Development and Psychopathology **25** (2013), 683–697
© Cambridge University Press 2013
doi:10.1017/S0954579413000102

Dynamic temporal relations between anxious and depressive symptoms across adolescence

CHRYSTYNA D. KOUROS, SUSANNA QUASEM, AND JUDY GARBER
Vanderbilt University

Abstract

Symptoms of anxiety and depression are prevalent among adolescents and associated with impairment in multiple domains of functioning. Moreover, anxiety and depression frequently co-occur, with estimated comorbidity rates as high as 75%. Whereas previous research has shown that anxiety symptoms predict increased depressive symptoms over time, the relation between depressive symptoms and later anxiety symptoms has been inconsistent. The present study examined dynamic relations between anxiety and depressive symptoms across adolescence and explored whether these longitudinal relations were moderated by maternal history of anxiety, family relationship quality, or children's attributional style. Participants included 240 children (M age = 11.86 years; 53.9% female) and their mothers, who were assessed annually for 6 years. Children reported on their depressive symptoms and mothers reported on their child's anxiety symptoms. Dynamic latent change score models indicated that anxiety symptoms predicted subsequent elevations in depressive symptoms over time. Depressive symptoms predicted subsequent elevations in anxiety symptoms among children who had mothers with a history of anxiety, reported low family relationship quality, or had high levels of negative attributions. Thus, whereas anxiety symptoms were a robust predictor of later depressive symptoms during adolescence, contextual and individual factors may be important to consider when examining relations between depressive symptoms and subsequent change in anxiety symptoms.

Symptoms of anxiety and depression are prevalent in children and adolescents and are associated with significant impairment in multiple domains, including social and academic functioning, poor peer and family relationships, alcohol and drug use, suicidal behavior, and risk for adult psychopathology (Axelson & Birmaher, 2001; Birmaher et al., 1996; Costello, Foley, & Angold, 2006). Anxiety and depression frequently co-occur. Approximately 25% to 50% of children with depression have a comorbid anxiety disorder, and 10% to 15% of children with anxiety have comorbid depression (Axelson & Birmaher, 2001). Costello, Mustillo, Erkanli, Keeler, and Angold (2003) estimated that comorbidity rates may be as high as 75%. Thus, epidemiological studies highlight that lifetime and concurrent comorbidity between symptoms of anxiety and depression are more likely than not. Questions remain, however, regarding how the presence of one disorder is related to the longitudinal course of the other disorder. The present study examined whether symptoms of anxiety and depression predicted subsequent changes in each other across adolescence.

Anxiety typically predates depression in most comorbid cases (e.g., Axelson & Birmaher, 2001; Kovacs, Gatsonis, Paulauskas, & Richards, 1989), leading researchers to posit that anxiety may be a vulnerability factor for developing subsequent depression (Avenevoli, Stolar, Li, Dierker, & Merikangas, 2001; Flannery-Schroeder, 2006; Merikangas, 1990; Seligman & Ollendick, 1998). Specifically, the behavioral and cognitive manifestations of anxiety may develop into patterns of behavior that place children at risk for developing symptoms of depression (Garber, 2007). For example, anxious children may withdraw from others, resulting in greater social isolation, peer rejection, and a decreased sense of self-competence. Impaired social competence, in turn, predicts increased risk for depression (e.g., Cole, Martin, Powers, & Truglio, 1996).

Longitudinal studies also have shown that anxiety predicts *increased* levels of depressive symptoms over time (e.g., Cole, Peeke, Martin, Truglio, & Serocynski, 1998; Keenan, Feng, Hipwell, & Klostermann, 2009; Reinherz et al., 1989; Snyder et al., 2009). Cole et al. (1998) examined longitudinal relations between anxiety and depressive symptoms over a 3-year period among children in third and sixth grades. Using an autoregressive cross-lag model, they found that anxiety predicted higher levels of subsequent depressive symptoms, based on both child and parent reports of children's symptoms. In a study using teachers' reports of children's

This work was supported in part by grants from the National Institute of Mental Health (R29 MH454580, K02 MH66249), the NICHD (P30HD15052), and a Faculty Scholar Award (1214-88) and grant (173096) from the William T. Grant Foundation. The first author was supported in part by an NIMH training grant (T32-MH18921) during preparation of this manuscript. We appreciate the cooperation of the Nashville Metropolitan School District, Drs. Binkley and Crouch, and we especially thank the parents and children who participated in the project. We also acknowledge Dr. Emilio Ferrer for his helpful guidance on data analyses.

Address correspondence and reprint requests to: Chrystyna D. Kouros, Department of Psychology, Southern Methodist University, P.O. Box 750442, Dallas, TX 75275; E-mail: ckouros@smu.edu.

https://doi.org/10.1017/S0954579413000102 Published online by Cambridge University Press

symptoms, Snyder et al. (2009) also found that anxiety symptoms predicted higher levels of depressive symptoms over time. Keenan et al. (2009) examined longitudinal relations between depressive symptoms and both social anxiety and generalized anxiety disorders (GAD) in a sample of 6- to 12-year-old girls. They found that changes in depressive symptoms over time were best accounted for by previous levels of depression, but social anxiety and GAD also predicted higher levels of depressive symptoms in the following year.

Evidence of the reverse relation, that is, between depression and later anxiety, has been less consistent. Two large epidemiological studies, the Great Smokey Mountains Study (Costello et al., 2003) and the Dunedin Multidisciplinary Health and Development Study (Moffitt et al., 2007), reported that depression preceded anxiety just as often as anxiety preceded depression. Pine, Cohen, Gurley, Brook, and Ma (1998) found that major depression in adolescence predicted an increased likelihood of developing GAD in adulthood even after adjusting for various demographic factors. Cole et al. (1998), however, failed to find a significant relation between child-reported depressive symptoms and subsequent anxiety symptoms. Other studies have found a negative relation between depression and later anxiety over time. Both parent reports (Cole et al., 1998) and teacher reports (Snyder et al., 2009) of children's depressive symptoms have been found to be related to *decreases* in anxiety symptoms over time. In sum, research indicates that whereas anxiety is a robust predictor of subsequent increases in depressive symptoms, the relation of depressive symptoms to later anxiety symptoms is less clear. The first goal of the current prospective study was to test dynamic, temporal relations between anxious and depressive symptoms in adolescents; that is, how do symptoms of anxiety and depression simultaneously predict changes in each other over time?

Moderators of the Relation Between Anxious and Depressive Symptoms

Some of the inconsistency in the literature regarding the longitudinal link between depressive and anxious symptoms may be because other variables that moderate these relations have not been examined. Both anxiety and depression in youth are associated with a variety of contextual and individual factors. In particular, parental psychopathology, the family environment, and cognitive style consistently have been implicated as risks that affect the onset and course of both anxious and depressive symptoms (e.g., Birmaher et al., 1996; Brozina & Abela, 2006; Rapee, 1997; Weissman, Leckman, Merikangas, Gammon, & Prusoff, 1984). Few studies, however, have examined whether such risk factors are related to the temporal associations between anxiety and depression. Moffitt et al. (2007) showed that adults with both major depression and GAD were especially likely to have a family history of psychopathology, exposure to early childhood adversity, and lower self-esteem. Our selection of moderators was guided not only by the prominence of these variables in the literature but also by the fact that they represent individual- and family-level variables that are malleable and may be amenable to change through intervention. Another purpose of the present study was to examine whether particular correlates of anxious and depressive symptoms (e.g., maternal history of psychopathology, family relationship quality, and level of negative attributions) moderated the strength of the coupling between anxious and depressive symptoms across adolescence.

Maternal history of anxiety and depression

Children of mothers with high levels of psychopathology are at an increased risk for internalizing problems (e.g., Biederman et al., 2006; Hammen, Burge, Burney, & Adrian, 1990; Kovacs et al., 1989; Mufson, Weissman, & Warner, 1992). In particular, offspring of parents with histories of anxiety disorders (e.g., Biederman, Rosenbaum, Bolduc, Faraone, & Hirschfeld, 1991; Hughes, Furr, Sood, Barmish, & Kendall, 2009; Merikangas, Dierker, & Szatmari, 1998) or depressive disorders (Beardslee, Versage, & Gladstone, 1998; Goodman & Gotlib, 1999) are at increased risk for both anxiety and depression. Weissman et al. (1984) found that children whose parents had both depression and an anxiety disorder were more likely to have depression and anxiety themselves as compared to children whose parents had only depression. The current study used a high-risk research design (e.g., Beardslee et al., 1998; Hammen, 1991) in which mothers with histories of depressive disorders were oversampled in order to obtain greater variability in the constructs of interest (i.e., children's anxious and depressive symptoms). In addition, we assessed mothers' histories of anxiety disorders and hypothesized that the relation between anxious and depressive symptoms across time would be stronger for adolescents whose mothers also had a history of anxiety disorders.

Family relationship quality

The quality of the family environment consistently has been linked to children's internalizing symptoms (e.g., Eberhart & Hammen, 2006; Hughes, Hedtke, & Kendall, 2008; Kaslow, Deering, & Racusin, 1994; Lau & Kwok, 2000; Sheeber, Hops, & Davis, 2001). Specifically, high levels of family conflict and low levels of family cohesiveness and expressiveness are related to increased levels of depressive symptoms (e.g., Aydin & Oztütüncü, 2001; Cole & McPherson, 1993; Feldman, Rubinstein, & Rubin, 1988; Mason, Schmidt, Abraham, Walker, & Tercyak, 2009; Sheeber, Hops, Alpert, Davis, & Andrews, 1997), as well as to symptoms of anxiety in children (e.g., Hughes et al., 2008; Pagani, Japel, Vaillancourt, Cote, & Tremblay, 2008). For example, children's trajectories of anxiety symptoms characterized as high were more likely to come from families whose family dysfunction trajectories also were high (Pagani et al., 2008).

https://doi.org/10.1017/S0954579413000102 Published online by Cambridge University Press

In addition, children with comorbid anxiety and depressive disorders have been found to report higher levels of family dysfunction compared to anxious children without comorbid depression (O'Neil, Podell, Benjamin, & Kendall, 2010). We hypothesized that a lower quality family environment (i.e., high levels of conflict and low levels of cohesion and expressiveness) would show a stronger positive longitudinal relation between anxious and depressive symptoms over time.

