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An Ecological Risk Model for Early Childhood Anxiety: The Importance of Early Child Symptoms and Temperament

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Abstract

Childhood anxiety is impairing and associated with later emotional disorders. Studying risk factors for child anxiety may allow earlier identification of at-risk children for prevention efforts. This study applied an ecological risk model to address how early childhood anxiety symptoms, child temperament, maternal anxiety and depression symptoms, violence exposure, and sociodemographic risk factors predict school-aged anxiety symptoms. This longitudinal, prospective study was conducted in a representative birth cohort (n=1109). Structural equation modeling was used to examine hypothesized associations between risk factors measured in toddlerhood/preschool (age=3.0 years) and anxiety symptoms measured in kindergarten (age=6.0 years) and second grade (age= 8.0 years). Early child risk factors (anxiety symptoms and temperament) emerged as the most robust predictor for both parent-and child-reported anxiety outcomes and mediated the effects of maternal and family risk factors. Implications for early intervention and prevention studies are discussed.

Keywords

Anxiety; Child anxiety; Toddler; Preschool; Risk factor; Longitudinal; Structural equation modeling; Ecological; Etiology; Temperament; Behavioral inhibition; Violence

Anxiety disorders represent one of the most pervasive mental health problems (Kessler et al. 1994). Prevalence rates for anxiety disorders in children are approximately 10% (Costello et al. 2003; Egger and Angold 2006). Given their association with later anxiety disorders, depression and externalizing disorders (Bittner et al. 2007; Cole et al. 1998), they have been

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framed as “gateway disorders” to a variety of later mental health problems (Kessler 2010). Anxiety in young children may be impairing, interfering with parent-child relationships, family functioning, and peer relationships (Warren 2004). Symptoms in toddlers and preschoolers have been shown to persist for a period of a year or longer (Briggs-Gowan et al. 2006; Mesman et al. 2001). These findings suggest that research informing prevention in young children could have far-reaching public health benefits.

To address the stability and impairing nature of child anxiety on emotional development, researchers have recommended *selective* prevention programs, targeting children most at risk (Hirshfeld-Becker and Biederman 2002; Rapee 2002). This type of approach requires identification of salient risk factors. Most research in this area has focused on individual risk factors within one level of the child’s ecology, such as child temperament or early symptoms (e.g., Mesman et al. 2001). Despite strong empirical evidence that both temperamental and environmental influences from multiple levels of ecology influence the unfolding of anxiety in early childhood, (Marakovitz et al. in press; Vasey and Dadds 2001) a longitudinal, ecological model that integrates child and environmental factors has yet to be examined empirically. In this paper, we examine a comprehensive risk model that includes contributions of child-, maternal-, and family/community-level factors on patterns of anxiety symptoms from early childhood to elementary school in a diverse community sample. Thus, we take advantage of a rare opportunity to examine longitudinal patterns of anxiety within a transactional-ecological framework to inform prevention and intervention programs.

Etiological Models for Child Anxiety

Ecological frameworks situate the individual child within a complex system of contexts that shape and influence development. Bronfenbrenner and Ceci (1994) present a transactional-ecological system of bi-directional influences varying from proximal (e.g., child temperamental vulnerability) to more distal (e.g., family, community) influences. Consistent with this framework, empirical evidence supports multiple influences on childhood anxiety, including temperament, parent psychopathology, parenting practices, family environment, and community factors (Karevold et al. 2009; Marakovitz et al. in press; Vasey and Dadds 2001). Further, cognitive-behavioral theories relating parenting to child anxiety suggest that early family influences may exacerbate temperamental vulnerability by reinforcing maladaptive cognitive and behavioral strategies (Chorpita and Barlow 1998).

Recent longitudinal research has been instrumental in uncovering the development and stability of anxiety symptoms. Karevold et al. (2009) tested relationships between child and environmental risk factors and internalizing symptoms from infancy through early adolescence in a population-based study. Although stability of risk factors was demonstrated (coefficients were approximately 0.50 for stability of child shyness), few early risk factors predicted later *symptoms*, and none specifically predicted anxiety. Also, the school-age focus did not permit the examination of risk exposure on earlier emerging symptoms. In a longitudinal, population-based study of the etiology of internalizing and externalizing symptoms, Bayer et al. (2008) tested a comprehensive set of risk factors from infancy through early preschool and identified both child and environmental factors as important contributors, but did not specifically investigate anxiety. Although important risk factors

have been identified, few studies have employed a longitudinal, multi-level (i.e., ecological), multi-informant approach.

Ecological Risk Factors for Child Anxiety

Child Level: Temperament and Early Symptoms

Two temperamental characteristics have been implicated in the early development of internalizing problems: *behavioral inhibition* and *negative emotionality*. Behavioral inhibition has been defined as a consistent tendency to display fear, withdrawal, or wariness in novel or unfamiliar situations, and is typically assessed by laboratory observation with novelty or social presses (e.g., Kagan et al. 1987). Parent-reported shyness in toddlerhood, has been demonstrated to be consistent with behavioral coding (Pfeifer et al. 2002). Behavioral inhibition is a risk factor for later anxiety: toddlers identified as inhibited are more likely to develop an anxiety disorder later in childhood (Biederman et al. 2001) and adolescence, even when assessed with parent report (Chronis-Tuscano et al. 2009).

A second risk factor for child anxiety is negative emotionality, a temperamental construct characterized by irritability, negative mood, difficulty being soothed, and intense negative emotional reactions (Sanson et al. 2004). Negative emotionality is often linked to childhood depression due to the central role of negative affect. However, the evidence for the specificity of negative emotionality is inconsistent; evidence suggests that this construct is associated with *mutifinality*, or related to many forms of childhood psychopathology (Shaw et al. 1997), including anxiety symptomology.

