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A Latent Growth Examination of Fear Development in Infancy: Contributions of Maternal Depression and the Risk for Toddler Anxiety

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Growth modeling was used to examine the developmental trajectory of infant temperamental fear with maternal fear and depressive symptoms as predictors of infant fearfulness and change in infant fear predicting toddler anxiety symptoms. In Study 1, a sample of 158 mothers reported their own depressive symptoms and fear when their children were 4 months of age and infant fearfulness at 4, 6, 8, 10, and 12 months. Maternal symptoms of depression predicted steeper increases in infant fearfulness over time ($z = 2.06$, $p < .05$), with high initial infant fear and steeper increases in fear (intercept, $z = 2.32$, $p < .05$, and slope, $z = 1.88$, $p < .05$) predicting more severe toddler anxiety symptoms. In Study 2, an independent sample of 134 mothers completed measures of maternal depression and fear when the infants were 4 months old, and standardized laboratory observations of infant fear were made at 8, 10, and 12 months. Consistent with Study 1, maternal depression accounted for change in fearfulness ($z = 2.30$, $p < .05$), with more frequent and more severe maternal symptoms leading to greater increases in infant fear and increases in fearfulness ($z = 2.08$, $p < .05$) leading to more problematic toddler anxiety. The implications and contributions of these findings are discussed in terms of methodology, fear development, and developmental psychopathology.

Keywords: fearfulness, infancy, latent growth modeling, parental attributes, developmental psychopathology

It has been noted that infancy is a period during which key developmental pathways emerge that may either reduce or increase the probability of later behavioral or emotional dysfunction (Crockenberg & Leerkes, 2000). However, it is only recently that studies have started to take advantage of sophisticated techniques that can model predictors of such developmental pathways, or trajectories, and outcomes associated with individual differences in change and stability of these trajectories over time in understanding the emergence of risk for behavioral dysfunction (e.g., Bridgett et al., 2009; Lengua, 2006). Early in life, individual differences in aspects of reactivity and self-regulation (i.e., temperament) represent logical targets for an examination of developmental trajectories, given mounting evidence of the important role of temperament in models of developmental psychopathology (e.g., Frick, 2004). However, with the notable exceptions indicated above, the literature examining developmental pathways of key individual differences in emotional reactivity that may place individuals at risk for behavioral and emotional dysfunction is relatively sparse. The goal of the current investigation is to expand the existing literature by examining early individual differences in fearfulness, an established domain of temperamental emotional reactivity, contributors to individual differences in trajectories of infant fear, and the role of individual differences in early fearfulness trajectories in the risk for subsequent internalizing problems.

Fear is an emotional response activated in the presence of stimuli signaling upcoming danger and serving an important defensive function (Rothbart & Bates, 2006). Fear activation is associated with a number of neurobehavioral changes, including inhibition of ongoing motor programs and preparation for coping options, such as fleeing, fighting, or hiding (Rothbart, Ahadi, & Hershey, 1994). Fearfulness is a multifaceted construct and, when examined by temperament researchers, different domains of this construct are often emphasized. These include motivational/affective, behavioral, and physiological (e.g., sympathetic arousal) aspects of fear (Rothbart & Bates, 2006).

In infancy, *fearfulness* has been operationalized as startle or distress to sudden changes in stimulation, novel physical objects,

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or social stimuli, as well as inhibited approach to novelty (Gartstein & Rothbart, 2003). *Behavioral inhibition,* a closely related term, has been used to describe a tendency of some children to withdraw and/or exhibit negative affect in response to novel stimuli (people, places, events, and objects; Garcia-Coll, Kagan, & Reznick, 1984). Although fear is, by definition, more inclusive than behavioral inhibition, these terms are frequently and herein used interchangeably. Fear reactivity has been included in the majority of prominent models and theories of temperament and is an early appearing domain of individual differences that, over time, translates into adult personality features (Goldsmith, Lemery, Buss, & Campos, 1999; Rothbart & Bates, 2006). Expressions of fear become increasingly observable between 6 and 12 months of age, allowing for identification of individual differences in the developmental trajectories of early fearfulness as well as potential predictors that may account for such differences.

Although the study of temperament has typically emphasized stability of individual differences, recent theoretical perspectives (e.g., Rothbart, 1989, Rothbart et al., 1994; Rothbart & Bates, 2006) have suggested that the systems underlying reactivity and regulation are not fully developed at birth and that maturation leads to changes, or instability, in the expression of temperament dimensions such as fearfulness. A number of studies have demonstrated increases in mean levels of fearfulness during the second half of the first year of life (Carnicero, Perez-Lopez, Gonzalez-Salinas, & Martinez-Fuentes, 2000; Rothbart, 1986, 1988). These increases (Carnicero et al., 2000; Rothbart, 1986, 1988; Scarr & Salapatek, 1970), have, in turn, been linked to inhibition of approach toward novel and/or intense stimuli (Rothbart, 1988; Rothbart et al., 1994). Growth in fearfulness decelerates later in childhood, stabilizing between kindergarten and the sixth grade (Côté, Tremblay, Nagin, Zoccolillo, & Vitaro, 2002). Although these studies support mean-level changes in fearfulness, individual differences in changes in fearfulness over time have not yet been examined.