Negative attributional style

Children's causal attributions for positive and negative events have been linked with their levels of depressive symptoms (e.g., Abela & Hankin, 2008). According to the reformulated learned helplessness model (Abramson, Seligman, & Teasdale, 1978), individuals who attribute negative events to internal, stable, and global causes and positive events to external, unstable, and specific factors are likely to exhibit high levels of depressive symptoms when faced with stress. In a further refinement of the helplessness model, the hopelessness model of depression (Abramson, Metalsky, & Alloy, 1989) proposed that inferential styles about causes, consequences, and the self serve as vulnerabilities to depression in the context of negative events. Relevant to the present study, a pessimistic inferential style about causes was defined as the tendency to attribute negative events to stable and global causes and positive events to unstable and specific causes. Evidence of a significant relation between children's negative attributional style and depressive symptoms has been found repeatedly (e.g., Abela & Hankin, 2008; Zavos, Rijsdijk, Gergory, & Eley, 2010).

The association between attributional style and anxiety symptoms has been less consistent (e.g., Brozina & Abela, 2006; Rodriguez & Pehi, 1998). For example, Rodriguez and Pehi (1998) found significant cross-sectional correlations between negative attributions and anxiety symptoms, which disappeared once concurrent depression was controlled. In a short-term prospective study, Brozina and Abela (2006) reported that children's inferential style about the causes of negative events interacted with daily hassles to predict increases in depressive but not anxious symptoms. However, Brozina and Abela did not examine whether the attributional style by stress interaction predicted changes in symptoms of anxiety and depression simultaneously over time. Another goal of the current study was to test whether the strength of the dynamic, longitudinal relations between anxiety and depressive symptoms varied as a function of a pessimistic inferential style about the causes of positive and negative events.

Analyses of the Relations of Anxious and Depressive Symptoms Over Time

An overall aim of this study was to examine dynamic, longitudinal relations between symptoms of anxiety and depression during adolescence. Several methodological approaches are available for examining longitudinal change, and each method assumes a different underlying model of developmental processes and change (Ferrer & McArdle, 2003). Each approach, therefore, can yield different conclusions regarding the longitudinal relations between symptoms of anxiety and depression. Typically, studies have used either latent growth curve (LGC) modeling (parallel process models) or autoregressive cross-lag models; in contrast, the current study used a dynamic latent change score (LCS) modeling approach (McArdle & Hamagami, 2001).

LGC models examine interindividual differences in intraindividual change (Bollen & Curran, 2006). That is, when participants have been assessed three or more times, using maximum likelihood estimation, LGC models estimate the average intercept (e.g., initial level) and average slope (rate of change) among participants. These two latent growth parameters provide information on the average shape of participants' trajectories over time. This model also allows for individual variability in the intercept and slope parameters. LGC models can be extended such that growth curves for two separate phenomena are fit and correlations among the growth parameters (e.g., correlation among slopes) are estimated. This type of model, called a *parallel process model*, provides information on how change in one variable is correlated with change in another variable. The relation between both variables is not time dependent, however; therefore, information about dynamic relations among variables (i.e., time-lagged relations or how one variable predicts change in the other variable over time) cannot be determined.

In contrast, *autoregressive cross-lag models* can estimate time-dependent relations. Specifically, these models estimate participants' score on a variable at a given point in time as a function of the participant's score at the previous time point (autoregressive effect), some proportion of the participant's score on another variable at the previous time point (cross-lag effect), and measurement error. Autoregressive cross-lag models can provide information on interrelations between two variables over time. However, this model does not allow for growth in the variables or for individual differences in growth (Ferrer & McArdle, 2003).

The approach used in the current study, *dynamic LCS modeling*, integrates features of both LGC and autoregressive cross-lag models. LCS models address specific questions about the temporal dynamics (i.e., time-dependent relations) between two variables, referred to as *longitudinal coupling*, while also estimating growth in the variables and allowing for individual differences in change. Coupling parameters can be estimated as time invariant (i.e., cross-lag paths set equal across time) or time varying, such that one can test whether the dynamics between two variables change over time. With regard to the longitudinal relations between symptoms of anxiety and depression, the LCS model can capture dynamic, transactional relations over time.

In summary, the current study examined dynamic, temporal relations between symptoms of anxiety and depression across adolescence (i.e., longitudinal coupling) and tested whether dynamic relations between anxious and depressive

https://doi.org/10.1017/S0954579413000102 Published online by Cambridge University Press

symptoms varied as a function of maternal history of anxiety, family relationship quality, or negative attributional style. In addition, to facilitate comparisons with other studies in this literature, we compared the pattern of findings based on LCS models to the results obtained when analyzing these data using the change models common in previous research to demonstrate how methodological choices can affect the observed relations between anxious and depressive symptoms.

Method

Participants

Participants were 240 mothers and children (54% female) who were part of a longitudinal study of children at risk for psychopathology. Children were first assessed in sixth grade (M age = 11.86 years, SD = 0.56 years) and then annually through Grade 12. The ethnic composition of the sample was 81.5% Caucasian, 14.8% African American, and the remaining 3.7% were Hispanic, Native American, or reported "Other." Families were predominantly working class (e.g., nurse's aide or salesclerk) to middle class (e.g., store manager or teacher) with a mean socioeconomic status (Hollingshead, 1975) of 41.67 (SD = 13.29).

Procedure

Parents of fifth-grade children from metropolitan public schools were invited to participate in a study about parents and children. A brief health history questionnaire comprising 24 medical conditions (e.g., diabetes, heart disease, and depression) and 34 medications (e.g., fluoxetine and amitriptyline) and a letter describing the project were sent to over 3,500 families. Of the 1,495 mothers who indicated an interest in participating, the 587 who had reported a history of depression, use of antidepressants, or no history of psychopathology were interviewed further by telephone. The remaining families were excluded because the mother either did not indicate depression or reported other serious health problems (e.g., cancer or multiple sclerosis). Of the 587 screened, 349 mothers reported either a history of depression or no history of psychiatric problems. The remaining 238 families were excluded because the mothers did not indicate sufficient symptoms to meet criteria for a depressive disorder (38%), they had other psychiatric disorders that did not also include a depressive disorder (19%), they were no longer interested (21%), they or the target child had a serious medical condition (14%), the target child was in the wrong grade (6%), or the family had moved out of the area (2%). The Structured Clinical Interview for DSM diagnoses (Spitzer, Williams, Gibbon, & First, 1990) was then conducted with the 349 mothers who had a history of some depression or had had no psychiatric problems. Interrater reliability was calculated on a random subset of 25% of these interviews. There was 94% agreement (κ = 0.88) for diagnoses of depressive disorders. The final sample of 240 families consisted of 185 mothers who had a history of a mood disorder (high-risk group) and 55 mothers who were lifetime free of psychopathology (low-risk group).

Children were first assessed in sixth grade (Time 1) and then yearly through 12th grade (Times 2 through 7). A research assistant, unaware of the mother's psychiatric history, interviewed and administered a battery of questionnaires separately to the mother and the adolescent. The study procedures met the approval of the institutional review board for the protection of human subjects. Mothers provided informed consent, and children completed an assent form. Only those measures relevant to the current study are described below.

Measures

Depressive symptoms. Children reported annually on their own depressive symptoms with the Children's Depression Inventory (CDI; Kovacs, 1981). The CDI consists of 27 items that measure cognitive, affective, and behavioral symptoms of depression. Children chose one of three sentences that best described them during the past two weeks (e.g., "I am sad once in a while," "I am sad many times," "I am sad all the time"). Items were scored 0 to 2 and were summed to create a total score (range = 0–54). The CDI has good internal consistency, test–retest reliability, and convergent validity with other self-report measures (Sitarenios & Kovacs, 1999). In the current sample, the coefficient α values ranged from 0.80 to 0.90 across time.

Anxiety symptoms. Mothers reported about their children's symptoms and behaviors on the Child Behavior Checklist (CBCL; Achenbach, 1991). Mothers rated how true a statement was about her child using a scale ranging from 0 (*not true*) to 2 (*very true or often true*). The anxiety symptoms composite (e.g., Snyder et al., 2009) was used as the measure of children's anxiety symptoms and was created by taking the mean of the following items: clings to adults or too dependent; feels he/she has to be perfect; nervous, high strung, or tense; too fearful or anxious; self-conscious or easily embarrassed; shy or timid; and worries (possible range for composite score was 0 to 2). The Cronbach α values ranged from 0.58 to 0.75 in the current sample across the time points.

Moderators

Mothers' history of anxiety. Mothers' psychopathology at Time 1 was assessed with the Structured Clinical Interview for DSM diagnoses (Spitzer et al., 1990). Mothers' anxiety history was coded as 1 (*any history*) if mothers reported current or lifetime panic disorder, social anxiety disorder, obsessive–compulsive disorder, or GAD and as 0 if no current or lifetime history of an anxiety disorder was reported.

Family relationship quality. Children completed the Family Environment Scale (Moos & Moos, 1994), a self-report measure of the social environment of the family. Children rated 36

https://doi.org/10.1017/S0954579413000102 Published online by Cambridge University Press

statements as true or false about their family (e.g., "We fight a lot in our family" or "There is a feeling of togetherness in our family.") The subscales of cohesion, expressiveness, and conflict assess the degree of commitment and support among family members, the degree to which family members are encouraged to express their feelings, and the degree to which they are encouraged to openly express conflict, respectively. These three subscales comprise the Family Relationship Index (FRI), which was created by summing the cohesion and expressiveness subscales, and then subtracting the conflict subscale. Children's FRI scores at Grade 6 were used in the current study; higher scores reflected better family relationship quality. The Cronbach α value of the FRI index was 0.82.