The advent of toddler-age symptom measures (Carter et al. 2003) and evidence of problem persistence in early preschool (Briggs-Gowan et al. 2006) and middle childhood (Mesman et al. 2001) support measuring preschool anxiety *symptomology* that is theoretically distinct from temperamental variation. For example, whereas shyness may be considered a normative temperamental characteristic, behaviors that suggest fearful responses or worry may be indicative of an emotional problem. The feasibility of differentiating between temperament and symptoms in young children- and how best to do so-remains a controversial issue. Many researchers focus on either early symptoms (Mesman et al. 2001) or temperament (Karevold et al. 2009), without addressing the other or their overlap. In an effort to be comprehensive, both are included in the present study with a latent variable methodology, allowing each to contribute individually and account for shared variance.

Maternal Level: Maternal Anxiety and Depression

Children of anxious parents are up to seven times more likely than children of non-anxious parents to develop an anxiety disorder (Turner et al. 1987), with genetic influences explaining approximately 50% of variation in anxiety symptoms in young children (Eley et al. 2003). Environmental influence can be partly explained by parent–child interactions—children may learn to model anxious parents' fearful and overprotective responses (Wood et al. 2003). Parents with anxiety disorders also tend to be more controlling and less warm than non-anxious parents (Dumas et al. 1995), but most studies have been cross-sectional or retrospective, limiting causal inferences.

Aspects of the environment that increase a child's sense of uncontrollability or diminish perceived warmth, such as maternal depression, could also heighten risk for child anxiety. Depressed mothers have been rated as less engaged and more authoritarian, affecting their responsivity and sensitivity (Pelaez et al. 2008). Further, the episodic and impairing nature of depression is likely to impact parents' consistency and availability. It is unclear if parental anxiety and depression represent independent risks, but twin and family studies point to a common vulnerability (Eley and Stevenson 1999), suggesting that both increase the risk for child anxiety. These findings highlight the role of maternal affective risk may play in an ecological model for the emergence and maintenance of child anxiety.

Family/Community Level: Sociodemographic Factors and Violence Exposure

Although proximal effects, such as genetic or parental influences, are often believed to have the greatest influence in early childhood, evidence suggests that more distal effects, including exposure to family conflict or violence increases risk of adjustment and internalizing problems. Specifically, in the current sample, McDonald and colleagues (2007) found that toddler exposure to violence involving a family member and family conflict both uniquely predicted adjustment problems after controlling for multiple demographic characteristics. Exposure to violence in early childhood has also been associated with anxiety *disorders* (Briggs-Gowan et al. 2010). Such exposure could contribute to a cognitive style in which the environment is interpreted as unpredictable and dangerous. Similarly, more contextual, sociodemographic risk factors such as living in poverty, having a teenage or single mother, limited household education, and minority ethnicity (although these data are inconsistent) have been implicated as risk factors for a number of social-emotional/behavioral problems (Duncan et al. 1994; McLeod and Shanahan 1993). Unfortunately, research linking risks to internalizing, rather than externalizing problems and disorders, is far under-represented.

Conceptualization of Risk in the Present Study

Despite empirical evidence that specific child and environmental risk factors predict child anxiety in late childhood (e.g., Karevold et al. 2009), longitudinal studies that integrate child and contextual factors within an ecological model are needed. Similarly, questions of whether risk factors affect children early in development are seldom addressed. O'Brien (2005) eloquently describes the need to employ statistical methods that reflect developmental complexity: "Because risk factors—even those at different levels of analysis—coexist, an important consideration in identifying risk and intervening to reduce risk has to do with defining the underlying latent structure through which multiple factors act to affect outcomes" (pp. 887).

The present study uses latent-variable methodology to model multiple levels of ecological risk (child, maternal, and family/community) to predict anxiety symptoms at two later time points (kindergarten and second grade). Both children and parents reported on anxiety in second grade. This approach is designed to be compatible with selective prevention methods by employing questionnaire data gathered in toddlerhood. Two models are presented: one in which the three levels of risk have unique, direct effects on kindergarten and second grade

anxiety symptoms (direct effects model), and one in which maternal and family/community risk have concurrent effects on early child temperament and symptoms, which predict later child anxiety symptoms (mediational model). Testing both models allows for comparison of whether early risk within the child level carries the maternal and community risk forward (i.e., the child internalizes early risk factors, mediating maternal and community risk) or if all three levels of risk independently predict later anxiety. To investigate the degree to which one risk variable might amplify the effect of another, moderation analyses, testing whether child risk factors are amplified by either maternal or family/community risk factors, are explored.

The following hypotheses are tested: 1) Toddler/preschool child temperament and early anxiety symptoms (Child Level), maternal anxiety and depression symptoms (Maternal Level), and sociodemographic risk and violence exposure (Family/Community Level) will uniquely predict kindergarten and second grade anxiety symptoms; 2) The association between maternal and family/community risk factors and anxiety symptoms in kindergarten and second grade will be meditated by Child Level risk; 3) The effect of toddler/preschool temperament and anxiety symptoms on kindergarten and second grade anxiety symptoms will be moderated (amplified) by other ecological risks (Maternal and Family/Community Levels).

