doctoral psychologist or advanced graduate students in psychology. All graduate students who conducted interviews had completed at least two graduate-level courses in psychological assessment. For the majority of clinic participant interviews (92%), the ADIS-C and ADIS-P were conducted by the same clinician. Diagnosticians were trained by observing videotaped interviews and were required to arrive at 100% agreement on at least two observed interviews before conducting an ADIS on their own. For the current study, 25% of the clinic sample (n = 6) was examined for reliability of the diagnoses. An interviewer blind to the diagnostic status of the child

watched the full videotaped interview and coded a copy of the ADIS for diagnoses. The agreement between two interviewers on anxiety disorder and other diagnoses on these cases was 100%.

The Children's Negative Cognitive Error Questionnaire (CNCEQ; Leitenberg et al., 1986) was used to measure interpretive biases. The CNCEQ is a 24-item measure with items to assess cognitive errors—namely, catastrophizing, overgeneralization, personalizing, and selective abstraction. The CNCEQ can be used to obtain a "total cognitive distortion score" as well as subscale scores for each type of cognitive error (Leitenberg et al., 1986). Each item proposes a hypothetical vignette and a negative interpretation of the vignette. The child is asked if he or she would interpret the hypothetical situation in the same way. The child rates on a five-point scale how similar the thought is to his/her own thought in response to the vignette. Four-week test-retest reliability for the CNCEQ total score was determined to be .65 ($p<.001$; Leitenberg et al., 1986). The authors reported internal consistency for the CNCEQ total score, using Cronbach's alpha, as .89 (Leitenberg et al., 1986). In the current study, Cronbach's alpha for the CNCEQ total scale was .87 for the clinic sample and .89 for the control sample.

The Anxiety Control Questionnaire—child form (ACQ-C; Weems et al., 2003) is a developmentally adapted version of the Anxiety Control Questionnaire (Rapee et al., 1996), a measure of control in anxiety disorders used with adults. The ACQ-C was used to assess perceived lack of control over external threats (e.g., feared objects or situations) and control over negative, internal, emotional, and bodily reactions associated with anxiety (e.g., heart racing, trembling). In the current study, judgment biases are operationalized as anxiety control beliefs using the ACQ-C. Children rate their agreement on a 5-point scale with each of the thirty items assessing control-related self-competencies. An example item is "When I am in a place that gets me nervous or afraid, I can take charge over and control my feelings." Weems et al. (2003) reported internal consistency estimates of the ACQ-C, using Cronbach's alpha, to be .94 and .93 in two independent samples. In the current study, Cronbach's alpha for the ACQ-C was .94 for the clinic sample and .95 for the control sample.

The Revised Child Anxiety and Depression scale (RCADS; Chorpita, Yim, Moffitt, Umemoto, & Francis, 2000) was used to measure symptoms of anxiety. The RCADS is a 47-item self-report questionnaire with each item scored on a 4-point scale. The symptoms measured by the RCADS are based on DSM-IV criteria for disorders. The authors have reported good convergent validity of the RCADS with other measures of childhood anxiety (Chorpita et al., 2000). Specifically, the GAD subscale was used as a covariate in the present study to test if CNCEQ and ACQ-C scores predicted anxiety disorder status beyond anxious affect. The GAD symptoms were used because they appear to best tap the general anxious affect component of anxiety disorders. Example items from this subscale are, "I worry that bad things will happen to me" and "I worry that something awful will happen to someone in my family." The RCADS GAD subscale evidenced adequate reliability in the clinic sample (Cronbach's alpha = .79) and the control sample (Cronbach's alpha = .74) of the present study.

The Child Behavior Checklist (CBCL; Achenbach, 1991) is a parent-report measure designed to assess the behaviors of youth ages 2 to 18. The internalizing scale was used to exclude potentially anxious youth from the control sample and externalizing scale of the CBCL was used as a covariate to test if CNCEQ scores and ACQ-C scores predicted diagnostic status beyond parent-reported externalizing symptoms. T-scores were calculated using normative data (Achenbach, 1991) and the clinical cutoffs recommended by Achenbach, Howell, Quay, and Conners (1991). All youth in the control sample were below

the clinical range on the internalizing scale. The CBCL has been widely used and has shown to have good reliability and validity (Achenbach, 1991).