Negative attributional style. The Children's Attributional Style Questionnaire (CASQ; Seligman et al., 1984) measures attribution dimensions derived from the reformulated learned helplessness and hopeless models (Abramson et al., 1978, 1989). The original CASQ contains 48 forced-choice items describing 24 positive and 24 negative events. In the current study, we used the revised CASQ (Thompson, Kaslow, Weiss, & Nolen-Hoeksema, 1998), containing 12 positive and 12 negative items, and included the additional 12 negative items from the original CASQ. Children choose between two explanations for why an event occurred (e.g., "You get a bad grade in school," with the two explanations being "I am not a good student" and "Teachers give hard tests"). The explanations assess children's attributions with regard to internal, stable, and global causes of positive and negative events. The current study used the globality/stability index (Abramson et al., 1989), which was created by subtracting children's global and stable attributions for negative events from their global and stable attributions for positive events; *lower* scores reflected higher levels of negative attributions. The Cronbach α value of the composite was 0.62 in the current sample. Scores at Grade 6 were used in the current study.

Analysis plan

To assess dynamic, longitudinal associations between anxiety and depressive symptoms, we fit a dynamic bivariate LCS model (McArdle & Hamagami, 2001), controlling for children's risk status (i.e., maternal history of depression). We also compared the bivariate LCS results to those from two traditional change models that typically have been used in previous research: the parallel process model and the autoregressive cross-lag model.

LCS models are an extension of LGC models and incorporate features of autoregressive cross-lag models. As a preliminary step, univariate LCS models were fit to examine latent change in anxious and depressive symptoms, respectively (e.g., Hawley, Ho, Zuroff, & Blatt, 2006; Kouros & Garber, 2010). Specifically, LCS analyses begin by partitioning observed scores into true scores (i.e., latent scores) and error variances. These latent scores predict the latent score at the next time point, and the residual represents latent change. The purpose of an LCS model is to predict these LCSs across time. When latent change in one variable is modeled, there are several different change models, or *univariate LCS models*, that can be tested. Four possible univariate change models were considered, including (a) a *no change model*, in which previous scores perfectly predicted scores at the subsequent time point; (b) a *proportional change model*, in which change was proportional to one's score at the previous time point; (c) a *constant change model*, in which change occurred systematically as a function of time (e.g., LGC model); and (d) a *dual change model* with time-varying proportional coefficients, in which latent change was predicted by some proportion of one's previous score plus systematic change that occurs over time.

Next, we tested a *bivariate LCS model*, in which anxious and depressive symptoms were modeled together and each variable simultaneously predicted latent change in the other variable. For example, latent change in depressive symptoms was modeled as a function of (a) systematic change that occurred over time (e.g., linear slope); (b) one's level of depressive symptoms at the previous time point, referred to as a proportional effect; and (c) one's level of anxiety symptoms at the previous time point, referred to as a coupling effect. Latent change in anxiety symptoms was simultaneously modeled as a function of (a) systematic change that occurred over time, (b) one's levels of anxiety symptoms at the previous time point, and (c) one's level of depressive symptoms at the previous time point. Thus,

$$\begin{aligned}\Delta \text{ depressive symptoms} &= S_D + \beta_D \text{ (previous depressive symptoms)} \\ &\quad + \gamma_D \text{ (previous anxiety symptoms)} \\ \Delta \text{ anxiety symptoms} &= S_A + \beta_A \text{ (previous anxiety symptoms)} \\ &\quad + \gamma_A \text{ (previous depressive symptoms).}\end{aligned}$$

Figure 1 presents a bivariate LCS model, where β_D and β_A represent the proportional effects for depressive symptoms and anxiety symptoms, respectively, and the parameters γ_{DA} and γ_{AD} represent longitudinal coupling between depressive symptoms and anxiety symptoms. If γ_{DA} is significant, this would indicate that one's level of depressive symptoms predicted subsequent change in anxiety symptoms. If γ_{AD} is significant, this would indicate that one's anxiety symptoms predicted subsequent change in depressive symptoms. When both γ_{DA} and γ_{AD} are significant, this indicates *bidirectional longitudinal coupling* between depressive symptoms and anxiety symptoms; if neither coupling parameter is significant, this would indicate that depressive symptoms and anxiety symptoms are not dynamically related over time.

Models were fit using AMOS statistical software, version 17.0 (Arbuckle, 2007). Full information maximum likelihood estimation was used to handle missing data. The fit of a particular model was assessed using several fit indices, including the relative χ^2 index (χ^2/df; Bollen, 1989), the comparative fit

https://doi.org/10.1017/S0954579413000102 Published online by Cambridge University Press

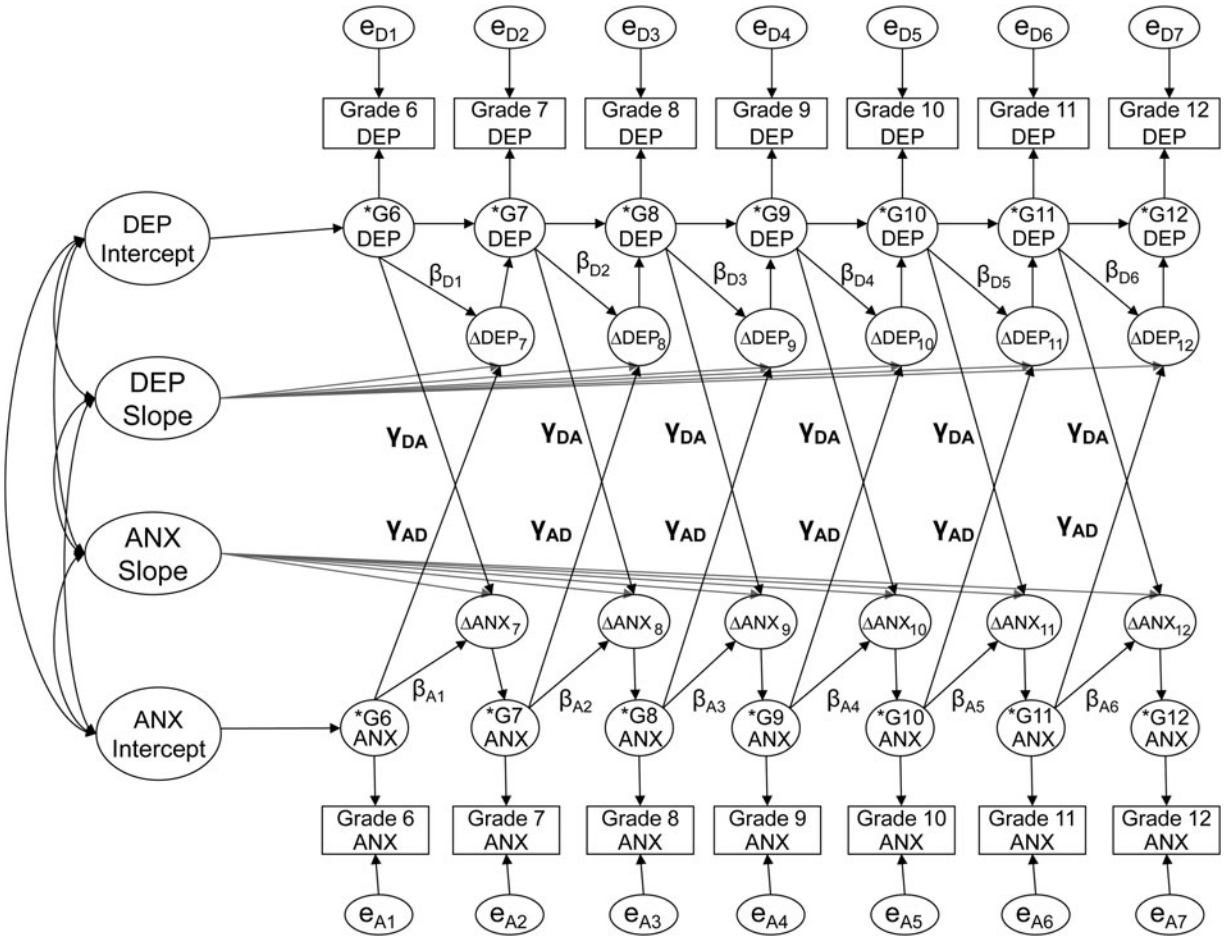

Figure 1. The bivariate latent change score (LCS) model of dynamic relations between symptoms of depression and anxiety. DEP, depressive symptoms; ANX, anxiety symptoms. Unlabeled one-arrow paths were set equal to 1. Error variances of observed variables were set equal across time for depressive and anxious symptoms, respectively, and the error variances of depressive and anxious symptoms within each time point were correlated and set equal over time (not shown in model). The asterisk indicates the latent variable score; Δ indicates the LCS (i.e., latent change); β_D and β_A represent time-varying proportional coefficients for depressive and anxious symptoms, respectively; γ_{DA} represents unidirectional longitudinal coupling from depressive symptoms to anxious symptoms, such that depressive symptoms predict subsequent change in anxious symptoms over time; and γ_{AD} represents unidirectional longitudinal coupling from anxious to depressive symptoms, such that anxious symptoms predict subsequent change in depressive symptoms over time.

index (CFI; Bentler, 1990), and the root mean square error of approximation (RMSEA; Browne & Cudeck, 1993).

Results

Descriptive statistics

Means, standard deviations, and bivariate correlations among the study variables are presented in Table 1. Across all time points, scores on the CDI ranged from 0 to 25–31. The percentages of adolescents with a cutoff score at or above 13 after Time 1 were 5.6%, 6.6%, 9.6%, 9.3%, 7.4%, and 14.2%, respectively, which is consistent with what would be expected based on comparisons with the norms for this age range (Kovacs, 1992). Anxiety and depressive symptom scores were positively correlated at every grade (except Grade 8) and positively correlated across time. There were no significant differences in boys' and girls' mean depressive or anxiety symptom scores at any time point.