Method

Participants

The present report includes analyses with two samples. Analyses with the parent-report outcome use the full sample; analyses with the child-report outcome use a subsample, as described below. Participants include parents and children who were born healthy and ascertained from birth records provided by the State of Connecticut Department of Public Health. Children were born at Yale New Haven Hospital in a Standard Metropolitan Statistical Area (SMSA) of the 1990 Census (Briggs-Gowan et al. 2001). Children who were at high risk for developmental delays due to premature birth, low birth weight, or birth complications were excluded. Families were excluded if 1) no parent could participate in English, 2) they had moved out of state, 3) no biological parent had custody, or 4) eligibility could not be verified. Excluded children were more likely to be of minority ethnicity and of low household education. The present study includes 74% of all eligible families (n=1109). Parents participated in the study when the child was between 22 and 48 months old (mean age=36.04 months, SD=6.84) and were followed when the child was in kindergarten (mean age=6.03 years, SD=0.39), and/or when the child was in second grade (mean age=8.01 years, SD=0.49). The response rate for the survey included in this report was 82.3% of 1491 eligible families initially ascertained from birth records and represents 92.3% of families who participated in this study at any time point (n=1329). Seventy children were excluded from this report due to having a non-maternal respondent at the first time point, but children with non-maternal respondents at the kindergarten (n=24) and second grade (n=21) time points were included (98% were mothers). For this report, there was 86% retention at the kindergarten time point (n=954) and 84% retention at the second grade time point (n=933). The parent-report sample is evenly split between boys (n=529) and girls (n=580) and is

racially and ethnically diverse (66.0% White, 17.4% Black/African American, 5.1% Hispanic/Latino, 8.4% Black/Hispanic, 1.8% Asian/Pacific Islander, and 1.3% other race/ethnicity). At the first time point, 25% of the respondents had a high-school degree or less education, and 75% had a degree higher than high-school. According to federal guidelines for income-to-needs ratio or the federal poverty guideline, 15.1% of the sample was living in poverty. These demographic data are representative of the Greater New Haven SMSA at the time the first data were collected.

To investigate risk for school-age mental health problems, an *intensive assessment subsample*, enriched for psychopathology (n=567), was invited to participate in direct child assessments in second grade. Eighty percent of children in this subsample were selected based on the presence of persistent social-emotional/behavioral problems in early childhood (according to parent or teacher report or service need) or parent- or teacher-reported language or learning difficulties or service need in early elementary school (for detailed sample description, see Carter et al. 2010). Of the 567 children, 252 were selected based on social-emotional/behavioral problems only, 83 were identified for language problems[1] only, 98 were identified based on problems in both areas, and 134 were selected at random from the group of children who had none of these problems. The response rate for this subsample was 78% (n=442). Participants in the intensive assessment subsample did not differ from non-participants in selection criteria (*Rao-Scott* χ^2 =1.4369, *ns*). The child-reported symptoms in second grade were gathered from interviews as part of the intensive assessment subsample. The final subsample (n=317; mean age=7.96 years, SD=0.44) was evenly split between boys (n=161) and girls (n=156) and was racially and ethnically diverse (65% White, 18.9% Black/African American, 7.3% Hispanic/Latino, 6.3% Black/Hispanic, 1.6% Asian/Pacific Islander, and 0.9% other race/ethnicity). The subsample included 27.5% of respondents with high-school degree or less education, and 19.4% of the sample was living in poverty. Compared with participants not selected for the subsample, participants were more likely to be living in poverty (χ^2 =6.27, df=1, p<0.05), but this was the only difference.

Procedure

In early childhood, parents were invited to participate by mail. Nonresponders were contacted by phone or in person. Informed consent procedures were followed and procedures reviewed by two university institutional review boards. Parents completed mailed questionnaires at all time points. In second grade, children in the intensive assessment subsample were interviewed in a study office or in the family's home, based on family preference. Families were given $25 or $30 for completing questionnaires and $100 for completing an in-person visit.

Measures

Toddler/Preschool Temperament and Early Symptoms—The Infant-Toddler Social and Emotional Assessment (ITSEA) is a 166-item parent report questionnaire that measures

[1]Language problems were included due to the overlap between language and behavior problems as risk factors for later social/emotional and behavioral problems.

social-emotional/behavioral problems and competencies in children 11–48 months old (Carter and Briggs-Gowan 2006; Carter et al. 2003). Items are rated on a 3 point scale from 0=Not true/Rarely to 2=Very True/Often. This study included *General Anxiety* (e.g., Seems nervous, tense, or fearful), *Separation Distress* (e.g., Cries or hangs onto you when you try to leave), *Inhibition to Novelty* (e.g., Is quiet or less active in new situations), and *Negative Emotionality* (e.g., Is irritable or grouchy). The four subscales demonstrated acceptable reliability and validity with respect to internal consistency, test-retest reliability, inter-rater reliability, and both predictive and concurrent validity across three assessment years (Carter and Briggs-Gowan 2006).

Toddler/Preschool Violence Exposure—The Child Life Events Scale (CLES) is a parent-report checklist indicating whether and at what age their child experienced a number of potentially traumatic events, whether they noticed a dramatic change in their child following the event(s), and how long the change lasted (Carter and Briggs-Gowan unpublished scale). Violence-related items have shown the strongest associations with symptoms (Briggs-Gowan et al. 2010). The following items were included: (1) saw violence in the neighborhood, (2) saw someone use a weapon to hurt or threaten a family member, (3) saw someone hit, push or kick a family member, and (4) experienced some other violent event. The 9-item CLES has demonstrated concurrent and predictive validity (Mongillo et al. 2009).

Toddler/Preschool Cumulative Sociodemographic Risk—The cumulative sociodemographic risk score assigns equal weights to the sum of the following sociodemographic variables: poverty, low household education, teenage mother, minority ethnicity, unemployment, and single parent household. Cumulative risk scores are recommended when variables are highly correlated (Sameroff et al. 2004); combining risks also reduces Type I error.