Procedures

The assessment of the cognitive variables (interpretive biases, judgment biases) and the behavioral/affective variables were the same with both the clinic and non-clinic samples. The child and parent were greeted and given a general overview of the assessment procedures. Informed consent was obtained from the parent and informed assent from the child. Standardized specific instructions were given to the child and parent separately. The child completed the self-report measures in a separate room from the parent and was assisted as necessary by trained research assistants (e.g., a research assistant may have read each question to a young participant while monitoring the child's comprehension).

Participants recruited for the control sample were finished with the assessment after the questionnaires were completed and were given a small monetary reward. Participants in the clinic sample did not receive a monetary reward because they were referred to the research laboratory at UNO in order to receive a comprehensive psychological evaluation, supervised by a licensed psychologist, free of charge or on a sliding fee scale. Children in the clinic sample continued with the assessment by taking part in the diagnostic interview—children were administered the ADIS-C and parents the ADIS-P. The diagnostic interviews, like the questionnaires, were completed with the parent and child in separate rooms.

Results

Before conducting the main analyses of the study, descriptive and correlation analyses were run. Correlations among the cognitive measures, as well as the measures assessing anxiety, depression, and externalizing symptoms in the full sample are presented in Table 3. Means and standard deviations of all measures for the clinic sample and the control sample are presented in Table 4. Examination of the scores indicated acceptable ranges on all measures for the planned analyses. In addition, analyses of internal consistency were conducted. As reported in the Measures section, all measures showed acceptable internal consistency.

Hypothesis 1: Interpretive and judgment biases—anxious vs. non-anxious youth

In order to test the hypothesis that the clinic sample will have a greater tendency toward interpretive biases (as assessed by the CNCEQ) and lower perceived anxiety-related control (as assessed by the ACQ-C) compared to the control sample, groups were compared using two-tailed independent samples *t* tests. Children in the clinic sample scored higher on the CNCEQ relative to control children ($t(70) = 2.62$, $p<.05$), indicating more interpretive biases. Children in the clinic sample scored lower on the ACQ-C relative to control children ($t(70) = -3.80$, $p<.001$), indicating lower perceived anxiety-related control (i.e., more judgment biases). Clinic children also scored significantly higher on measures of anxiety (RCADS-GAD) and parent-reported internalizing and externalizing symptoms (CBCL internalizing and externalizing scales), as reported in Table 4.

Hypothesis 2: Incremental validity of CNCEQ and ACQ-C

Logistic regression (Tabachnick & Fidell, 2007) was used to test the hypothesis that the CNCEQ and ACQ-C scores would demonstrate incremental validity in predicting diagnostic status. In these logistic regression models, demographics were not used as covariates because the samples were matched on age, gender, ethnicity, and family income level and, thus, are not different on those variables. In the first analysis, anxiety disorder status was the dependent variable (coded as 1 for the control sample and 2 for the clinic sample), with CNCEQ scores and ACQ-C scores entered together as predictors. Overall classification

accuracy of the full logistic regression model was 76.4% and the model was significant, $\chi^2(2) = 15.72$, $p<.001$. In addition, the ACQ-C was a significant predictor while controlling for CNCEQ scores, Wald = 7.81, $p<.01$. However, the CNCEQ was not a significant predictor while controlling for ACQ-C scores (Wald = 2.48, p=.12).[2]

As a final test of the CNCEQ, subscale scores were used instead of the full scale. The CNCEQ can be used to assess four types of negative cognitive errors—catastrophizing (i.e., expecting an outcome to be catastrophic or misinterpreting an event as a catastrophe), overgeneralizing (i.e., believing that a single negative outcome is representative of all similar future experiences), personalizing (i.e., attributing control over negative outcomes to personal causes), and selective abstraction (i.e., selectively focusing on the negative aspects of experiences). And, these have been found to have some differentially strong associations with anxiety symptoms Epkins, 1996; Weems et al., 2001).