The development of fearfulness in infancy can be conceptualized as a function of both proximal causes (i.e., maturation of CNS fear circuitry) and more distal influences, such as parental characteristics, which may account for individual differences in the expression of fear over time. Caregivers' own fearfulness would be expected to affect the child's level of fear/behavioral inhibition through both genetic and environmental pathways. Parents who are themselves fearful are likely to approach their infant, and other novel and/or social contexts in the presence of their infant, with uncertainty and hesitation, leading to an exacerbation of the children's fearful reactions (Muris, Steernemans, Merckelbach, & Meesters, 1996). For example, following a socially anxious mother–stranger interaction, infants have demonstrated more fear and avoidance with a stranger, compared with their responses following maternal interaction with a stranger during a neutral/pleasant condition (de Rosnay, Cooper, Tsigaras, & Murray, 2006).

In addition to maternal fear, maternal depression is potentially capable of exerting its influence on individual differences in infant fear development. Dysphoria and other symptoms (e.g., lack of energy, anhedonia) can manifest themselves as emotional unavailability, negative affect, and depressive cognitions, which diminish the quality of parent–child interactions (Cummings & Davies, 1994; Downey & Coyne, 1990). As many as 15% of women become depressed after giving birth (Kaplan, Bachorowski, & Zarlengo-Strouse, 1999), and infancy may represent a key period for the influence of maternal depressive symptoms on child social–emotional development (Hammen & Rudolph, 1996), including early fearfulness. Longitudinal studies have examined the influence of maternal fear on child fearfulness, and relationships have been found between maternal depressive symptoms and later infant fear during strange situations and fear of strangers in particular (Sugawara, Kitamura, Toda, & Shima, 1999). Pauli-Pott, Mertesacker, and Beckmann (2004) also found that combined maternal depression and anxiety symptoms predicted increases in infant fearfulness.

These studies demonstrate the potential influence of maternal characteristics on infant fearfulness; however, previous studies examining the influences of maternal characteristics on infant fearfulness did not utilize methods that allow researchers to examine how maternal characteristics affect individual differences in the process of fear development. Likewise, although prior studies have established infant fear reactivity as a risk factor for later anxiety symptoms (Goldsmith, Lemery, Aksan, & Buss, 2000; Kagan, Snidman, Zenter, & Peterson, 1999), prior investigations have not examined the contributions of maternal characteristics to infant fear development and, subsequently, how individual differences in fear development may account for early risk for anxiety jointly in a single investigation. To address these notable gaps in prior research, in the current study, we relied on latent growth modeling (LGM), a powerful technique for analyzing developmental changes, to determine contributors (e.g., maternal characteristics) to individual differences in changes in fear over the first year of life, and to model outcomes (e.g., anxiety) associated with different rates of change, extending the literature addressing early fear development and subsequent links to internalizing problems. LGM offers considerable advantages over more traditional means of examining change, typically accomplished through either repeated-measures analyses of variance evaluating mean-level changes or correlations that address the degree of rank-order stability, both of which have been criticized because of the limitations associated with these approaches in answering questions concerning developmental processes (Halverson & Deal, 2001; Lemery, Goldsmith, Klinnert, & Mrazek, 1999; Pedlow, Sanson, Prior, & Oberklaid, 1993). Unlike these traditional techniques, LGM provides an opportunity to account for measurement error and missing data and, perhaps most importantly, to examine models reflecting the process of development (Duncan, Duncan, & Strycker, 2006; McCartney et al., 2006), providing the means to examine individual differences in the degree of stability versus change in fearfulness, which can be anticipated on the basis of existing theory (Kagan, 1998; Partridge, 2000; Thomas & Chess, 1977, 1989).

In the present study, we evaluated the developmental trajectory of child fearfulness in the first year of life, using both parent report (Study 1) and laboratory-based observations (Study 2) of children's fear. The latter is of particular importance given lingering concerns regarding the limitations of parent report in the context of temperament assessment (Kagan, 1998; Rothbart & Bates, 2006; Rothbart & Goldsmith, 1985) as well as extensive research linking maternal depression to potential perceptual distortions and subsequent overreporting of negative child behaviors and emotional expressions (Friedlander, Weiss, & Traylor, 1986; Gartstein, Bridgett, Dishion, & Kaufman, 2009; Geller & Johnston, 1995; Richters & Pellegrini, 1989). We anticipated that the overall level of fearfulness would increase over the first year of life, consistent with studies identifying mean-level changes in fear and that interindividual differences in the trajectories of fearfulness would be observed. In addition, maternal fear

and depressive symptoms were evaluated as contributing to initial levels of fearfulness, as well as growth of this temperament attribute over the first year of life. We predicted that maternal fear and depressive symptoms would be related to the initial level and the change in infant fear over time, thus accounting for individual differences in fear early in infancy as well as the subsequent developmental trajectory of fear. Finally, participants in both studies were followed into toddlerhood to examine the effect of mother's characteristics and early fear development on emerging symptoms of anxiety. That is, consistent with prior literature linking fear and internalizing problems, as well as Crockenberg and Leerkes's (2000) proposition regarding developmental trajectories evident in infancy and leading to later increased risk, we anticipated that high fear early in infancy and greater increases in fearfulness during the first year of life would be associated with the highest levels of anxiety symptoms in toddlerhood, with maternal characteristics also accounting for increased risk of toddler anxiety.