Toddler/Preschool-Age Maternal Anxiety—The Beck Anxiety Inventory (BAI) is a widely-used, 21-item, self-report measure of physiological and cognitive symptoms of anxiety (Beck et al. 1988). Included as an indicator of parent anxiety, the respondent is asked to rate the degree to which he or she has “been bothered by these feelings” (e.g., nervous) in the past week. Responses are given on a 4-point scale of 0 (not at all) to 3 (severely). Internal consistency (alpha) is 0.92 and 1-week test-retest correlation is 0.75.

Toddler/Preschool-Age Maternal Depression—The Center for Epidemiologic Studies Depression Inventory (CES-D) is a widely used, 20-item, self-report measure of adult depression symptoms (Radloff 1977). This measure has high internal consistency (coefficient alphas from 0.84 to 0.90) and good test-retest reliability (ranging from 0.51 to 0.67) for 2- and 4-week intervals.

Kindergarten and Second Grade Child Anxiety Symptoms—The Child Behavior Checklist (CBCL) is a very widely-used parent report of emotional and behavior problems in children (Achenbach 1992). Answers are given on a 3-point scale ranging from 0 (*not at all*) to 2 (*a lot*). The CBCL *DSM Anxiety Problems* subscale was employed to assess anxiety

symptoms (Achenbach et al. 2003). This subscale is made up of 6 items that pertain to child anxiety (e.g., nervous, high-strung, or tense; fears going to school).

Second Grade Child-Reported Child Anxiety Symptoms—The Berkeley Puppet Interview (BPI) is an interactive interview for young children (Ablow et al. 1999). Two identical puppets make opposing statements about themselves (e.g., "I worry if other kids will like me," "I don't worry if other kids will like me") and then ask children to describe themselves ("How about you?"). Verbal and nonverbal responses are rated on a 7 point scale, with 7 most positive, 1 most negative, and 4 neutral. BPI scores were reversed so higher scores indicate higher symptoms to simplify reporting. The 7-item *overanxious* subscale was included as a child anxiety outcome. Responses were scored by two trained coders and good interrater reliability was achieved (intra-class correlation=0.90). Internal consistency was acceptable for the current sample (α=0.73).

Data Analytic Plan

Data were analyzed with two statistical packages: SPSS Version 16 and Mplus Version 5.1 (Muthen and Muthen 2007). Mplus was used for all analyses with latent variables. Structural equation modeling (SEM) using the maximum likelihood estimator was used to evaluate the *direct effects* and *mediational* models, predicting to school-age anxiety symptoms from toddler/preschool child, maternal, and family/community risk factors. Regression analyses with SPSS were used to explore moderation effects. SEM has two components: a *measurement model* describing the relationships between observed risk variables and latent factors, and a *structural model* describing the relationships between latent risk factors and outcome variables. In diagrams, latent factors are represented as ovals while observed variables are rectangles.

Four fit indices and cut off values were used: 1) The Bentler Comparative Fit Index (CFI), ranges from 0 to 1.0 with a value of 0.9 representing adequate fit and 0.95 "good" fit (Hu and Bentler 1999); 2) The root mean square error of approximation (RMSEA) is minimally sensitive to sample size, with a cut-off value of less than 0.1 for "reasonable" fit and 0.05 or 0.06 for acceptable or "good" fit, respectively (Fan et al. 1999; Hu and Bentler 1999); 3) The Standardized Root Mean Square Residual (SRMR), ranging from 0 to 1.0, with values less than 0.08 considered adequate (Hu and Bentler 1999); and 4) The Chi square (χ^2) statistic, which is reported but *not used as a measure of fit*, as it is a poor estimate with large samples (Fan et al. 1999). Acceptable fit of measurement models with latent variables, according to above fit criteria, was confirmed before testing structural models. In structural models, paths from latent risk variables were treated as "causal," predicting dependent, outcome variables.

Results

Missing Data, Descriptive Statistics and Correlation Analysis

Less than 2% of data were missing for all toddler/preschool-age risk variables. For kindergarten and second grade parent-reported anxiety, 14.1 and 16.0% of data were missing, respectively, largely reflecting attrition. Full Information Maximum Likelihood was used to estimate missing data. This method has demonstrated low parameter bias with

missing data rates as high as 25% (Enders and Bandalos 2001). Independent samples *t*-tests demonstrated that the only significant sex difference was that girls were more anxious in toddlerhood/preschool (t=−3.06, p<0.01), but this effect was small (η^2 =0.008). There were no significant sex differences in the Intensive Assessment Subsample (n=317). Table 1 shows the correlation matrix for all variables of interest. As expected, many risk factors were significantly intercorrelated and predicted school-age anxiety symptoms. Sex differences in correlations were tested, but only 5.5% of differences were significant (z>2.0; p<0.05), attributable to chance by conventional standards. As expected, compared to unselected children, children in the intensive assessment subsample (n=317) had elevated symptoms and risk factors-except sociodemographic risk or violence exposure (both small effects, η^2<0.07). Hence, this sample was enriched for symptoms, but comparable to the full sample on community risk.

Child sex was examined as a moderator of the association between early ecological risks and later anxiety outcomes using multi-group modeling with a cross-group equality constraints method. However, since sex differences were rare and subtle across measurement and structural models, single-group models are presented. Sex differences are noted where relevant.