Preliminary analyses: Univariate LCS models of depressive and anxious symptoms

Univariate LCS analyses, controlling for risk, indicated that the dual change model with time-varying proportional effects best represented change in both depressive and anxious symptoms. Specifically, for depressive symptoms, the dual change model provided the best fit to the data, χ^2 (28, N = 240) = 50.91, χ^2/df = 1.82, CFI = 0.95, RMSEA = 0.06, Akaike information criterion (AIC) = 82.91, compared to the no change, χ^2 (38, N = 240) = 137.98, AIC = 149.98; proportional change, χ^2 (37, N = 240) = 128.26, AIC = 142.26; and constant change, χ^2 (34, N = 240) = 76.28, AIC = 96.28, models. Parameter estimates indicated that, on average, depressive symptom scores linearly declined over time (β = –0.75, SE = 0.38, $p < .05$),

https://doi.org/10.1017/S0954579413000102 Published online by Cambridge University Press

https://doi.org/10.1017/S0954579413000102 Published online by Cambridge University Press

Table 1. *Means, standard deviations, and intercorrelations among study variables*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Risk[a]	—																		
2. Child sex	.06	—																	
3. Grade 6 depressive symptoms	.19**	−.07	—																
4. Grade 6 anxious symptoms	.26**	−.05	.14*	—															
5. Grade 7 depressive symptoms	.21**	−.03	.50**	.19**	—														
6. Grade 7 anxious symptoms	.18**	.01	.09	.63**	.14*	—													
7. Grade 8 depressive symptoms	.20**	−.05	.41**	.26**	.60**	.12	—												
8. Grade 8 anxious symptoms	.22**	−.12†	.01	.55**	.14†	.57**	.11	—											
9. Grade 9 depressive symptoms	.14*	.06	.29**	.28**	.44**	.18*	.48**	.19*	—										
10. Grade 9 anxious symptoms	.17*	.04	.09	.60**	.25**	.57**	.18*	.63**	.36**	—									
11. Grade 10 depressive symptoms	.19*	.05	.29**	.23**	.33**	.15†	.36**	.14	.50**	.33**	—								
12. Grade 10 anxious symptoms	.26**	.01	.09	.56**	.23**	.50**	.19*	.56**	.35**	.66**	.28**	—							
13. Grade 11 depressive symptoms	.23**	.08	.28**	.25**	.42**	.19*	.46**	.07	.57**	.32**	.52**	.21*	—						
14. Grade 11 anxious symptoms	.28**	−.11	.03	.51**	.15*	.51**	.13†	.50**	.20*	.56**	.14	.65**	.24**	—					
15. Grade 12 depressive symptoms	.15*	.12	.26**	.25**	.49**	.12	.49**	.09	.54**	.22**	.50**	.30**	.56**	.29**	—				
16. Grade 12 anxious symptoms	.24**	.03	.20**	.52**	.30**	.44**	.32**	.36**	.30**	.55**	.29**	.62**	.30**	.30**	.43**	—			
Moderators[b]																			
17. Mother anxiety history[c]	.38**	−.02	.21**	.20**	.27**	.21**	.25**	.20**	.11	.15*	.08	.12	.23**	.23**	.25**	.17**	—		
18. Negative attributional style	−.15*	.17	−.54**	−.11†	−.42**	−.05	−.30**	−.06	−.22**	−.05	−.24**	−.08	−.13†	−.05	−.17*	−.08	−.19*	—	
19. Family relationship index	−.21**	.17*	−.55	−.11†	−.50**	−.01	−.38**	−.01	−.26**	−.13†	−.15†	−.09	−.23**	−.23**	−.25**	−.07	−.26**	.47**	—
Mean	—	—	6.11	0.34	4.76	0.38	4.68	0.31	4.88	0.28	5.74	0.24	5.17	0.27	5.72	0.24	—	0.98	17.70
SD	—	—	4.99	0.33	4.45	0.33	5.06	0.28	5.22	0.29	5.50	0.24	5.40	0.32	6.39	0.29	—	0.56	4.77

Note: $N = 240$ at Grade 6.

[a]Risk, mothers' history of a depressive disorder coded 0 = *no history of depression* (low risk) and 1 = *history of depression* (high risk); depressive symptoms were assessed with the Children's Depression Inventory; anxious symptoms were assessed with the anxiety subscale of the Child Behavior Checklist.

[b]Level of moderators at Grade 6 used in the analyses, median split created for latent change score analyses.

[c]Mothers' anxiety history coded such that 0 = *no history of anxiety* and 1 = *any history of anxiety* (social, panic, obsessive compulsive disorder, and/or generalized anxiety disorder).

†$p < .10$; *$p < .05$, **$p < .01$.

Table 2. *Parameter estimates from bivariate latent change score analysis examining dynamic relations between depressive and anxiety symptoms*

	Depressive Symptoms ↔ Anxiety Symptoms	
Parameter Estimates	Depressive Symptoms	Anxiety Symptoms
Intercept		
Mean	4.35 (0.63)**	0.22 (0.04)**
Variance	12.06 (2.15)**	0.06 (0.01)**
Linear slope		
Mean	0.42 (0.42)	−0.04 (0.02)†
Variance	1.50 (0.74)	0.00 (0.00)
Proportional coefficients		
β_1	−0.42 (0.10)**	0.01 (0.09)
β_2	−0.29 (0.14)*	−0.22 (0.08)**
β_3	−0.23 (0.12)†	−0.11 (0.09)
β_4	−0.16 (0.12)	−0.23 (0.10)†
β_5	−0.25 (0.10)*	0.04 (0.13)
β_6	−0.16 (0.10)	−0.21 (0.10)*
Coupling parameters		
$\gamma_{ANXIETY \rightarrow DEPRESSION}$	2.92 (1.49)*	
$\gamma_{DEPRESSION \rightarrow ANXIETY}$		0.01 (0.01)†

Note: Unstandardized parameter estimates are reported (standard errors). Analyses controlled for risk.
†$p < .10$. *$p < .05$. **$p < .01$.

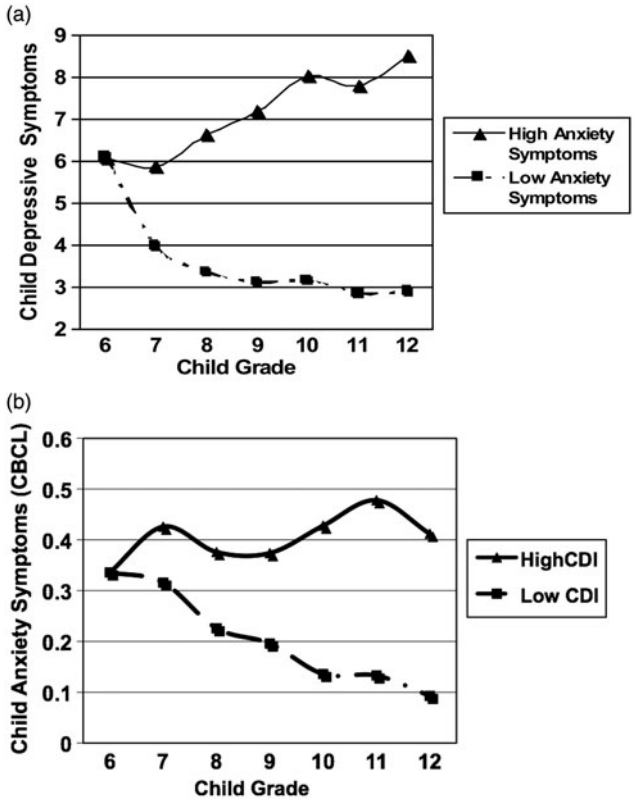

Figure 2. (a) The expected change in children's depressive symptoms over time. The *Y* axis is truncated in the figure. Trajectories are plotted for children with the average level of depressive symptoms at Grade 6. Low anxiety is the Time 1 (Grade 6) Child Behavior Checklist (CBCL) anxiety score that was 1 *SD* below the mean. High anxiety is the Time 1 (Grade 6) CBCL anxiety score that was 1 *SD* above the mean. (b) The expected change in children's anxiety symptoms over time. Low Children's Depression Inventory (CDI) is the Time 1 (Grade 6) CDI score that was 1 *SD* below the mean. High CDI is the Time 1 (Grade 6) CDI score that was 1 *SD* above the mean.

and scores at Grades 6 and 10 predicted subsequent declines in scores at the next time point ($\beta_{D1} = –0.38$, $SE = 0.09$, $p < .01$; $\beta_{D5} = –0.25$, $SE = 0.10$, $p < .01$). Moreover, there was significant variability in both the intercept ($\sigma^2 = 12.44$, $p < .01$) and the slope ($\sigma^2 = 1.33$, $p < .05$) parameters, indicating individual differences in change over time. The dual change model with time-varying proportional effects also best represented change in anxiety symptoms, χ^2 (28, $N = 240$) = 53.78, $\chi^2/df = 1.92$, CFI = 0.96, RMSEA = 0.06, AIC = 85.78, as compared to the no change, χ^2 (38, $N = 240$) = 160.44, AIC = 172.44; proportional change, χ^2 (37, $N = 240$) = 112.64, AIC = 126.64; and constant change, χ^2 (34, $N = 240$) = 76.44, AIC = 96.44, models. However, the average growth parameters in this model were not significant. Accounting for time-varying proportional effects, there was significant individual variability in the intercept ($\sigma^2 = 0.06$ $p < .01$), but not the slope ($\sigma^2 = 0.001$, $p = .14$). There were no significant differences between boys and girls in the intercept or slope growth parameters for anxious or depressive symptoms. Based on these preliminary univariate models, dual change score models of anxiety and depressive symptoms were used in subsequent analyses of the dynamic relation between these two constructs.

Dynamic relations between anxious and depressive symptoms: Bivariate LCS model

A bivariate LCS model was fit to examine dynamic, longitudinal relations between anxious and depressive symptoms, controlling for risk. Results from the bivariate LCS model are presented in Table 2. This model provided a good fit to the sample data, χ^2 (100, $N = 240$) = 161.06, $\chi^2/df = 1.61$, CFI = 0.95, RMSEA = 0.05, and was more parsimonious compared to a model in which the dynamics between anxious and depressive symptoms (i.e., γ_{DA} and γ_{AD}) were allowed to vary over time, $\Delta\chi^2$ (10, $N = 240$) = 13.12.