Study 1

Method

Participants. A total of 158 families with a 4-month-old infant from Washington, Oregon, Idaho, Montana, and Nevada agreed to participate. Families were recruited through newspaper birth announcements and hospital websites. Eleven of the contacted caregivers declined participation (see Table 1 for demographic information). English-speaking primary caregivers from diverse economic and educational backgrounds took part in this study. Approximately equal numbers of male (43.9%) and female

Table 1
Descriptive Statistics for Study 1: Primary Caregiver and Infant Demographics; Independent and Dependent Variables

Characteristic	*M*	Range	*SD*	%
Caregiver age (in years)	30.43	20–46	4.93	
Ethnicity				
Caucasian				92.2%
Native American				3.2%
Hispanic/Latino				1.9%
Other[a]				2.4%
Living arrangement				
Married				92.9%
Cohabitating				3.9%
Single				1.9%
Remarried				1.3%
Highest education attainment (in years)	15.10	8–25	2.73	
Less than high school				1.5%
High school diploma				39.2%
Some college				26.9%
Bachelor's degree				24.6%
Graduate degree				7.7%
Family income	$61,072	$8,000–$130,000	$27,017	
Maternal ATQ Fear	3.80	1.71–5.86	0.89	
Maternal BDI Depression	8.83	0–43	7.09	
Infant sex				
Male infants				46.6%
Female infants				53.4%
Infant birth weight (oz.)	120.89	63–184	20.39	
4-month infant fear, $t(145) = -0.21$, $p > .05$, $d = .03$				
Male infants	2.17		1.04	
Female infants	2.14		0.79	
6-month infant fear, $t(115) = 1.66$, $p > .05$, $d = -.31$				
Male infants	2.23		1.08	
Female infants	2.53		0.85	
8-month infant fear, $t(95) = 2.57$, $p < .05$, $d = -.53$				
Male infants	2.39		1.00	
Female infants	2.92		1.00	
10-month infant fear, $t(90) = 2.30$, $p < .05$, $d = -.48$				
Male infants	2.89		1.02	
Female infants	3.38		1.01	
12-month infant fear, $t(74) = 1.14$, $p > .05$, $d = -.26$				
Male infants	2.96		0.94	
Female infants	3.21		0.99	
24-month toddler anxiety, $t(55) = 0.43$, $p > .05$, $d = .21$				
Male infants	1.82		1.36	
Female infants	2.17		1.91	

Note. ATQ = Adult Temperament Questionnaire; BDI = Beck Depression Inventory.
[a] Other included participants of African American, Pacific Islander, Filipino, and Asian or Asian American ethnicity.

(56.1%) infants were enrolled. Only families with healthy full-term 4-month-old infants were eligible to participate; families with infants who were premature, experienced significant medical difficulties or birth complications, or were identified as being developmentally delayed or disabled were not eligible to participate.

Measures

IBQ-R. The Infant Behavior Questionnaire—Revised (IBQ-R; Gartstein & Rothbart, 2003) is a parent-report measure of infant temperament, developed for use with infants between the ages of 3 and 12 months. Scores can be obtained for 14 fine-grained scales, including fear, and three overarching, higher order factors (Extraversion/Surgency, Negative Affectivity, and Regulation/Orienting). The Fear scale, which measures distress and/or startle to new stimuli (e.g., "How often during the last week did the baby startle to a sudden or loud noise?"), distress to novel stimuli (e.g., "When visiting a new place, how often did the baby show distress for the first few minutes?"), and sudden changes to the environment (e.g., "How often during the last week did the baby startle at a sudden change in body position [e.g., suddenly being moved]?"), has demonstrated satisfactory psychometric properties (for ages 3 to 6 months, $\alpha = .90$; for ages 6 to 9 months, $\alpha = .89$; and for ages 9 to 12 months, $\alpha = .87$) and represents the primary focus of this study (Gartstein & Rothbart, 2003). Convergent validity of the Fear scale has also been demonstrated, insofar as this scale loaded onto the Negative Emotionality factor, together with Distress to Limitations and Sadness, and was significantly correlated with these two scales, designed to measure negative emotionality (Gartstein, Knyazev, & Slobodskaya, 2005; Gartstein & Rothbart, 2003). Evidence demonstrating predictive and construct validity of this instrument is also available, including prediction of toddler depressive symptoms with infant negative emotionality and significant correlations between IBQ-R scales, including Fear, and laboratory-based observation indicators (e.g., Gartstein & Bateman, 2008; Gartstein & Marmion, 2008).