Parent Report Outcome Models

The measurement model was tested with three theoretical latent factors, representing early child, maternal, and family/community factors (see Fig. 1). Based on modification indices, two correlated errors among ITSEA subscales were allowed and maintained in models (see Figs. 1 and 2). The measurement model represented a good fit for the data (See Table 2 for all fit indices). The *direct effects* structural model included the child, maternal, and family/community factors with regression paths to two endogenous variables: parent-reported anxiety in kindergarten and second grade (see Fig. 1). Non-significant paths were trimmed in the final model. Model fit (see Table 2) satisfied criteria for adequate fit across indices and approached more conservative values for “good” fit for the CFI (0.940) and RMSEA (0.065). This model also explained a total of 22 and 26% of the variance in parent-reported child anxiety in kindergarten and second grade, respectively. Child factors was the most robust toddler/preschool risk variable, predicting kindergarten and second grade anxiety (β=0.50, p<0.001 and β=0.18, p<0.01, respectively). Maternal factors did not significantly predict anxiety symptoms at either time point. Family/community factors did not predict anxiety symptoms in kindergarten, but did predict anxiety in second grade, although in the opposite direction as hypothesized (β=− 0.13, p<0.05). Multi-group modeling revealed that this effect was only present for girls (and the only significant sex difference). Tests that isolated the effects of all three latent risk variables indicated that all three significantly predicted both outcome variables in expected directions.

To test the mediational model (See Fig. 1), a model in which maternal and family/community factors predicted child factors concurrently, and child factors predicted later anxiety symptoms, was evaluated. This model tested child factors as a mediator of maternal and family/community factors. The mediational model was also an adequate-good fit for the data (see Table 2), and this model did not differ from the direct effects model ($\chi^2\Delta$ =1.88,

*df*Δ =1, p=0.17). Family/community factors again negatively predicted second grade anxiety. A formal test of mediation was done with the Mplus calculation of indirect effects of risk factors "through" the mediator, child factors. All four indirect effects were significant, suggesting that child factors mediated the effect of maternal (β=0.13, p<0.01; β=0.08, p<0.01) and family/community (β=0.18, p<0.001; β=0.12, p<0.001) factors on anxiety symptoms in both kindergarten and second grade, respectively. Alternative models in which maternal factors mediated the effects of child and family/community factors did not meet criteria for acceptable fit (e.g., CFI<0.90).

To maintain the continuous representation of risk variables, moderation tests were conducted with aggregate variables for each level of risk. Variables (e.g., ITSEA Anxiety, ITSEA Separation Distress, etc.) were standardized and summed to create the aggregate (e.g., child factors), which was used to create product terms. Hierarchical regression was used to test if maternal or family/community factors moderated child factors. Child, maternal, and family/community aggregate factors were entered as Step 1; the two-way product terms and a 3-way product term were entered as Step 2. Child factors again significantly predicted anxiety symptoms in kindergarten (β= 0.43; p<0.001) and second grade (β=0.28; p<0.001). Maternal factors did not predict anxiety in either model, and family/community factors predicted anxiety symptoms only in kindergarten (β=0.09; p<0.01). No interactions achieved significance.

Child Report Outcome Models

Because the subsample completing the BPI was much smaller (n=317), child-report models were run separately. A measurement model with child, maternal, and family/community factors resulted in inadequate overall fit (RMSEA>0.09). The family/community risk variable was dropped, providing a good fit for the data (Table 2). The *direct effects* structural model included the final measurement model predicting to child-reported second grade anxiety, which also provided a good fit for the data. Consistent with the parent-report model, the Child Level factors latent variable was the more robust predictor (β=0.21, p<0.05; see Fig. 2) and maternal factors were not significantly associated with child-reported anxiety.

The mediational model (see Fig. 2), which included paths from maternal factors to child factors and from child factors to child-reported second grade anxiety (again testing child factors as a mediator of maternal factors), provided a good fit for the data. Consistent with the parent-report model, the indirect effect indicated that child factors mediated the effect of maternal factors on child-reported anxiety (β=0.11, p<0.05). Moderation was tested using hierarchical regression with the child-reported outcome. Specifically, a model testing whether maternal factors moderated the effect of child factors on child-reported anxiety was run. Neither child nor maternal factors significantly predicted child-reported anxiety symptoms (β=0.06 and 0.12 respectively), and the product term was also non-significant (β= −0.02; p<0.10).

Discussion

This study used SEM to examine an ecological risk model with a multi-informant anxiety outcome within a longitudinal framework spanning the toddler/preschool years to second

grade. This study was designed to be compatible with selective prevention models by employing only questionnaire data for early risk factors within a representative sample. Models generally fit the data well and provided evidence for how ecological risk factors affect child anxiety presentation. Although maternal affective symptoms and community violence exposure and cumulative risk were associated with child symptoms and temperament concurrently in early childhood, child symptoms and temperament emerged as the strongest predictor of kindergarten and second grade anxiety symptoms across parent and child-report models. Findings suggest that focusing on child factors may be a powerful and efficient way to assess early risk for targeted intervention, but also that contextual risk factors influence children's temperamental and anxiety symptom presentation early in life. Results generally support recommendations for selective prevention (Hirshfeld-Becker and Biederman 2002); variations in child temperament and symptom presentation, even assessed by parent-report, may be useful for identifying risk pathways.

As in previous research, most toddler risk factors were intercorrelated and many were associated with later anxiety symptoms (e.g., Mesman and Koot 2001). Although parent-reported and child-reported anxiety were not correlated (highlighting the value of multiple informants), similar patterns of risk emerged for parent and child report models. Not surprisingly with a sample this young, sex differences were rare and subtle across analyses (e.g., Mesman et al. 2001). With respect to the parent-reported anxiety outcome measurement model, there was strong support for the conceptualization of risk factors parceled according to child, maternal, and community domains, supporting ecological theory (Bronfenbrenner and Ceci 1994). The inadequate fit of the child-report outcome model including family/community factors may have been due to the smaller sample size. Within a toddler/preschool sample, parceling out temperamental and symptom variation is challenging, if not impossible, both theoretically and methodologically (Cicchetti and Toth 1997). Some have even suggested that behavioral inhibition may actually be best understood as an early manifestation of anxiety symptomology (Egger and Angold 2006). To acknowledge the unique developmental aspects that these constructs represent, temperament and early childhood symptoms were combined within a latent factor that allowed them to contribute uniquely to a single, theoretical source of risk while correlated errors between the inhibition to novelty and two anxiety symptom scales partly accounted for their overlap. The same latent variable methodology was used to account for the shared and distinct contributions of maternal anxiety and depression symptoms, which often co-occur.