Four logistic regression analyses were run in which diagnostic status was used as the dependent variable, and the ACQ-C along with one CNCEQ subscale (at a time) were entered together as predictors. In the first model, the catastrophizing subscale and ACQ-C were entered together as predictors and the model was significant ($\chi^2(2) = 14.40$, $p<.01$). And, the ACQ-C (Wald = 9.26, $p<.01$) demonstrated incremental validity over the catastrophizing subscale (Wald = 1.22, $p=.27$). In the second model, the overgeneralizing subscale and ACQ-C were entered as predictors. Again, the model was significant ($\chi^2(2) = 22.32$, $p<.001$) and the ACQ-C (Wald = 6.17, $p<.05$) and overgeneralizing subscale (Wald = 7.57, $p<.01$) were both significant predictors. In the third model, the personalizing subscale and ACQ-C were entered as predictors. The overall model was significant ($\chi^2(2) = 13.22$, $p<.01$) and the ACQ-C (Wald = 9.86, $p<.01$) demonstrated incremental validity over the personalizing subscale (Wald = .03, $p=.86$). In the fourth model, the selective abstraction subscale and ACQ-C were entered as predictors. The model was significant ($\chi^2(2) = 14.65$, $p<.01$) and the ACQ-C (Wald = 7.96, $p<.01$) demonstrated incremental validity over the selective abstraction subscale (Wald = 1.46, $p=.23$).

To summarize, catastrophizing, personalizing, and selective abstraction subscales performed similarly to the CNCEQ total score (i.e., they did not demonstrate incremental validity over the ACQ-C). The overgeneralizing subscale, on the other hand, did demonstrate incremental validity over the ACQ-C and both were significant predictors in the model.

Hypothesis 3: Predicting diagnostic status beyond symptom measures

Given the evidence that the CNCEQ did not predict diagnostic status beyond that predicted by the ACQ-C, the ACQ-C was the focus of the next set of analyses. A series of sequential logistic regression analyses was used to test the hypothesis that the ACQ-C would predict diagnostic status while controlling for two covariates. Anxiety disorder status was used as the dependent variable. In each separate analysis, one covariate was put in the first block and the ACQ-C in the second block. Results are presented in Table 5. To summarize, the ACQ-C did predict diagnostic status while controlling for Generalized Anxiety Disorder symptoms (RCADS-GAD subscale) and parent-reported externalizing symptoms (CBCL externalizing scale).[3]

[2]In order to explore whether the interaction of the CNCEQ and ACQ-C may be a better predictor of diagnostic status, an interaction term of CNCEQ scores x ACQ-C scores was created in a sequential logistic regression model. Results indicated that this interaction term did not significantly predict diagnostic status beyond that predicted by the CNCEQ and ACQ-C (each entered individually in the model).

Hypothesis 4: Age and gender moderation

The moderating effects of age and gender were tested using moderated logistic regression analyses. It was examined whether age or gender moderated the relationship between interpretive biases (CNCEQ scores) and anxiety disorder status. In order to test gender as a potential moderator, anxiety disorder status was used as the dependent variable in the logistic regression model, then CNCEQ scores were entered into the first predictor block, gender into the second block, and the interaction term of gender x CNCEQ scores into the third block. Block 1 (CNCEQ scores) was significant ($\chi^2 = 6.42$, $p<.05$), and block 2 (gender) was not a significant step in the model ($\chi^2 = .01$, $p=.94$). Block 3 was a significant step in the model ($\chi^2 = 6.69$, $p<.05$), Wald = 5.71, $p<.05$ for the interaction term, indicating that gender did moderate the relationship between interpretive biases and diagnostic status.