ATQ. We used the Adult Temperament Questionnaire (ATQ; Evans & Rothbart, 2007; Rothbart, Ahadi, & Evans, 2000) to obtain a measure of maternal fear. Examples of Fear items include the following: "I become easily frightened" (Item 1); "Loud noises sometimes scare me" (Item 61); and "When I try something new, I am rarely concerned about the possibility of failing" (Item 75; reverse scored). Satisfactory psychometric properties, including adequate internal consistency ($\alpha = .64$) and significant associations with Big Five personality factors, have been documented for this self-report instrument (Evans & Rothbart, 2007; Rothbart et al., 2000).

BDI-II. Maternal depressive symptoms were measured with the Beck Depression Inventory—II (BDI-II; Beck, Steer, & Brown, 1996; Beck, Steer, Ball, & Ranieri, 1996). The BDI-II has been widely used in research and clinical settings as an indicator of depressive symptoms and their severity, consistently demonstrating satisfactory reliability and validity (Beck et al., 1996). Specifically, satisfactory internal consistency ($\alpha = .91$), test–retest reliability (one week, $r = .93$), and convergent validity, have been demonstrated for this self-report measure of depressive symptoms. In the current study, internal consistency of the BDI-II ($\alpha = .90$) was similar to that which has been observed in other reports.

Child Behavior Checklist (CBCL) for ages 1.5–5. We measured child psychopathology using the CBCL for ages 1.5 to 5 years (Achenbach & Rescorla, 2000). Of particular interest in the current investigation was the Anxiety Problems scale. This measure has been widely used both as a psychopathology measure in research applications and as a tool for assessing behavioral problems in clinical settings.

Procedure

Primary caregivers (i.e., mothers) were mailed initial questionnaire packets when their infants were approximately 3.5 months of age. Initial packets contained the IBQ-R (Gartstein & Rothbart, 2003), the ATQ (Rothbart et al., 2000), the BDI-II (Beck et al., 1996), a demographics questionnaire, and consent forms. When infants were 6 months ($n = 123$), 8 months ($n = 101$), 10 months ($n = 97$), and 12 months ($n = 80$) of age, primary caregivers also completed the IBQ-R (Gartstein & Rothbart, 2003). These ages were selected because of previous research demonstrating signif-

Table 2
Correlation Matrix of Selected Study 1 Maternal Demographics/Characteristics and Infant/Toddler Attributes

	Maternal variable					Infant variable					
Characteristic	Age	Education	Income	Depression	Fear	4-month fear	6-month fear	8-month fear	10-month fear	12-month fear	24-month anxiety
Maternal variable											
Age	—	.25**	.46**	.03	.01	−.13	−.06	−.08	.09	.06	−.13
Education		—	.42**	−.03	−.02	−.12	−.07	−.08	−.01	.03	−.09
Income			—	.03	−.06	−.17*	−.09	−.04	.07	.06	−.09
Depression				—	.05	.03	.04	.18	.30**	.16	−.23
Fear					—	.13	.09	.11	.07	.08	.33*
Infant variable											
4-month fear						—	.64**	.45**	.38**	.46**	.33**
6-month fear							—	.63**	.45**	.47**	.29*
8-month fear								—	.63**	.69**	.21
10-month fear									—	.74**	.14
12-month fear										—	.31*

Note. All maternal variables were collected when infants were 4 months of age. Sample sizes vary and correlations presented are based on listwise deletion as opposed to latent growth modeling analyses, which estimate missing data utilizing maximum likelihood estimation.
* $p < .05$. ** $p < .01$.

Table 3
Parameter Estimates and Standard Errors for Initial Fear Latent Growth Modeling in Study 1

Parameter	Coefficient[a]	*SE*
Mean intercept	1.75**	0.017
Mean slope	0.07**	0.004
Intercept variance	0.04**	0.008
Slope variance	0.003**	0.001
Covariance	−0.005**	0.002
Error variance		
4-month infant fear	0.01**	0.004
6-month infant fear	0.02**	0.006
8-month infant fear	0.03**	0.006
10-month infant fear	0.03**	0.004
12-month infant fear	0.01*	0.004

[a] Coefficients presented are not standardized.
* $p < .05$. ** $p < .01$.

icant developmental changes in fear/behavioral inhibition over the second half of the first year of life (Carnicero et al., 2000; Gartstein & Rothbart, 2003; Rothbart, 1986). Two-month assessment intervals provided the sensitivity necessary to detect individual differences in these fast-paced developmental changes.

All packets were completed and returned within one week of the infant's 4-, 6-, 8-, 10-, and 12-month "birthdays." When toddlers reached 24 months of age, families were sent the CBCL. A total of 60 families returned the CBCL (Table 1 displays descriptive statistics for all demographic variables, maternal characteristics, and infant characteristics; Table 2 shows associations between these variables). Families were compensated with $10 for their participation at each time point. Attrition was minimized through frequent data collection activities as well as consistent contact with the families in the intervals between the multiple-wave assessments. Despite these efforts, not all families completed all of the phases of the evaluation.