Parameter estimates indicated longitudinal coupling between anxiety and depressive symptoms, such that symptoms of anxiety predicted subsequent elevations in depressive symptoms over time ($\gamma_{AD} = 2.92$, $SE = 1.49$, $p < .05$). Expected trajectories for children with average levels of depressive symptoms at Grade 6, based on all parameter estimates (slope, proportional, and coupling estimates) are depicted in Figure 2a. Trajectories of depressive symptoms differed for children depending on their level of anxiety symptoms. Children with low levels of anxiety at Grade 6 showed decreasing symptoms of depression through Grade 12, whereas children with high levels of anxiety at Grade 6 had an overall increase in depressive symptoms through Grade 12. At the same time, depressive symptoms predicted subsequent elevations in anxiety symptoms at the trend level ($\gamma_{DA} = 0.01$, $SE = 0.01$, $p = .051$; see Figure 2b).

https://doi.org/10.1017/S0954579413000102 Published online by Cambridge University Press

Moderators of coupling effects

Next, multigroup bivariate LCS analyses were run to examine whether the dynamic relation between anxious and depressive symptoms differed by mothers' history of anxiety, quality of family relationships, and children's global/stable attributional style. Multigroup analyses in structural equation modeling compare a series of increasingly restricted models to test whether a parameter(s) is equivalent or varies between groups. Specifically, a model in which parameters are freely estimated for each group is compared to a model in which certain parameters are constrained to be equal between groups. A nonsignificant chi-square difference test would indicate that the constrained parameter(s) is equivalent across groups, whereas a significant chi-square difference test would indicate that the parameter(s) differs between groups. Once a parameter is found to be equivalent across groups, that parameter is constrained to be equal between groups as additional parameters are tested.

Mothers' history of anxiety. Multigroup bivariate LCS analyses examined whether longitudinal coupling between symptoms of depression and anxiety differed for children whose mothers had a history of any anxiety disorder compared to children whose mothers did not have a history of anxiety, controlling for risk (i.e., mothers' history of depression; Table 3). The final model provided a good fit to the sample data, χ^2 (213, N = 240) = 316.41, χ^2/df = 1.49, CFI = 0.91, RMSEA = 0.05. The relation of anxiety symptoms to change in depressive symptoms was equivalent between groups; that is, anxiety symptoms predicted subsequent elevations in depressive symptoms among children regardless of their mothers' history of anxiety (γ_{AD} = 3.25, SE = 1.36, $p < .05$). In contrast, a significant group difference was found for γ_{DA}, indicating that depressive symptoms predicted subsequent elevations in anxiety symptoms for children whose mothers had a history of anxiety (γ_{DA} = 0.01, SE = 0.01, $p < .01$) but not for children whose mothers did not have a history of anxiety (Figure 3). Thus, bidirectional, longitudinal coupling was found for children whose mothers had a history of an anxiety disorder.

Family relationship quality. Two groups were created based on a median split to examine whether the dynamic, longitudinal relation between depressive and anxious symptoms differed for children reporting low (M = 13.86, SD = 4.02) as compared to high (M = 21.21, SD = 1.72) levels of family relationship quality, controlling for risk (Table 3). The final model provided a good fit to the sample data, χ^2 (212, N = 240) = 298.35, χ^2/df = 1.41, CFI = 0.92, RMSEA = 0.04. The coupling parameter γ_{AD} did not differ between groups, indicating that anxiety symptoms predicted subsequent elevations in depressive symptoms for children reporting both low and high levels of family relationship quality (γ_{AD} = 3.19, SE = 1.11, $p < .01$). Group differences were found in γ_{DA}, indicating that depressive symptoms predicted subsequent elevations in anxiety symptoms for children with low family relationship quality (γ_{DA} = 0.04, SE = 0.01, $p < .01$) but not for children with high family relationship quality. Thus, evidence of bidirectional, longitudinal coupling between anxiety and depressive symptoms was found for children with low family relationship quality.

Negative attributional style. Two groups were created based on a median split to examine whether the dynamic, longitudinal relations between depressive and anxious symptoms differed for children with low (M = 1.42, SD = 0.28) and high (M = 0.44, SD = 0.40) levels of negative attributions, controlling for risk (Table 4). The final model provided a good fit to the sample data, χ^2 (215, N = 240) = 313.96, χ^2/df = 1.46, CFI = 0.91, RMSEA = 0.04. The coupling parameter representing the effect of anxiety symptoms on subsequent change in depressive symptoms did not differ between groups, indicating that anxiety symptoms were related to subsequent elevations in depressive symptoms for children with both low and high levels of negative attributions (γ_{AD} = 4.10, SE = 1.10, $p < .01$). In contrast, group differences were found in γ_{DA}, indicating that depressive symptoms predicted subsequent elevations in anxiety symptoms for children with high levels of negative attributions (γ_{DA} = 0.01, SE = 0.01, $p < .01$) but not for children with low levels of negative attributions. In sum, bidirectional longitudinal coupling between depressive and anxious symptoms was found for children with high levels of negative global/stable attributions.

Alternative models of changes

Finally, we compared the results from the bivariate LCS analysis to results based on a parallel process model and an autoregressive cross-lag model similar to what has been used by others in this literature (e.g., Cole et al., 1998; Snyder et al., 2009). These analyses allowed us to explore whether the different methods for modeling change yielded similar or different findings, which may account for some of the inconsistencies across studies.

Parallel process model. A parallel process model was fit to examine whether children's anxiety and depressive symptom slopes were correlated over time, controlling for risk. Separate growth models were fit for anxious symptoms and depressive symptoms, respectively.

A linear model provided a more parsimonious fit to the data compared to a quadratic growth model for depressive symptoms, $\Delta\chi^2$ (3) = 7.38, p = .06. Although the linear slope was not significant, there was significant individual variability in the slope parameter, σ^2 = 0.54, χ^2 (230) = 448.05, $p < .01$. For anxiety symptoms, a quadratic model provided a better fit compared to the linear growth model, $\Delta\chi^2$ (3) = 14.31, $p < .01$. Anxiety symptoms decreased linearly over time (β = –0.03, SE = 0.01, $p < .01$), although the quadratic slope was not significant. There was significant individual variability in

https://doi.org/10.1017/S0954579413000102 Published online by Cambridge University Press

https://doi.org/10.1017/S0954579413000102 Published online by Cambridge University Press

Table 3. *Results from multigroup bivariate latent change score analyses: mothers' history of anxiety and family relationship quality as moderators*

	Mothers' History of Anxiety				Family Relationship Quality			
	No History		Positive History		Quality Low		Quality High	
Parameters	Depressive	Anxious	Depressive	Anxious	Depressive	Anxious	Depressive	Anxious
Intercept								
Mean	4.19 (0.61)**	0.23_a (0.04)**	5.56 (0.90)**	0.23_a (0.04)**	7.16 (0.65)**	0.22_b (0.04)**	2.58 (0.46)**	0.22_b (0.04)**
Variance	11.86_a (2.08)**	0.06_b (0.01)**	11.86_a (2.08)**	0.06_b (0.01)**	13.12 (3.08)**	0.07_c (0.10)*	2.08 (0.32)	0.07_c (0.10)*
Slope								
Mean	0.14 (0.38)	-0.02_a (0.02)	1.04 (0.53)†	-0.02_a (0.02)	0.02_b (0.34)	-0.03_c (0.02)	0.02_b (0.34)	-0.03_c (0.02)
Variance	1.18 (0.56)*	0.001 (0.00)**	3.00 (1.25)*	0.01 (0.01)	1.23_a (0.40)**	0.03 (0.01)*	1.23_a (0.40)**	0.002 (0.001)*
Proportional coefficients								
β_1	-0.48_a (0.09)**	0.07 (0.09)	-0.48_a (0.09)**	−0.15 (0.12)	-0.38_b (0.06)**	−0.74 (0.17)**	-0.38_b (0.06)**	0.21 (0.09)*
β_2	-0.35_a (0.13)**	−0.12 (0.08)	-0.35_a (0.13)**	−0.40 (0.10)**	-0.21_b (0.09)*	−0.75 (0.15)**	-0.21_b (0.09)*	−0.11 (0.08)
β_3	0.004 (0.15)	−0.03 (0.09)	−0.48 (0.12)**	−0.33 (0.14)*	-0.17_a (0.08)*	−0.68 (0.17)**	-0.17_a (0.08)*	−0.00 (0.10)
β_4	−0.13 (0.11)	−0.07 (0.11)	−0.28 (0.15)†	−0.48 (0.16)**	−0.18 (0.08)*	−0.87 (0.17)**	0.02 (0.11)	0.01 (0.12)
β_5	-0.30_a (0.09)**	0.01_b (0.12)	-0.30_a (0.09)**	0.01_b (0.12)	-0.17_c (0.07)*	−0.66 (0.21)**	-0.17_c (0.07)*	0.21 (0.15)
β_6	-0.18_a (0.10)†	−0.05 (0.11)	-0.18_a (0.10)†	−0.46 (0.13)**	0.04 (0.10)	−0.85 (0.17)**	−0.31 (0.07)**	0.05 (0.12)
Coupling parameters								
γ_{AD}	3.25_a (1.36)*		3.25_a (1.36)**		3.19_a (1.11)**		3.19_a (1.11)**	
γ_{DA}		0.00 (0.01)		0.02 (0.01)**		0.04 (0.01)**		−0.00 (0.01)

Note: Unstandardized parameter estimates (standard errors) are presented. Similar subscripts in the same row indicate a parameter that is equivalent between groups.
†$p < .10$. *$p < .05$. **$p < .01$.