In order to further explore the significant interaction, post-hoc probing was conducted, as recommended by Holmbeck (2002). Findings of the previous logistic regression analysis illustrated that the association between CNCEQ scores and diagnostic status is conditional on values of the moderator (gender); but, those analyses did not identify the specific conditions (males/females) by which CNCEQ scores are significantly related to diagnostic status (Holmbeck, 2002). This post-hoc analysis is based on Holmbeck's (2002) use of linear regressions for post-hoc probing, although the present study employs a logistic regression model due to the dichotomous nature of the dependent variable (clinic vs. control samples). To examine the conditions of the moderator, the effects of gender (moderator) on the relationship between CNCEQ scores (predictor) and diagnostic status (outcome) were tested. Results of post-hoc probing showed that the CNCEQ was a significant predictor of diagnostic status for females (Wald = 8.52, $p<.01$) but was not a significant predictor for males (Wald = .01, $p=.91$).

In order to test age as a potential moderator in a logistic regression model, anxiety disorder status was used as the dependent variable, then CNCEQ scores were entered into the first predictor block, age as a continuous variable into the second block, and the interaction term of age x CNCEQ scores into the third block; and, age was centered in order to reduce the effects of multicolinearity (Tabachnick & Fidell, 2007). Results indicated that block 1 (CNCEQ scores) was significant ($\chi^2 = 6.42$, $p<.05$), and block 2 (age) was not a significant step in the regression model ($\chi^2 = .31$, $p=.58$). Block 3 was a statistically significant step in the model ($\chi^2 = 5.36$, $p<.05$), Wald = 4.29, $p<.05$ for the interaction term, indicating that age did moderate the relationship.

Post-hoc probing of the significant interaction was conducted in the same way as with gender. To examine conditions of the moderator, the effects of age (moderator) on the association between CNCEQ scores (predictor) and diagnostic status (outcome) were tested. Because age is a continuous moderator, it was centered prior to conducting the analysis in order to reduce the effects of multicollinearity; and, this allowed for the creation of slopes (representing relationships between predictor and outcome) for values of the moderator one standard deviation above and below the mean (Holmbeck, 2002). The mean age of the full sample is 10.97 years and the standard deviation is 3.29 years. Results of post-hoc probing indicated that the CNCEQ significantly predicted diagnostic status for values of age one standard deviation above the mean (older children; Wald = 7.75, $p<.01$) but not for values of

[3]Due to the large amount of comorbid externalizing diagnoses of the clinic sample, it was explored whether the CBCL externalizing scale may function as a moderator on the relationships between the CNCEQ and diagnostic status and the ACQ-C and diagnostic status. Two sequential logistic regression analyses were run, for the CNCEQ and ACQ-C separately, to test whether the interaction term (CNCEQ scores x CBCL externalizing T-scores, ACQ-C scores x CBCL externalizing T-scores) predicted diagnostic status beyond that predicted by the cognitive measure and externalizing measure individually. Results indicated that the CBCL externalizing scale was not acting as a moderator on the relationship between CNCEQ scores and diagnostic status, nor on the relationship between ACQ-C scores and diagnostic status.

age one standard deviation below the mean (younger children; Wald = .10, p=.75). Results thus suggest that the predictive ability of the CNCEQ improved as a function of older age.[4]

In an additional set of logistic regression analyses, it was examined whether age or gender moderated the relationship between judgment biases (ACQ-C scores) and anxiety disorder status. These analyses were conducted in the same way as reported with the CNCEQ, and results indicated that neither age nor gender moderated the relationship.

Discussion

This study adds to the research literature by demonstrating that interpretive biases (operationalized as negative cognitive errors and measured by the CNCEQ) differentiate youth with anxiety disorders from non-anxious youth, as suggested by theory (Beck, 1976; Weems & Watts, 2005) but until now not empirically tested. This study also adds to the literature by incrementing evidence that judgment biases (operationalized as anxiety control beliefs and measured by the ACQ-C) differentiate youth with anxiety disorders from non-anxious youth (Weems et al., 2003). It is also the first study to demonstrate significant differences in both types of cognitive biases across a sample of youth with anxiety disorders and a comparison sample matched on age, gender, ethnicity, and family income level. These results suggest that youth with anxiety disorders are more likely to have interpretive and judgment biases than their non-anxious peers.