Missing Data

A series of missing data analyses were conducted to examine the possibility that data were not missing completely at random. Only one comparison, out of 35, yielded a significant difference between responders and nonresponders. Primary caregivers who completed the 6-month assessment reported significantly higher infant fearfulness at the previous 4-month assessment ($M = 2.25$) than did primary caregivers who did not complete the 6-month assessment ($M = 1.88$), $t(152) = 2.29$, $p = .02$. Differences between responders and nonresponders were not detected in terms of maternal age, years of education, income, BDI-II scores, or maternal fear at any time point. Primary caregivers who responded at the 8-, 10-, and 12-month assessments did not report significantly different 4-month infant fear than did primary caregivers who completed only the 4-month assessment. Finally, families completing 24-month CBCL questionnaires were not significantly different from families that did not return toddler CBCL evaluations on maternal age, years of education, income, BDI-II scores, maternal fear, or any evaluation of infant fear (all ps $> .05$). Given these findings, missing data were handled with the use of maximum likelihood estimators. Maximum likelihood estimation draws on available data from each participant at each time point "optimally" by using an expectation-maximization algorithm to obtain

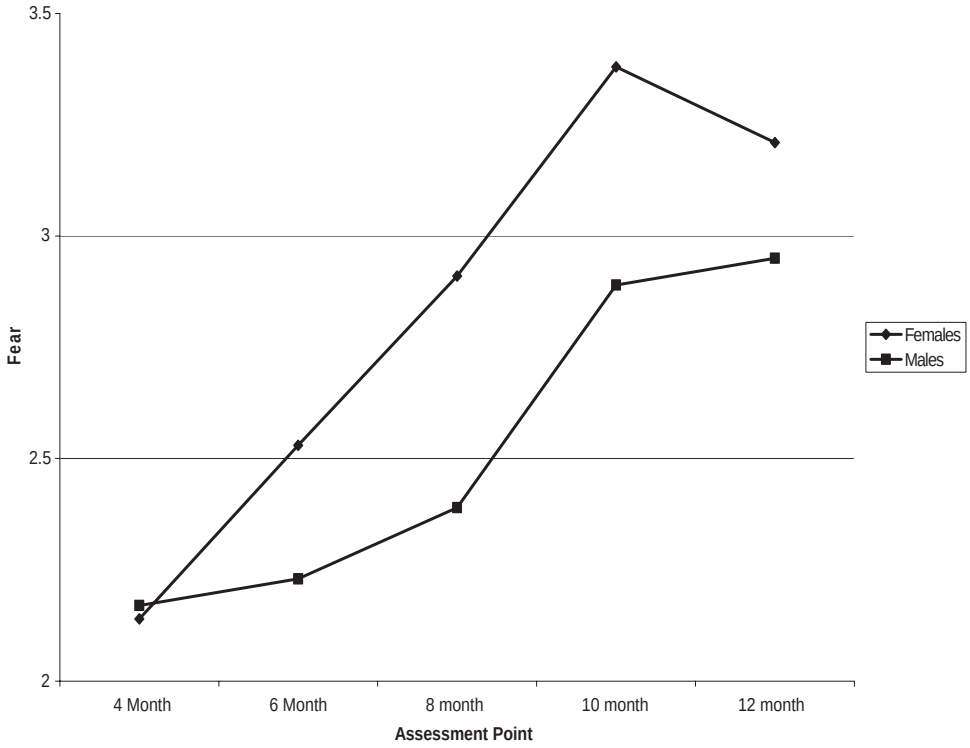

Figure 1. Developmental trajectory of maternal-reported infant fear by gender.