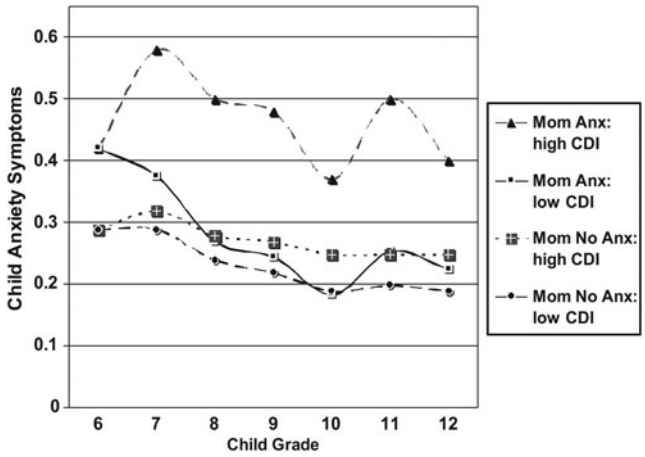

Figure 3. The expected change in children's anxiety symptoms over time, as moderated by mothers' history of anxiety. The *Y* axis is truncated in the figure. Trajectories are plotted for children with average levels of anxiety symptoms at Grade 6. Low Children's Depression Inventory (CDI) is the Time 1 (Grade 6) CDI score that was 1 *SD* below the mean. High CDI is the Time 1 (Grade 6) CDI score that was 1 *SD* above the mean.

children's linear, $\sigma^2 = 0.01$, χ^2 (220) = 284.97, $p < .01$, and quadratic, $\sigma^2 = 0.0001$, χ^2 (220) = 276.57, $p < .01$, growth.

Next, we fit a parallel process model to examine whether linear changes in depressive symptoms were correlated with linear and/or quadratic growth in anxiety symptoms. This model provided a good fit to the sample data, χ^2 (97) = 155.88, $\chi^2/df = 1.60$, CFI = 0.95, RMSEA = 0.05. Results indicated that although the intercepts for anxious and depressive symptoms were significantly correlated ($r = .23$, $p < .05$), the linear slopes were not significantly correlated ($r = -.03$, $p = .86$). In addition, the linear slope for depressive symptoms was not correlated with the quadratic slope for anxious symptoms ($r = .15$, $p = .35$). Thus, results of the parallel process analysis indicated that changes in anxious and depressive symptoms were not related.

Autoregressive cross-lag model. An autoregressive cross-lag model was fit to the data (e.g., Keenan et al., 2009), controlling for risk. Although several cross-lag paths were significant, this model provided a poor fit to the sample data, χ^2 (77, $N = 240$) = 355.72, $\chi^2/df = 4.62$, CFI = 0.79, RMSEA = 0.12 (results available upon request). Therefore, support for longitudinal relations between anxious and depressive symptoms was not found using this analytic approach.

Discussion

The current longitudinal study examined the dynamic temporal associations between anxious and depressive symptoms in youth followed from early through middle adolescence. Consistent with previous research (e.g., Cole et al., 1998; Snyder et al., 2009), we found that symptoms of anxiety were a robust predictor of subsequent elevations in depressive symptoms over time in adolescents. This relation was not trivial; for example, a child with high levels of anxiety in Grade 6 was predicted to increase 2.42 points on the measure of depressive symptoms (i.e., CDI), or roughly 0.5 *SD*, during the important 6-year developmental period of adolescence.

Table 4. *Results from multigroup bivariate latent change score analyses: negative attributions as a moderator*

	Negative Attributions			
	Low		High	
Parameters	Depressive	Anxious	Depressive	Anxious
Intercept				
Mean	2.69 (0.52)**	0.19 (0.04)**	7.24 (0.65)**	0.30 (0.04)**
Variance	1.79 (1.38)	0.05 (0.01)**	11.81 (3.40)**	0.09 (0.02)**
Slope				
Mean	0.39_b (0.41)	−0.02 (0.03)	0.39_b (0.41)	−0.04 (0.04)
Variance	2.09_a (0.75)**	0.01_b (0.003)†	2.09_a (0.75)**	0.01_b (0.003)†
Proportional coefficients				
β_1	-0.50_a (0.08)**	0.56 (0.13)**	0.50_a (0.08)**	−0.30 (0.11)**
β_2	-0.38_a (0.11)**	−0.05 (0.09)	-0.38_a (0.11)**	−0.29 (0.11)*
β_3	-0.29_a (0.10)**	0.24 (0.14) †	-0.29_a (0.10)**	−0.23 (0.13)†
β_4	0.20_a (0.10)*	0.23 (0.15)	0.20_a (0.10)*	−0.41 (0.13)**
β_5	-0.29_a (0.08)**	0.50 (0.18)**	-0.29_a (0.08)**	−0.14 (0.17)
β_6	-0.24_a (0.08)**	0.19 (0.14)	-0.24_a (0.08)**	−0.36 (0.14)**
Coupling parameters				
γ_{AD}	4.10_a (1.44)**		4.10_a (1.44)**	
γ_{DA}		−0.02 (0.01)†		0.02 (0.01)**

Note: Unstandardized parameter estimates (standard errors) are presented. Similar subscripts in the same row indicate a parameter that is equivalent between groups.
†p<.10. *$p < .05$. **$p < .01$.

https://doi.org/10.1017/S0954579413000102 Published online by Cambridge University Press

Several explanations have been proposed for why anxiety predicts later depression. In particular, negative sequelae of anxiety can confer increased risk of developing or exacerbating already present symptoms of depression (Flannery-Schroeder, 2006). For example, socially anxious children may try to avoid negative evaluations from others by withdrawing or disengaging. Such dysfunctional behaviors may actually increase the likelihood of the very rejection they are trying to avert, which then may result in feelings of sadness, loneliness, and low self-worth (e.g., Alden & Taylor, 2004; Gazelle & Ladd, 2003). Thus, the emotional, cognitive, and behavioral manifestations of anxiety may create the very conditions that are likely to contribute to elevated levels of depressive symptoms.

The present study found a robust relation between prior symptoms of anxiety and subsequent symptoms of depression, over and above prior depressive symptoms. Moreover, this relation was operative among children at both high and low risk with regard to several individual and contextual factors. Further exploration of the precise mechanisms intervening between anxiety and depression is needed to inform the construction of interventions aimed at preventing the emergence of depression in anxious children (Garber & Weersing, 2010).

In contrast to the often replicated finding that anxiety precedes depression, results regarding the reverse relation, that is, between prior depressive symptoms and subsequent anxiety, have been more complex (Cole et al., 1998; Costello et al., 2003; Moffitt et al., 2007). The current study showed that depressive symptoms were followed by elevations in anxious symptoms for a subset of youth who had mothers with a history of anxiety, reported low family relationship quality, or had a more negative attributional style. It is notable that the correlations among these moderating variables were small to modest. Thus, these three factors may make relatively independent contributions to the longitudinal association between children's depressive symptoms and subsequent anxiety symptoms.

Children are likely to encounter multiple risk processes. For example, the cumulative risk of being exposed to both parental psychopathology and poor family relationship quality might further exacerbate the anxiety–depression relation (e.g., Forehand, Biggar, & Kotchick, 1998). Alternatively, these factors also might interact, conferring greater coupling between anxiety and depressive symptoms at high levels of both moderators. For example, Kouros, Merrilees, and Cummings (2008) found that the robust negative association between interparental conflict and children's emotional security about the family was further strengthened in the context of high paternal depressive symptoms. Given the modest size of the current sample, however, we did not explore all possible interactions of the multiple risk factors on the longitudinal relation between anxiety and depressive symptoms. Further research is needed to examine how various risk factors work together, in either a cumulative or an interactive way, to predict children's mental health, thereby providing an ecologically valid model of children's risk experiences.

One potential explanation for the depression to anxiety link is that in the context of adverse conditions such as poor family relationships or maternal anxiety, depressed adolescents may lack adequate resources and sufficient social support to help them deal with the stressors they encounter. Such depressed adolescents also may have acquired from their anxious mothers the use of less adaptive responses to stress such as rumination, excessive worry, and heightened physiological reactivity. These uncontrolled responses to stress (e.g., involuntary disengagement; Compas, Connor-Smith, Saltzman, Thomsen, & Wadsworth, 2001) may heighten and exacerbate their symptoms of anxiety, particularly if uncertainty about how to handle ongoing or new stressors persists. In addition, adolescents with more pessimistic explanatory styles tend to attribute negative events and their associated depressive symptoms to global/stable causes that they expect will persist. Under these conditions, adolescents with depressive symptoms may become increasingly anxious, realizing that they have neither sufficient support nor adequate skills to ameliorate their distress or the circumstances surrounding it.

Thus, contextual and individual factors may impact the strength and direction of the association between depressive and anxious symptoms. Moreover, the fact that depressive symptoms predicted changes in anxiety symptoms for only a subset of children, whereas anxiety predicted later depression regardless of the moderating factors, suggests that the processes by which depressive symptoms predict anxiety likely differ from those by which anxiety predicts later depression. Therefore, potential moderators as well as mediators of these relations should be examined separately in future prospective investigations.

This study made several notable contributions to our understanding of children's depressive and anxious symptom trajectories. Whereas previous research has focused on samples of children in middle childhood, this study examined dynamic relations between symptoms of anxiety and depression across adolescence, an important developmental period when such internalizing symptoms are increasing (e.g., Axelson & Birmaher, 2001; Hankin et al., 1998). This study provides some clues for understanding the inconsistent findings regarding the relation of depressive symptoms to later anxiety that have been reported in the literature; that is, we showed that when accounting for certain individual and contextual risk factors, children with depressive symptoms *do* have subsequent elevations in symptoms of anxiety during adolescence.

Another strength of the current study was the use of a bivariate LCS model to examine longitudinal coupling between symptoms of anxiety and depression over time. The use of different change models yielded different results with regard to these longitudinal relations (Ferrer & McArdle, 2010). Similarly, Snyder et al. (2009) found a positive correlation between parents' and teachers' reports of children's anxious and depressive symptoms, yet when the autoregressive cross-lag paths were added to the model, a negative relation between depression and later anxiety was found. The LCS models better captured the dynamic relations between symptoms of anxiety and depression that would have been missed by using the other change models. In the current study, the

https://doi.org/10.1017/S0954579413000102 Published online by Cambridge University Press

dynamic relation between symptoms of anxiety and depression would not have been detected if we had only relied on a parallel process or autoregressive cross-lag model.