Results add a congruent line of evidence to research showing a link between anxiety problems and interpretive and judgment biases in terms of the extant research showing that these biases are linearly related to anxiety symptoms in youth (Epkins, 1996; Leitenberg et al.,1986; Leung & Wong, 1998; Watts & Weems, 2006; Weems et al., 2001; Weems et al., 2003; Weems et al., 2007). Furthermore, while several of the previous studies used youth with non-clinical levels of anxiety and demonstrated relationships between cognitive biases and anxious symptoms, rather than diagnoses (Leitenberg et al., 1986; Watts & Weems, 2006; Weems et al., 2007), the present study was able to demonstrate differences in the cognitive biases by diagnostic status. While the results are consistent with theory, results also suggest that not every youth with an anxiety disorder exhibits more interpretive and judgment biases compared to their non-anxious peers (the role of moderators will be discussed) and results of the incremental analyses were mixed. Results do suggest, though, that youth with anxiety disorders are more likely to score higher on the measures of these biases.

In examining the incremental validity of the CNCEQ and the ACQ-C, it was found that the ACQ-C predicted anxiety disorder status while controlling for the CNCEQ, but the CNCEQ did not predict anxiety disorder status while controlling for the ACQ-C. Although previous research has demonstrated the incremental validity of both the CNCEQ and ACQ-C in predicting anxious symptoms in a community sample (Weems et al., 2007), in the present study the full scale CNCEQ did not significantly add to the prediction of diagnostic status beyond that predicted by the ACQ-C. A number of reasons may account for this finding. The first is that a perceived lack of control over external threats and/or negative internal emotional and bodily reactions (i.e., judgment bias) is a more salient feature in the

[4]Due to the lack of incremental validity of the CNCEQ over the ACQ-C, it was explored whether the interaction terms (gender x CNCEQ scores, age x CNCEQ scores, as created in the previous logistic regression analyses) significantly predicted diagnostic status beyond that predicted by the ACQ-C. Results indicated that neither interaction term was a significant predictor while controlling for the ACQ-C. Also due to the large amount of comorbid externalizing diagnoses of the clinic sample, it was also explored whether these interaction terms (gender x CNCEQ scores, age x CNCEQ scores) significantly predicted diagnostic status beyond that predicted by the CBCL externalizing scale. Results indicated that these interaction terms remained significant while controlling for the CBCL externalizing scale.

experience of an anxiety disorder relative to interpreting neutral stimuli in a negative way (i.e., interpretive bias). The clinic and control samples did significantly differ on CNCEQ scores, but this group difference was not as large as that with the ACQ-C (Cohen's d = .63 for CNCEQ, −.91 for ACQ-C).

Another explanation may be that the ACQ-C is a better specific predictor of anxiety than the CNCEQ. Evidence and theory suggests there may be content specificity in the type of cognitions that differentiate individuals with emotional disorders (Beck, 1976; Laurent & Stark, 1993; Leung & Poon, 2001; Weems et al., 2007). That is, the cognitive processes (e.g., to catastrophize, to overgeneralize) may not show specificity to different psychological disorders; the content of the cognitive schemas (e.g., loss/failure, fear of harm) may be more important (Beck & Emery, 1985; Beck, Rush, Shaw, & Emery, 1979). The content of the ACQ-C is focused on anxiety-related events and sensations and may, thus, be a better specific predictor of anxiety. The vignettes of the CNCEQ, on the other hand, primarily involve events of loss and failure (Leung & Wong, 1998) and, due to its content, may not be as effective at predicting membership in an anxiety disordered sample compared to the ACQ-C. However, some evidence of incremental validity was found using the subscales of the CNCEQ.