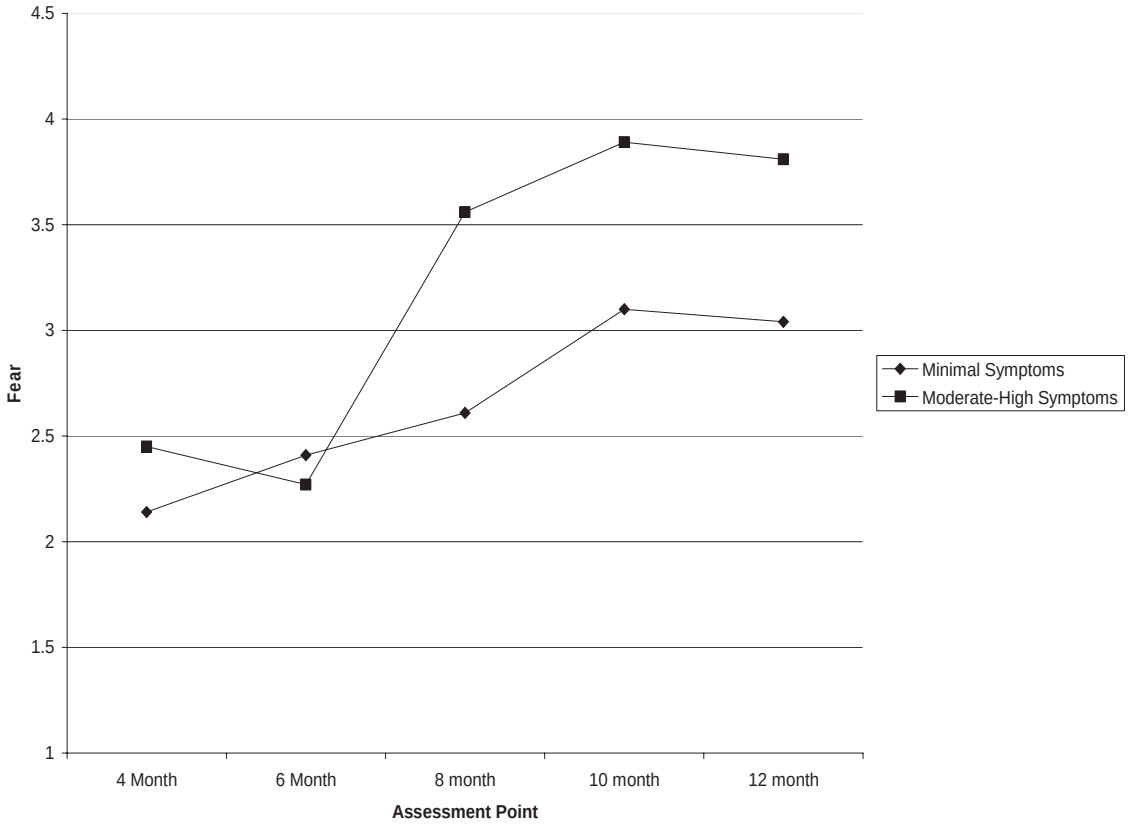

Figure 2. Developmental trajectories of maternal-reported infant fear based on level of maternal depressive symptoms. Maternal caregivers with minimal symptoms of depression (n = 149) and moderate to high symptoms of depression (n = 9) were determined by clinical cut-offs on the Beck Depression Inventory—II (0–13 = minimal; 14–19 = mild; 20–28 = moderate; 29+ = high); for the purposes of this study, "minimal symptoms" of depression were defined as scores between 0 and 19 and "moderate–high" symptoms of depression were defined as a BDI score of 20 or higher.

maximum likelihood estimates (Bentler, 2004; Pettit, Keiley, Laird, Bates, & Dodge, 2007). Of note, it has been suggested that this method be utilized in situations in which no single variable has greater than 90% missing data (Muthén & Muthén, 1998); missing data at its greatest (62.5% for 24-month CBCL Anxiety Problems scale) in the current study is well within this recommended limit.

Analytic Strategy

We carried out LGM analyses examining the growth trajectories of infant fearfulness from 4 to 12 months of age using EQS 6.1 (Bentler, 2004). Although some of the benefits of LGM have been mentioned above, a more detailed description of LGM and the flexibility of this method for addressing complex multivariate developmental questions as well as methodological requirements for using LGM can be found in a number of sources (Byrne & Crombie, 2003; Curran & Hussong, 2003; Duncan, Duncan, & Strycker, 2006; Duncan, Duncan, Strycker, Li, & Alpert, 1999; McCartney, Burchinal, & Bub, 2006). Similar to other structural equation modeling applications, the fit of the LGM is evaluated with fit statistics; in the present study, these included the robust chi-square goodness-of-fit statistic, the comparative fit index (*CFI*), Akaike's information criterion (*AIC*), and the root mean square error of approximation (*RMSEA*) (see Akaike, 1987; Bentler, 1990; Browne & Cudeck, 1993; Raykov & Marcoulides, 2000, for complete descriptions of these fit indices, and Byrne, 2006, for a brief discussion of the advantages of the use of robust statistics in structural equation modeling).

We used a two-step approach to LGM to address our hypotheses. First, an initial LGM model was fit to the data without including maternal predictors of fear or 24-month toddler anxiety in the model. Consistent with the recommendation by Byrne and Crombie (2003), a subsequent growth model, including predictors of infant fearfulness intercept and slope and toddler anxiety symptoms outcome, was fit to the data if the residuals associated with the intercept and slope were significant. That is, maternal characteristics were examined as predictors of initial levels of infant fearfulness, and changes in fear over time, which in turn were evaluated as predictors of toddler anxiety symptoms, if significant individual differences in these parameters (i.e., intercept and slope) of fearfulness could be identified. With the exception of the initial LGM, at all stages of the analyses, child gender was entered as a covariate in the LGM models. Gender was included because of prior studies indicating early appearing male–female dif-