There was partial support for the first hypothesis—that child, maternal, and community risk factors in toddlerhood would uniquely predict later anxiety symptoms. Child anxiety symptoms and temperament represented the most robust predictor across informants and models, consistent with prior cross-sectional (Marakovitz et al. in press) and longitudinal research (Biederman et al. 2001; Mesman et al. 2001). Although maternal anxiety and depression symptoms were not directly associated with kindergarten or school age anxiety when child factors were included in models, correlations and indirect effects suggest that these are important risk factors. In a similar sample, Mesman and Koot (2001) reported that after controlling for preschool anxiety symptoms, family psychopathology and socioeconomic status were no longer predictive of later internalizing problems, suggesting that these early risks tend to have a strong effect early in development, and there is

developmental stability in child symptoms. Consistent with a previous research (e.g., Carter et al. 2010; Duncan et al. 1994), violence exposure and sociodemographic risk were also related to child symptoms, but this association was mostly limited to concurrent and indirect effects, suggesting these factors also affect children early.

The second hypothesis—that maternal and family/community factors would be concurrently associated with early child symptoms and temperament—was strongly supported by mediational models. These models were also more parsimonious and had no-non-significant paths. Child risk factors mediated other contextual risks, and consistent with a transactional-ecological framework (Cicchetti and Toth 1997), mediational models tested the degree to which environmental risk factors affect children early in life and alter development, rather than how risk factors independently affect anxiety symptoms over time (direct-effects model). This mediation highlights the complexity of developmental influences (Cicchetti and Toth 1997), which is often overlooked when risk factors are treated independently. Mediational models provided strong evidence that the effects of maternal and community factors influenced the child at an early age, consistent with theoretical and empirical research (Chorpita and Barlow 1998; Dumas et al. 1995). Having an anxious or depressed parent, living in an underprivileged environment, or being exposed to violence leads to early childhood risk, which increase anxiety symptomology over time. In general, findings also highlight the co-occurrence of risk factors, and the concurrent association between maternal internalizing problems and early child symptoms likely partially reflects a genetic contribution. Present findings illuminate a small piece of a complex, developmental process in which the transaction between the child and environment begins very early in life and likely influences the child's negotiation of developmental tasks such as the separation from parents and developing social skills (Cicchetti and Toth 1997). Such impairment evidences the need for very early intervention and prevention. Learning more about these processes may be possible by employing cross-lag models with risk measured at each time point, an area for future research.

The hypothesis that the effect of early child symptoms and temperamental risk would be amplified in ecological environments with higher maternal and family/community risks, (a moderation effect), was not supported. This is somewhat surprising given research documenting the potential moderating relationship between maternal personality and behavior and child temperament predicting later social wariness (Degnan et al. 2008). Most studies that have found evidence of moderation compare extreme (high-low) groups of temperamental risk (e.g., Degnan et al.); we chose to represent this construct in a continuous fashion, which may have obscured moderation effects, but better captured the range of risk present in the community. Also, our measure of temperament was a parent-reported measure, which may not be as powerful as an observational assessment of temperament.

One unexpected finding was that sociodemographic risk and violence exposure, modeled as a latent factor, predicted *lower* second grade anxiety. Multi-group analyses uncovered that this effect was only true for girls, suggesting that parents in high-risk environments may underestimate or underreport their daughters' anxiety symptoms. However, this finding must be interpreted with caution as both risk variables were positively correlated with anxiety,

which did not differ for boys and girls, and isolated direct effects were in the expected, positive direction.

Limitations and Future Directions

This study used a large community sample that reflected diversity with respect to race, ethnicity, education, and income. Despite a lack of association across informants for anxiety symptoms at school age, risk pathways for parent-and child-reported symptoms were similar. The use of questionnaire assessments in the toddler years suggests that this method may be appropriate for early identification for large-scale selective prevention studies. However, findings should be interpreted with some important limitations. First, it must be noted that the majority of data were collected from a single, maternal informant. Although parents are the most knowledgeable informants of their preschool children, and research suggests that parent report is consistent with observational assessments (e.g., Pfeifer et al. 2002), respondent bias may have inflated some associations. As the current report relies on a continuous measurement of anxiety symptoms, we can not infer that the risk patterns observed generalize to anxiety *disorders*, although research with diagnostic measures has demonstrated the importance of such risks (Carter et al. 2010). Sensitivity and specificity analyses, as well as anxiety symptom trajectories, will be necessary to more precisely identify children at highest risk. The comprehensiveness of the model could be expanded or refined; other indicators, such as peer or teacher relationships, could improve or expand the model presented here. It is unfortunate that data on parenting practices (i.e., overprotection) were not available for analysis with this sample. Finally, despite this sample's diversity, it is largely composed of upper- and middle-class White, European-American families; power limitations prohibited testing models with minority subsamples.