In terms of incremental validity with the ACQ-C, the overgeneralizing subscale performed differently compared to the CNCEQ total score. Results of logistic regression analyses indicated that the overgeneralizing subscale did demonstrate incremental validity over the ACQ-C in predicting diagnostic status. The tendency to overgeneralize (i.e., to believe that a single negative outcome is representative of all similar future experiences) may be a more important cognitive feature in distinguishing clinically anxious youth compared to the other types of negative cognitive errors. While the relatively small size of the clinic sample should be considered and these analyses should be replicated with a larger sample of youth with anxiety disorders, the results pointing to differential findings depending on the use of CNCEQ subscale scores are consistent with past research showing differential associations with aspects of anxiety and depression (Epkins, 1996; Leung & Wong, 1998; Weems et al., 2001; Weems et al., 2007).

While present results were consistent in part with past research, the pattern of linkages between anxiety and CNCEQ subscales has not always been consistent. For example, in a community sample of youth, Epkins (1996) used the Social Anxiety Scale for Children—Revised (SASC-R; La Greca & Stone, 1993) and the Children's Depression Inventory (CDI; Kovacs, 1981, 1992) to form groups of socially anxious children and dysphoric children, and found that the overgeneralizing and personalizing subscale scores were significantly higher in the social anxiety group compared to the dysphoric group. In a clinic referred sample of youth, Weems et al. (2001), found that the overgeneralizing subscale was the best predictor of trait anxiety (as measured by the State-Trait Anxiety Inventory for Children—trait scale (STAIC; Spielberger, 1973)), while the selective abstraction subscale was the best predictor of depression (as measured by the CDI). So, while there seems to be some specificity in terms of subscales' links to anxiety, there also seems to be considerable sample variation. Thus, the results of the present study on the CNCEQ need to be understood in light of the moderators of the CNCEQ.

This study also adds to the research literature by describing the effects of age and gender on the relationships between interpretive and judgment biases and diagnostic status. Moderating effects were found for the CNCEQ but not for the ACQ-C. Results are consistent with previous research using the ACQ-C in finding that neither gender nor age had an effect on the relationship between judgment biases and anxiety in youth (Weems et al., 2003; Weems et al., 2007). Regarding the effects of age and gender on CNCEQ scores, previous findings

have been mixed (e.g., Weems et al., 2001; Weems et al., 2007). Results from the present study show that both age and gender moderated the relationship between CNCEQ scores (interpretive biases) and anxiety disorder status. This finding is partially in contrast to Weems et al. (2001), who found that age but not gender moderated the relationship between interpretive biases and self-reported anxiety symptoms in a clinically anxious sample of youth; and, it is in contrast to Weems et al. (2007), who found that neither age nor gender moderated the relationship between interpretive biases and self-reported anxiety symptoms in a community sample of youth. However, the present study differs from both of the previously mentioned studies (Weems et al., 2001; Weems et al., 2007) in that it tested moderation on the relationship between interpretive biases and diagnostic status, not self-reported anxiety symptoms.

Regarding the influence of gender, results suggested that CNCEQ scores are significantly related to diagnostic status for females but not males. As mentioned previously, CNCEQ scores did not predict diagnostic status beyond that predicted by the ACQ-C and may not be as salient in the experience of clinical anxiety. Perhaps this is true in the experience of clinical anxiety for males. That is, male youth with anxiety disorders may not be characterized by a tendency toward interpretive biases; this may be more of a characteristic of female youth with anxiety disorders. Research has shown that there is approximately a 2:1 girl to boy ratio for anxiety disorders (Costello et al., 2004) and that girls report more fears than boys (Ginsburg & Silverman, 2000; Ollendick, King, & Frary, 1989; Ollendick, Langley, Jones, & Kephart, 2001; Ollendick, Matson, & Helsel, 1985). It may be possible that biased ways of thinking and, specifically, interpretive biases could occur more often in anxious females and contribute to the increased rates of anxiety in girls. With inconsistencies in the literature regarding sex differences in the occurrence of interpretive biases in anxious youth (Leitenberg et al., 1986; Weems et al., 2001; Weems et al., 2007), the effects of moderation on the CNCEQ should be tested in future studies using larger samples of youth with anxiety disorders.