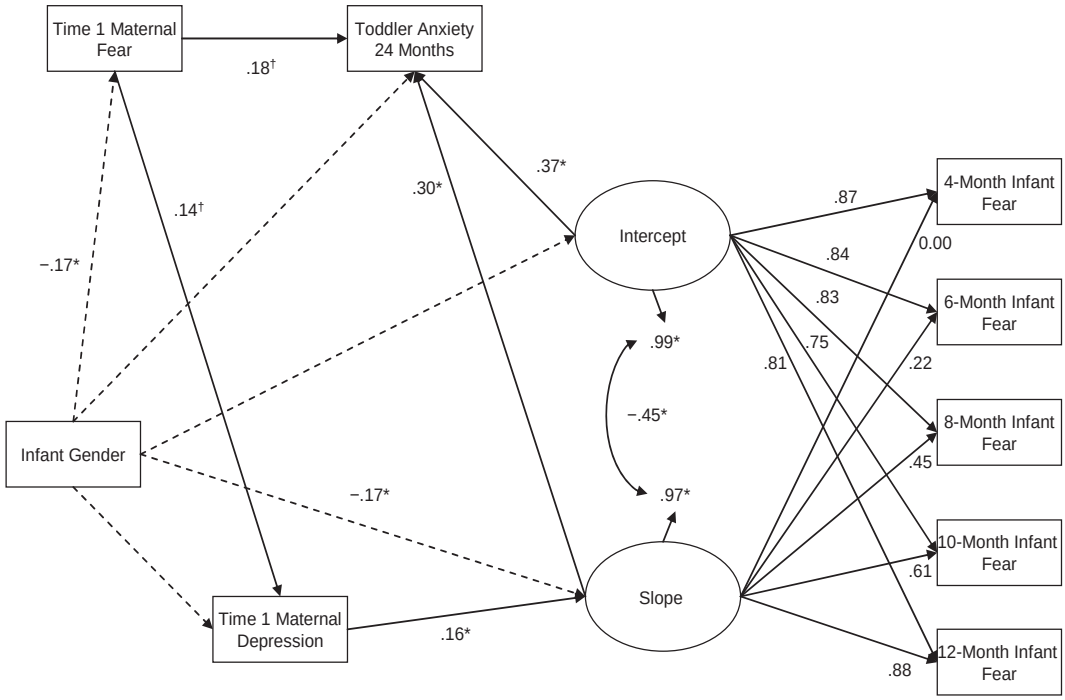

Figure 3. Final standardized latent growth model of maternal report of infant fear from 4 to 12 months of age with maternal depression as predictor of change and toddler anxiety outcome. For clarity, the constant and residuals associated with each fear time point and the predictors have been omitted. Pathways that were not significant were also omitted for clarity. Dashed lines from gender to other variables are included to signify that gender was controlled for. A significant relationship between infant gender and slope of fear was observed. † $p < .10$. * $p < .05$.

ferences on indices related to fearfulness. For example, female infants were described as exhibiting greater hesitation in approaching novel objects, relative to their male counterparts (Rothbart, 1988) and were reported as manifesting significantly higher levels of fear by their caregivers (Martin, Wisenbaker, Baker, & Huttunen, 1997). More recently, Else-Quest, Hyde, Goldsmith, and Van Hulle (2006) conducted a meta-analysis of gender differences in temperament for infants and children, demonstrating a small but a statistically significant mean effect size of gender for fearfulness ($d = -0.12$), with girls demonstrating greater levels of fear in comparison with boys.

Results

Infant fearfulness increased across the study time frame (4 months: $M = 2.14$, $SD = 0.91$; 6 months: $M = 2.39$, $SD = 0.99$; 8 months: $M = 2.69$, $SD = 1.02$; 10 months: $M = 3.09$, $SD = 1.03$; and 12 months: $M = 3.09$; $SD = 0.96$). The initial LGM of infant fearfulness from 4 to 12 months of age fit the data well, robust $\chi^2(df = 10) = 14.98$, $p = .013$; *CFI* = 1.00; *RMSEA* = .00 (90% confidence interval [*CI*] = .00 to .07); *AIC* = −5.02. Findings indicated significant interindividual differences in both initial levels of infant fearfulness ($z = 5.20$, $p < .01$) and in changes in infant fear across time ($z = 5.75$, $p < .01$). Table 3 presents unstandardized coefficients and standard errors associated with the initial LGM.

Given the significant intercept and slope variances, we examined a subsequent LGM model, controlling for infant gender, with maternal fear and depressive symptoms (BDI-II) as predictors of initial levels of infant fearfulness and changes in infant fear across time, as well as toddler anxiety symptom. Results indicated a well fitting model, robust $\chi^2(df = 23) = 29.01$, $p = .14$; *CFI* = 1.00; *RMSEA* = .00 (90% *CI* = .00 to .04); *AIC* = −14.98. Infant gender accounted for significant variance in interindividual differences in slope ($z = 2.18$, $p < .05$); although male and female infants displayed a similar developmental trajectory (i.e., both are increasing in fear over time), female infants had steeper increases in fear over time than did male infants (See Figure 1). Gender differences in initial levels of infant fearfulness were not observed ($z = -0.89$, $p > .05$). Maternal fear did not account for variance in initial levels of fearfulness ($z = 0.73$, $p > .05$) or variance in changes in infant fear over time ($z = -0.35$, $p > .05$). However, maternal depressive symptoms accounted for significant variance in changes in infant fearfulness from 4 to 12 months of age ($z = 2.06$, $p < .05$).[1] Specifically, higher maternal depressive symptoms/severity when infants were 4 months of age predicted in-

[1] We attempted to perform this analysis controlling for family income-to-needs and maternal education, because as noted by one of the reviewers, these variables could mitigate the effect of maternal depressive symptoms on the slope of infant fearfulness; however, this model failed to converge. Thus, we reduced the model to include only the relevant demographic variables and maternal depressive symptoms. This model fit the data well, robust $\chi^2(19) = 26.89$, $p = .14$; *CFI* = 1.00; *RMSEA* = .00 (90% confidence interval = .00 to .07); *AIC* = −11.11, with the effects of maternal depressive symptoms on the slope of infant fear, $z = 2.37$, $p < .05$, remaining after accounting for the demographic variables.