Theoretically and methodologically, this study sought to provide data on which prevention studies can be based. Despite growing consensus that a selective prevention approach may have powerful ameliorative effects for child anxiety, uncertainty remains regarding identifying children accurately but practically (Rapee 2002). Toward that end, results support employing early anxiety symptoms and temperament as predictors of later child anxiety, reinforcing the importance of early assessment, intervention, and investigation early risk factors.

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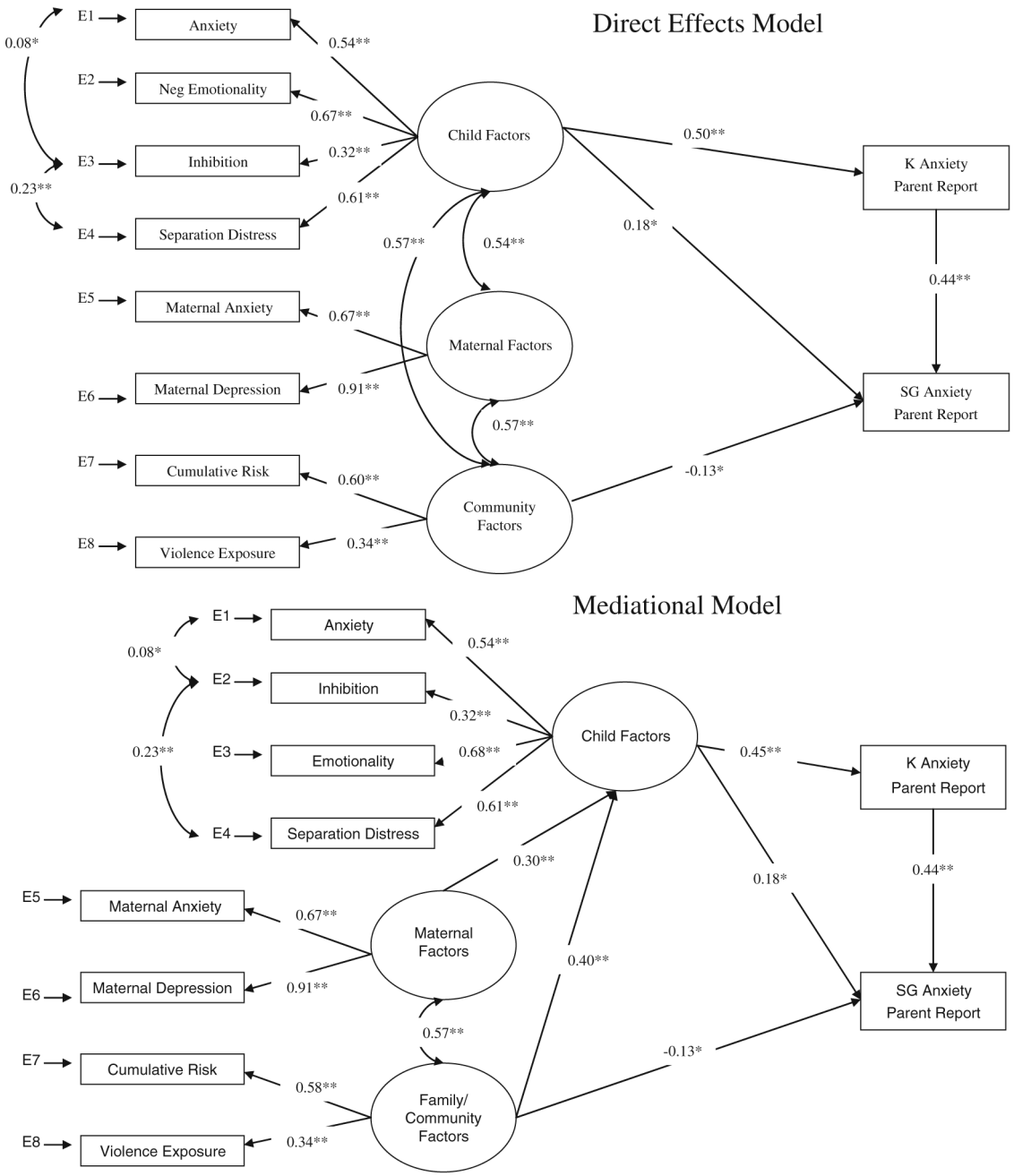

Fig. 1.

Final structural models with parent-reported outcome. *Note.* *p<0.05 **p<0.001. All values displayed are standardized. Non-significant paths have been trimmed