Ultimately, the choice of which change model to use depends on one's theory about how symptoms are expected to be related over time. For example, the parallel process model would assume that the rates of change in anxious and depressive symptoms are related prospectively but would not account for any time-dependent relations between symptoms over time. The autoregressive cross-lag model would account for time-dependent relations over time but not for systematic growth or individual differences in change in anxious and depressive symptoms across time. The LCS model used here more accurately represented the theoretical perspective on how symptoms of anxiety and depression are longitudinally coupled over time.

The limitations of this study provide directions for future research. First, the extent to which the results of this study generalize to children with clinical diagnoses of anxiety or depressive disorders is not known. Replication of the current study with a clinical sample is needed to determine whether the relations observed in the present high-risk, community sample would be the same in youth with more severe forms of these disorders. Second, the measures of anxiety and depression in the current study were questionnaires rather than clinical interviews. Nevertheless, the use of different informants about adolescents' depressive and anxious symptoms reduced the possibility that the correlations between these constructs were primarily due to shared method. In addition, the measure of anxiety symptoms did not include overlapping items with depressive symptoms, which also reduced the likelihood that the correlations between these variables were spurious. Third, the measure of anxiety assessed an array of symptoms that cut across a range of anxiety disorders. The relations between depressive symptoms and each type of anxiety disorder may differ, however. For example, whereas many anxiety disorders typically occur prior to depression, panic disorder and obsessive–compulsive are less likely to precede depression (Lewinsohn, Zinbarg, Seeley, Lewinsohn, & Sack, 1997).

Fourth, maternal history of anxiety, family relationship quality, and adolescents' negative attributions were tested separately as moderators, but they do not occur in isolation. That is, children are likely exposed to multiple risk factors. Although the current sample was not large enough to consider the moderators simultaneously, future research should explore the cumulative risk to which children are exposed and how this may weaken or exacerbate the longitudinal relations between symptoms of anxiety and depression.

Fifth, the moderators were assessed in Grade 6, reflecting preadolescent exposure to these risk factors. However, these individual and contextual factors likely were also changing over time. Taking into account the time-varying nature of family and individual risk processes will allow for a more complete understanding of children's symptom trajectories (Kouros, Cummings, & Davies, 2010). Sixth, although a strength of this study is the prospective longitudinal design and the data analytic technique did account for baseline correlations, allowing for more cogent statements regarding temporal relations, there may be unmeasured third variables, such as shared genetic vulnerability (e.g., Zavos et al., 2010), that account for the longitudinal coupling between symptoms of anxiety and depression observed in this study.

The clinical implications of these findings are that symptoms of anxiety and depression can predict the longitudinal course of each other across adolescence, and therefore accounting for levels of both types of symptoms is important for charting children's mental health trajectories. The robust predictive nature of anxiety for later depressive symptoms underscores the importance of early preventive efforts for children exhibiting anxious symptoms to ameliorate possible negative consequences on children's depressive symptoms (Garber & Weersing, 2010). In addition, among children with depressive symptoms, targeted interventions for children whose mothers have a history of anxiety and depression, children from families with poor relationship quality, or children with pessimistic attributional styles may help reduce the likelihood that these children will experience subsequent elevations in anxiety symptoms.

Whereas the findings of the present study suggest *who* to target for interventions, questions still remain about *what* to target in the interventions. We posited that lack of social support and maladaptive responses to stress may potentially explain how depressive symptoms predict later anxiety; a test of these mediating processes, however, is warranted. Similarly, interventions targeted at addressing social withdrawal and low self-esteem among anxious children may provide clues into the mechanisms by which anxiety predicts later depressive symptoms. In order to refine existing prevention programs as well as develop new interventions for effectively reducing symptoms of anxiety and depression, a key direction for future research would be to examine the specific mechanisms by which symptoms of one disorder (e.g., anxiety) are related to changes in the other disorder (e.g., depression) over time.

References

Abela, J. R. Z., & Hankin, B. L. (2008). Cognitive vulnerability to depression in children and adolescents: A developmental psychopathology perspective. In J. R. Z. Abela & B. L. Hankin (Eds.), *Handbook of depression in children and adolescents* (pp. 35–78). New York: Guilford Press.

Abramson, L. Y., Metalsky, G. I., & Alloy, L. B. (1989). Hopelessness depression: A theory-based subtype of depression. *Psychological Review*, *96*, 358–372.

Abramson, L. Y., Seligman, M. E., & Teasdale, J. D. (1978). Learned helplessness in humans: Critique and reformulation. *Journal of Abnormal Psychology*, *87*, 49–74.

Achenbach, T. M. (1991). *Integrative guide for the 1991 CBCL/4-18, YSR, and TRF profiles*. Burlington, VT: University of Vermont, Department of Psychiatry.

Alden, L. E., & Taylor, C. T. (2004). Interpersonal processes in social phobia. *Clinical Psychology Review*, *24*, 857–882.

https://doi.org/10.1017/S0954579413000102 Published online by Cambridge University Press

Arbuckle, J. L. (2007). *AMOS 16.0 user's guide*. Chicago: Small Waters Corporation.

Avenevoli, S., Stolar, M., Li, J., Dierker, L., & Merikangas, K. (2001). Comorbidity of depression in children and adolescents: Models and evidence from a prospective high-risk family study. *Biological Psychiatry*, *49*, 1071–1081.

Axelson, D. A., & Birmaher, B. (2001). Relations between anxiety and depressive disorders in childhood and adolescence. *Depression and Anxiety*, *14*, 67–78.

Aydin, B., & Oztütüncü, F. (2001). Examination of adolescents' negative thoughts, depressive mood, and family environment. *Adolescence*, *36*, 77–83.

Beardslee, W. R., Versage, E. M., & Gladstone, T. R. G. (1998). Children of affectively ill parents: A review of the past 10 years. *Journal of the American Academy of Child & Adolescent Psychiatry*, *37*, 1134–1141.

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin*, *107*, 238–246.

Biederman, J., Petty, C., Hirshfeld-Becker, D. R., Henin, A., Faraone, S. V., Dang, D., et al. (2006). A controlled longitudinal 5-year follow-up study of children and high and low risk for panic disorder and major depression. *Psychological Medicine*, *36*, 1141–1152.

Biederman, J., Rosenbaum, J. F., Bolduc, E. A., Faraone, S. V., & Hirschfield, D. R. (1991). A high-risk study of young children of parents with panic disorder and agoraphobia with and without comorbid major depression. *Psychiatry Research*, *37*, 333–348.

Birmaher, B., Ryan, N. D., Williamson, D. E., Brent, D. A., Kaufman, J., Dahl, R. E., et al. (1996). Childhood and adolescent depression: A review of the past 10 years. Part I. *Journal of the American Academy of Child & Adolescent Psychiatry*, *35*, 1427–1439.

Bollen, K. A. (1989). *Structural equations with latent variables*. New York: Wiley.

Bollen, K. A., & Curran, P. J. (2006). *Latent growth curve models: A structural equation perspective*. Hoboken, NJ: Wiley.

Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 136–262). Thousand Oaks, CA: Sage.

Brozina, K., & Abela, J. R. Z. (2006). Symptoms of hopelessness depression and anxiety in children: Specificity of the hopelessness theory. *Journal of Clinical Child and Adolescent Psychology*, *35*, 515–527.

Cole, D. A., Martin, J. M., Powers, B., & Truglio, R. (1996). Modeling causal relations between academic and social competence and depression: A multitrait–multimethod longitudinal study of children. *Journal of Abnormal Psychology*, *105*, 258–270.

Cole, D. A., & McPherson, A. E. (1993). Relation of family subsystems to adolescent depression: Implementing a new family assessment strategy. *Journal of Family Psychology*, *7*, 119–133.

Cole, D. A., Peeke, L. G., Martin, J. M., Truglio, R., & Serocynski, A. D. (1998). A longitudinal look at the relation between depression and anxiety in children and adolescents. *Journal of Consulting and Clinical Psychology*, *66*, 451–460.

Compas, B. E., Connor-Smith, J. K., Saltzman, H., Thomsen, A. H., & Wadsworth, M. E. (2001). Coping with stress during childhood and adolescence: Problems, progress, and potential in theory and research. *Psychological Bulletin*, *127*, 87–127.

Costello, E. J., Foley, D. L., & Angold, A. (2006). 10-year research update review: The epidemiology of child and adolescent psychiatric disorders: 11. Developmental epidemiology. *Journal of the American Academy of Child & Adolescent Psychiatry*, *45*, 8–25.

Costello, E. J., Mustillo, S., Erkanli, A., Keeler, G., & Angold, A. (2003). Prevalence and development of psychiatric disorders in childhood and adolescence. *Archives of General Psychiatry*, *60*, 837–844.

Eberhart, N. K., & Hammen, C. L. (2006). Interpersonal predictors of onset of depression during the transition to adulthood. *Personal Relationships*, *13*, 195–206.

Feldman, S. S., Rubinstein, J. L., & Rubin, C. (1988). Depressive affect and restraint in early adolescents: Relationships with family structure, family process and friendship supports. *Journal of Early Adolescence*, *8*, 279–296.

Ferrer, E., & McArdle, J. J. (2003). Alternative structural models for multivariate longitudinal data analysis. *Structural Equation Modeling*, *10*, 493–524.

Ferrer, E., & McArdle, J. J. (2010). Longitudinal modeling of developmental changes in psychological research. *Current Directions in Psychological Science*, *19*, 149–154.

Flannery-Shroeder, E. C. (2006). Reducing anxiety to prevent depression. *American Journal of Preventive Medicine*, *31*, S136–S142.

Forehand, R., Biggar, H., & Kotchick, B. A. (1998). Cumulative risk across family stressors: Short- and long-term effects for adolescents. *Journal of Abnormal Child Psychology*, *26*, 119–128.