Regarding the influence of age, findings suggest that CNCEQ scores are significantly related to diagnostic status for older children but not younger children. That is, the CNCEQ may be better able to predict diagnostic status in samples of older children. Furthermore, while there was not a significant difference across the age groups on the total amount of negative cognitive errors made (i.e., CNCEQ total scores), age was negatively linearly (as a continuous variable) associated with CNCEQ scores (Table 3). Together, the age findings are consistent with other studies in which younger children (in community and clinic samples) tend to report more interpretive biases (Leitenberg et al., 1986) but these biases tend to be less associated with anxiety levels (Weems et al., 2001). Thus, the interpretive biases exhibited by younger children may not be indicative of anxious symptoms or anxiety disorders, but of normal cognitive development (Weems et al., 2001). When older children report interpretive biases, it may be more strongly related to clinical levels of anxiety.

The present study also assessed ability of the ACQ-C to predict diagnostic status beyond measures of anxiety and externalizing symptoms. The ACQ-C did predict diagnostic status beyond the RCADS-GAD subscale—a measure of DSM-based Generalized Anxiety Disorder symptoms, indicating that judgment biases distinguished the anxious children from the non-anxious children while controlling for self-reported symptoms of anxiety. This is particularly relevant because GAD was the most common anxiety diagnosis of the clinic sample. In addition, due to the comorbid diagnoses of the clinic sample, especially ADHD, the CBCL externalizing scale was also used as a covariate and results show that the ACQ-C did predict diagnostic status while controlling for parent-reported externalizing symptoms and behaviors.

This study is limited by the small size of the clinic sample and their varied comorbid diagnoses. A larger clinic sample as well as a sample of youth with anxiety disorders only may have increased the predictive abilities of the CNCEQ and ACQ-C. However, comorbidity is, in general, more the rule than the exception in childhood (Costello et al., 2004). The generalizability of these findings to other types of clinic samples is unknown. Future studies would benefit from including a sample of youth with anxiety disorders as well as a sample with externalizing disorders and a sample with affective disorders. Another limitation is the cross-sectional nature of the present study. It is unclear whether interpretive and judgment biases are predictive of anxiety disorders in youth or simply associated with them. In addition, two other types of cognitive biases—attention and memory biases—were not assessed in the present study. Research is needed to investigate the relationships among interpretive, judgment, attention, and memory biases in samples of youth with anxiety disorders. Finally, self-report was the only method used to assess cognitive biases.

Despite its limitations, this study shows that interpretive and judgment biases are a significant part of the experience of anxiety disorders for many youth. These biases, which are not typically evaluated by commonly used measures of anxious symptoms or by DSM-based clinical interviews, may be important in choosing treatment methods that are best matched to the individual's unique characteristics. Efficacy of Cognitive Behavioral Therapy over the past decade points to the usefulness of addressing faulty or biased ways of thinking in anxious youth. In addition to changing negative cognitive errors, which some cognitive behavioral interventions may already focus on, it would likely be beneficial to also address anxiety control beliefs and foster a positive sense of control in anxious children.

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Table 1

Diagnoses of the clinic sample

Clinic Sample (*n* = 24)		
Anxiety disorder(s) only	3	(12.5%)
Anxiety and externalizing disorder(s)	11	(45.8%)
Anxiety and an affective disorder	1	(4.2%)
Anxiety and externalizing disorder(s) and an affective disorder	9	(37.5%)

Number of youth meeting diagnosis for:		
Generalized Anxiety Disorder	19	(79.2%)
Specific Phobia	16	(66.7%)
Social Phobia	14	(58.3%)
Separation Anxiety Disorder	11	(45.8%)
Obsessive-Compulsive Disorder	6	(25.0%)
Posttraumatic Stress Disorder	4	(16.7%)
Panic Disorder	2	(8.3%)
Agoraphobia	1	(4.2%)
Attention-Deficit/Hyperactivity Disorder	19	(79.2%)
Oppositional Defiant Disorder	6	(25.0%)
Conduct Disorder	0	
Dysthymia	7	(29.2%)
Major Depressive Disorder	3	(12.5%)

Note: Externalizing disorder(s) includes Attention-deficit/hyperactivity disorder or Oppositional defiant disorder. Affective disorder includes Major depressive disorder or Dysthymia.