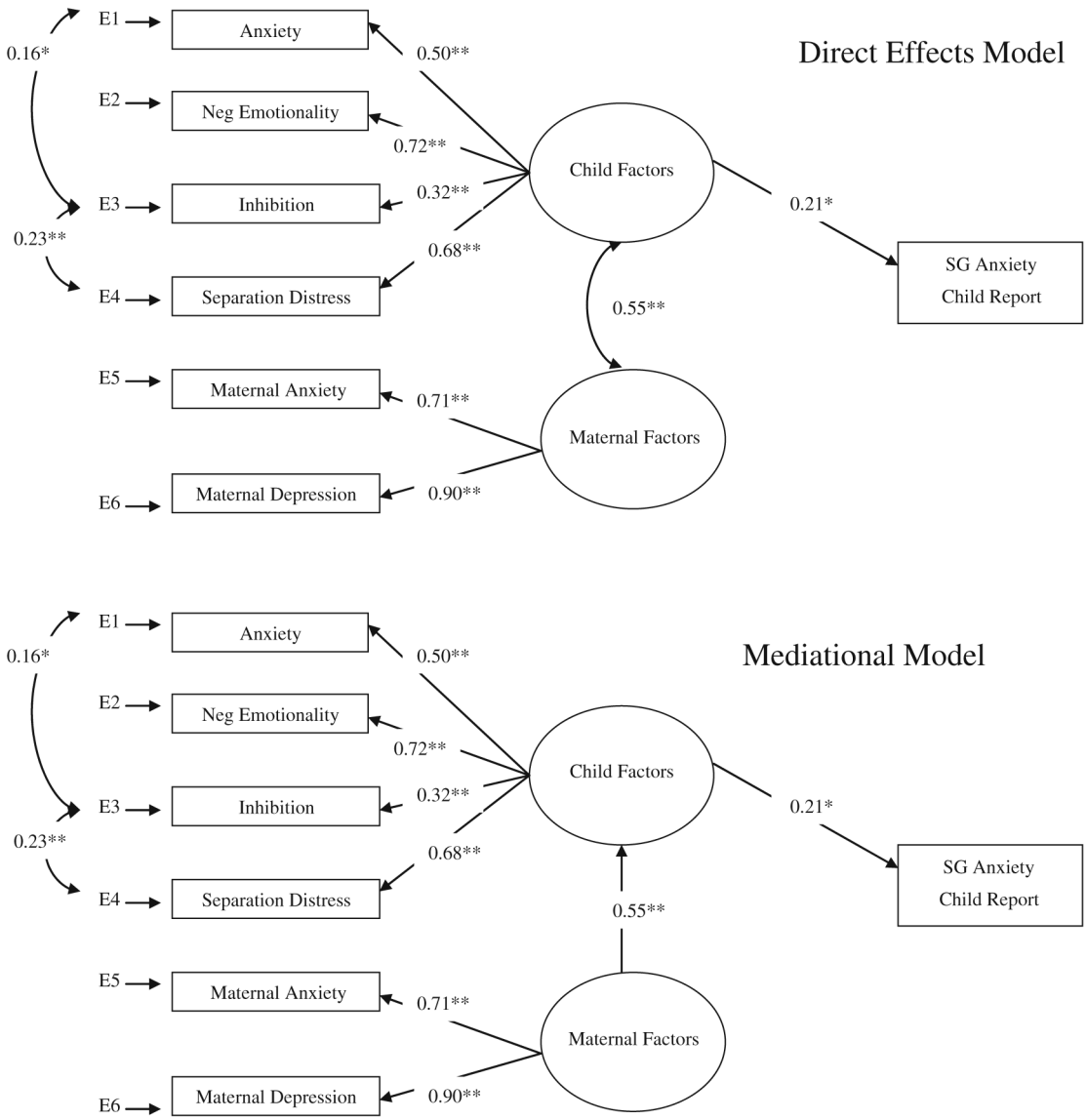

Fig. 2.

Final structural models with child-reported outcome. *Note.* *p<0.05 **p<0.001. All values displayed are standardized. Non-significant paths have been trimmed

Table 1

Descriptive statistics and two-tailed bivariate Pearson correlations for all variables

	1	2	3	4	5	6	7	8	9	10	11
1. ITSEA Anxiety	–	0.35**	0.22**	0.28**	0.25**	0.26**	0.28**	0.13**	0.38**	0.25**	0.09
2. ITSEA NE		–	0.23**	0.46**	0.29**	0.34**	0.17**	0.14**	0.35**	0.22**	0.19*
3. ITSEA Inhibition		–	0.37**	0.16**	0.15**	−0.01	−0.03	0.24**	0.16**	0.08	
4. ITSEA Separation			–	0.25**	0.29**	0.27**	0.09*	0.31**	0.20**	0.14*	
5. Parent Anxiety					–	0.63**	0.14**	0.15**	0.19*	0.15**	0.06
6. Parent Depression					–	0.33**	0.20**	0.22**	0.12**	0.17*	
7. Soc Dem Risk							–	0.20**	0.21**	0.08*	0.22**
8. Violence Exposure							–	0.08*	0.08*	0.07	
9. K Anxiety									–	0.50**	0.04
10. SG Anx										–	0.02
11. BPI SG Anx											–
N	1105	1104	1103	1108	1090	1090	1105	1106	953	932	317
Mean	0.34	0.54	0.82	0.74	4.95	8.95	0.89	0.10	1.16	1.01	11.81
SD	0.28	0.33	0.49	0.41	5.95	8.28	1.34	0.35	1.47	1.48	8.21

* $p<0.05$

** $p<0.001$.

ITSEA=Infant-Toddler Social and Emotional Assessment; NE=Negative Emotionality; Soc Dem=cumulative sociodemographic; K=kindergarten; SG=second grade; BPI=Berkeley Puppet Interview (child report)

Table 2

Fit indices for final measurement and structural models for parent- and child-reported outcomes

Model	*n*	χ^2	*Df*	CFI	SRMR	RMSEA (90% CI)	R^2K	R^2SG
Measurement Models								
Parent Report Outcome	1109	116.986**	15	0.936	0.037	0.078 (0.065–0.092)		
Child Report Outcome	317	9.943	6	0.991	0.021	0.046 (0.00–0.094)		
Direct Effect Structural Models								
Parent Report Outcome	1109	153.713**	27	0.940	0.036	0.065 (0.055–0.075)	0.22**	0.26**
Child Report Outcome	317	21.631*	10	0.974	0.035	0.061 (0.024–0.096)		0.05
Mediational Structural Models								
Parent Report Outcome	1109	155.589**	28	0.939	0.036	0.064 (0.054–0.074)	0.21**	0.26**
Child Report Outcome	317	21.63*	10	0.974	0.035	0.061 (0.024–0.096)		0.05

* $p<0.05$,

** $p<0.001$.

K=kindergarten; SG=second grade; CFI=comparative fit index; SRMR=standardized root mean square residual; RMSEA=root mean square error of approximation