Garber, J. (2007). Depression in youth: A developmental psychopathology perspective. In A. S. Masten (Ed.), *Multilevel dynamics in developmental psychopathology: Pathways to the future* (pp. 191–242). New York: Erlbaum.

Garber, J., & Weersing, V. R. (2010). Comorbidity of anxiety and depression in youth: Implications for treatment and prevention. *Clinical Psychology: Science and Practice*, *17*, 293–306.

Gazelle, H., & Ladd, G. W. (2003). Anxious solitude and peer exclusion: A diathesis-stress model of internalizing trajectories in childhood. *Child Development*, *74*, 257–278.

Goodman, S. H., & Gotlib, I. H. (1999). Risk for psychopathology in the children of depressed mothers: A developmental model for understanding mechanisms of transmission. *Psychological Review*, *106*, 458–490.

Hammen, C. L. (1991). *Depression runs in families: The social context of risk and resilience in children of depressed mothers*. New York: Springer–Verlag.

Hammen, C., Burge, D., Burney, E., & Adrian, C. (1990). Longitudinal study of diagnoses in children of women with unipolar and bipolar affective disorders. *Archives of General Psychiatry*, *47*, 1112–1117.

Hankin, B. L., Abramson, L. Y., Moffitt, T. E., Silva, P. A., McGee, R., & Angell, K. E. (1998). Development of depression from preadolescence to young adulthood: Emerging gender differences in a 10-year longitudinal study. *Journal of Abnormal Psychology*, *107*, 128–140.

Hawley, L. L., Ho, M. R., Zuroff, D. S., & Blatt, S. J. (2006). The relationship of perfectionism, depression, and therapeutic alliance during treatment for depression: Latent difference scores analysis. *Journal of Consulting and Clinical Psychology*, *74*, 930–942.

Hollingshead, A. B. (1975). *Four Factor Index of Social Status*. Unpublished manuscript, Yale University.

Hughes, A. A., Furr, J. M., Sood, E. D., Barmish, A. J., & Kendall, P. C. (2009). Anxiety, mood, and substance use disorders in parents of children with anxiety disorders. *Child Psychiatry and Human Development*, *40*, 405–419.

Hughes, A. A., Hedtke, K. A., & Kendall, P. C. (2008). Family functioning in families of children with anxiety disorders. *Journal of Family Psychology*, *22*, 325–328.

Kaslow, N. L., Deering, C. G., & Racusin, G. R. (1994). Depressed children and their families. *Clinical Psychology Review*, *14*, 39–59.

Keenan, K., Feng, X., Hipwell, A., & Klostermann, S. (2009). Depression begets depression: Comparing the predictive utility of depression and anxiety symptoms to later depression. *Journal of Child Psychology and Psychiatry*, *50*, 1167–1175.

Kouros, C. D., Cummings, E. M., & Davies, P. T. (2010). Early trajectories of interparental conflict and externalizing problems as predictors of social competence in preadolescence. *Development and Psychopathology*, *22*, 527–538.

Kouros, C. D., & Garber, J. (2010). Dynamic associations between maternal depressive symptoms and adolescents' depressive and externalizing symptoms. *Journal of Abnormal Child Psychology*, *38*, 1069–1081.

Kouros, C. D., Merrilees, C. E., & Cummings, E. M. (2008). Marital conflict and children's emotional security in the context of parental depression. *Journal of Marriage and Family*, *70*, 684–697.

Kovacs, M. (1981). Rating scales to assess depression in school children. *Acta Paedopsychiatrica*, *46*, 305–315.

Kovacs, M. (1992). *The Children's Depression Inventory (CDI) manual.* Toronto: Multi-Health Systems.

Kovacs, M., Gatsonis, C., Paulauskas, S. L., & Richards, C. (1989). Depressive disorders in childhood: IV. A longitudinal study of comorbidity with and risk for anxiety disorders. *Archives of General Psychiatry*, *46*, 776–782.

Lau, S., & Kwok, L. (2000). Relationship of family environment to adolescents' depression and self-concept. *Social Behavior and Personality*, *28*, 41–50.

Lewinsohn, P. M., Zinbarg, R., Seeley, J. R., Lewinsohn, M., & Sack, W. H. (1997). Lifetime comorbidity among anxiety disorders and between anxiety disorders and other mental disorders in adolescents. *Journal of Anxiety Disorders*, *11*, 377–394.

Mason, M. J., Schmidt, C., Abraham, A., Walker, L., & Tercyak, K. (2009). Adolescents' social environment and depression: Social networks, extracurricular activity, and family relationship influences. *Journal of Clinical Psychology in Medical Settings*, *16*, 346–354.

McArdle, J. J., & Hamagami, F. (2001). Latent difference score structural models for linear dynamic analyses with incomplete longitudinal data.

https://doi.org/10.1017/S0954579413000102 Published online by Cambridge University Press

In L. M. Collins & A. G. Sayer (Eds.), *New methods for the analysis of change* (pp. 139–175). Washington, DC: American Psychological Association.

Merikangas, K. R. (1990). Comorbidity of anxiety and depression: Review of family and genetic studies. In J. D. Maser & C. R. Cloninger (Eds.), *Comorbidity of mood and anxiety disorders* (pp. 331–348). Washington, DC: American Psychiatric Association.

Merikangas, K. R., Dierker, L. C., & Szatmari, P. (1998). Psychopathology among offspring of parents with substance abuse and/or anxiety disorders: A high-risk study. *Journal of Child Psychology and Psychiatry*, *39*, 711–720.

Moffitt, T. E., Harrington, H., Caspi, A., Kim-Cohen, J., Goldberg, D., Gregory, A. M., et al. (2007). Depression and generalized anxiety disorder: Cumulative and sequential comorbidity in a birth cohort followed prospectively to age 32 years. *Archives of General Psychiatry*, *64*, 651–660.

Moos, R., & Moos, B. (1994). *Family Environment Scale manual: Development, applications, research* (3rd ed.). Palo Alta, CA: Consulting Psychologist Press.

Mufson, L., Weissman, M. M., & Warner, V. (1992). Depression and anxiety in parents and children: A direct interview study. *Journal of Anxiety Disorders*, *6*, 1–13.

O'Neil, K. A., Podell, J. L., Benjamin, C. L., & Kendall, P. C. (2010). Comorbid depressive disorders in anxiety-disordered youth: Demographic, clinical, and family characteristics. *Child Psychiatry and Human Development*, *41*, 330–341.

Pagani, L. S., Japel, C., Vaillancourt, T., Cote, S., & Tremblay, R. E. (2008). Links between life course trajectories of family dysfunction and anxiety during middle childhood. *Journal of Abnormal Child Psychology*, *36*, 41–53.

Pine, D. S., Cohen, P., Gurley, D., Brook, J., & Ma, Y. (1998). The risk for early-adulthood anxiety and depressive disorders in adolescents with anxiety and depressive disorders. *Archives of General Psychiatry*, *55*, 56–64.

Rapee, R. M. (1997). Potential role of childrearing practices in the development of anxiety and depression. *Clinical Psychology Review*, *17*, 47–67.

Reinherz, H. Z., Stewart-Berghauer, G., Pakiz, B., Frost, A. K., Moeykens, B. A., & Holmes, W. M. (1989). The relationship of early risk and current mediators to depressive symptomatology in adolescence. *Journal of the American Academy of Child & Adolescent Psychiatry*, *28*, 942–947.

Rodriguez, C. M., & Pehi, P. (1998). Depression, anxiety, and attributional style in a New Zealand sample of children. *New Zealand Journal of Psychology*, *27*, 28–34.

Seligman, L. D., & Ollendick, T. H. (1998). Comorbidity of anxiety and depression in children and adolescents: An integrative review. *Clinical Child and Family Psychology Review*, *1*, 125–144.

Seligman, M. E., Kaslow, N. J., Alloy, L. B., Peterson, C., Tanenbaum, R. L., & Abramson, L. Y. (1984). Atrributional style and depressive symptoms among children. *Journal of Abnormal Psychology*, *93*, 235–238.

Sheeber, L., Hops, H., Alpert, A., Davis, B., & Andrews, J. (1997). Family support and conflict: Prospective relations to adolescent depression. *Journal of Abnormal Child Psychology*, *25*, 333–344.

Sheeber, L., Hops, H., & Davis, B. (2001). Family processes in adolescent depression. *Clinical Child and Family Psychology Review*, *4*, 19–35.

Sitarenios, G., & Kovacs, M. (1999). Use of the Child Depression Inventory. In M. E. Maruish (Ed.), *The use of psychological testing for treatment planning and outcomes assessment* (pp. 267–298). Mahwah, NJ: Erlbaum.

Snyder, J., Bullard, L., Wagener, A., Leong, P. K., Snyder, J., & Jenkins, M. (2009). Childhood anxiety and depressive symptoms: Trajectories, relationship, and association with subsequent depression. *Journal of Clinical Child & Adolescent Psychology*, *38*, 837–849.

Spitzer, R. L., Williams, J. B. W., Gibbon, M., & First, M. B. (1990). *User's guide for the Structured Clinical Interview for DSM-III-R: SCID*. Washington, DC: American Psychiatric Association.

Thompson, M., Kaslow, N. J., Weiss, B., & Nolen-Hoeksema, S. (1998). Children's Attributional Style Questionnaire—Revised: Psychometric examination. *Psychological Assessment*, *10*, 166–170.

Weissman, M. M., Leckman, J. F., Merikangas, K. R., Gammon, G. D., & Prusoff, B. A. (1984). Depression and anxiety disorders in parent and children: Results from the Yale Family Study. *Archives of General Psychiatry*, *41*, 845–852.

Zavos, H. M., Rijsdijk, F. V., Gregory, A. M., & Eley, T. C. (2010). Genetic influences on the cognitive biases associated with anxiety and depression symptoms in adolescents. *Journal of Affective Disorders*, *124*, 45–53.

https://doi.org/10.1017/S0954579413000102 Published online by Cambridge University Press