Table 2

Demographic information for the clinic and control samples

		Clinic Sample, *n* = 24 (%)	**Control Sample, *n* = 48 (%)**
Age	7-11 years old	54.2	54.2
	12-17 years old	45.8	45.8
Sex	Female	54.2	54.2
	Male	45.8	45.8
Ethnicity	Black	29.2	33.3
	White	58.3	58.3
	Hispanic	0	2.1
	Other	12.5	6.2
Family Income Level	$0 - $11,999	16.7	12.5
	$12,000 - $20,999	4.2	8.3
	$21,000 - $30,999	12.5	25.0
	$31,000 - $40,999	12.5	6.2
	$41,000 - $50,999	29.2	12.5
	Over $51,000	25	35.4

Table 3

Correlations among Cognitive and Symptom Measures

	CNCEQ	ACQ-C	RCADS-GAD	CBCL-ext
CNCEQ				
ACQ-C	−.33**			
RCADS-GAD	.26*	−.48**		
CBCL-ext	.15	−.06	−.08	
Age	−.25*	−.01	.15	.09

CNCEQ = Children's Negative Cognitive Error Questionnaire, ACQ-C = Anxiety Control Questionnaire—child form, RCADS-GAD = Revised Child Anxiety and Depression Scales—Generalized Anxiety Disorder subscale, CBCL-ext = Child Behavior Checklist externalizing scale T-score.

* $p<.05$

** $p<.01$

Table 4

Summary of comparisons of the clinic and control samples

	Clinic Sample *M* (*SD*)	Control Sample *M* (*SD*)	*t*	*p*	Cohen's *d*
CNCEQ	57.20 (16.29)	46.81 (15.63)	2.62	.011	.63
ACQ-C	51.82 (25.28)	75.71 (25.06)	−3.80	.000	−.91
RCADS—GAD	14.58 (4.38)	10.48 (3.13)	4.57	.000	1.09
CBCL—internalizing	56.50 (17.36)	47.88 (9.60)	2.72	.008	.65
CBCL—externalizing	54.75 (12.78)	48.52 (7.96)	2.54	.013	.61

CNCEQ = Children's Negative Cognitive Error Questionnaire, ACQ-C = Anxiety Control Questionnaire—child form, RCADS-GAD = Revised Child Anxiety and Depression Scales—Generalized Anxiety Disorder subscale, CBCL—internalizing = Child Behavior Checklist internalizing scale T-score, CBCL—externalizing = Child Behavior Checklist externalizing scale T-score, Cohen's *d*, effect size statistic.

Table 5

Summary of logistic regression analyses predicting anxiety disorder status with ACQ-C scores, controlling for anxiety and other symptoms

Variables	Model χ^2	Model *p*	Wald	Odds Ratio	95% Confidence Interval	
					Lower	Upper
Model 1: ACQ-C predicting beyond RCADS-GAD subscale						
1. GAD	17.69	.000	12.13**	.74	.62	.88
2. GAD	22.72	.000	7.75**	.77	.64	.93
ACQ-C			4.57*	1.03	1.00	1.06
Model 2: ACQ-C predicting beyond CBCL externalizing scale						
1. CBCL-ext	6.18	.013	5.48*	.94	.89	.99
2. CBCL-ext	18.44	.000	4.63*	.94	.89	.99
ACQ-C			9.70**	1.04	1.01	1.06

ACQ-C = Anxiety Control Questionnaire—child form, GAD = Revised Child Anxiety and Depression Scales—Generalized Anxiety Disorder subscale, CBCL—ext = Child Behavior Checklist externalizing scale T-score, Note: A Wald test is used to test the statistical significance of each coefficient in the model

* $p<.05$

** $p<.01$