Table 4
Parameter Estimates and Standard Errors for the Fear Latent Growth Modeling Predictor–Outcome Model in Study 1

Parameter	Coefficient[a]	*SE*
Mean fear intercept	2.21**	0.09
Intercept fear variance	0.02**	0.005
Gender to intercept	−0.03	0.03
Maternal fear to intercept	0.01	0.02
Maternal depression to intercept	0.03	0.06
Mean fear slope	0.06**	0.02
Slope fear variance	0.002**	0.001
Gender to slope	−0.015*	0.007
Maternal fear to slope	−0.002	0.004
Maternal depression to slope	0.025*	0.012
Covariance	−0.003**	0.001
Mean of gender	1.46**	0.042
Mean of maternal fear	4.26**	0.224
Gender to maternal fear	−0.30**	0.148
Mean of maternal depression	0.79**	0.117
Gender to maternal depression	0.04	0.042
Maternal fear to maternal depression	0.38	0.024
Toddler anxiety		
Path from gender	−0.09	0.35
Path from maternal fear	0.34	0.24
Path from maternal depression	−1.29	0.81
Path from infant fear intercept	3.60**	1.55
Path from fear slope	10.76*	5.76
Error variance		
Gender	0.249**	0.003
Maternal variable		
Fear	0.739**	0.074
Depression	0.056**	0.006
Infant variable		
4-month fear	0.008**	0.002
6-month fear	0.014**	0.002
8-month fear	0.015**	0.003
10-month fear	0.020**	0.003
12-month fear	0.006**	0.003
Toddler anxiety	1.871**	0.314

[a] Coefficients presented are not standardized.
* $p < .05$. ** $p < .01$.

creases/steeper slopes in infant fearfulness across the 8-month time span after accounting for infant gender (See Figure 2). Maternal depression did not account for initial levels of infant fearfulness at 4 months of age ($z = -0.51$, $p > .05$).

Infant gender and maternal depressive symptoms did not account for significant variance in 24-month toddler anxiety symptoms. Consistent with predictions, a significant trend indicated that higher reported levels of maternal fear predicted greater CBCL Anxiety Problems scores when toddlers reached 24 months of age ($z = 1.44$, $p < .10$). Both the intercept of infant fearfulness ($z = 2.32$, $p < .05$) and the slope of infant fear ($z = 1.88$, $p < .05$), accounted for significant variance in toddler anxiety symptoms, with higher initial fearfulness and steeper increases in infant fear over time predicting greater CBCL Anxiety Problems scores (See Table 4 for unstandardized path coefficients and standard errors; see Figure 3 for the full LGM structural model). Together, maternal characteristics, high initial levels of infant fear, and steeper, inclining trajectories of infant fearfulness over the first year of life accounted for 20% of the variance in toddler CBCL anxiety problem ratings.

Discussion

Findings in Study 1 largely supported hypotheses, with greater maternal depression symptoms predicting steeper increases in fearfulness over time after accounting for infant gender. Although both male and female infants had increases in fearfulness across time, female infants had steeper slopes (i.e., steeper increases) in mother-reported infant fearfulness than did male infants. Maternal fear did not emerge as an indicator of either initial levels of infant fearfulness at 4 months of age or of changes in infant fear. Finally, at the 24-month evaluation of toddler CBCL Anxiety Problems, both intercept (i.e., higher initial levels) and steeper slopes (i.e., steeper increases) of mother-reported infant fearfulness predicted higher toddler anxiety symptoms after accounting for infant gender and maternal depressive symptoms. Study 1 makes methodological contributions, with the use of LGM including both predictors of intercept and slope factors as well as the use of intercept and slope factors of infant fearfulness as predictors of toddler anxiety symptom outcomes.

One primary limitation of Study 1 is that primary caregivers completed questionnaires addressing their own depression and fear, ratings of infant fearfulness, and toddler anxiety symptoms. Although studies relying on single reporting sources continue to make important and substantive contributions, there has been growing debate regarding the potential limitations inherent in reliance on single sources of data and inflation of indices reflecting associations between variables due to source variance in particular. Additionally, prior research has suggested that maternal depressive symptoms may have a distorting effect on the caregivers' perceptions of child behavior, leading to overreporting of difficulties relative to other sources of information (e.g., Gartstein et al., 2009; Youngstrom, Izard, & Ackerman, 1999). These factors should be considered in interpreting the results of Study 1 and should be addressed in replication/extension efforts. Thus, in Study 2 we addressed the single source limitation of Study 1 by using laboratory assessments of infant fear, conducted with an independent sample of infants.

Study 2

Method

Participants. We recruited an independent sample of 134 English-speaking mothers with 4-month-old infants from eastern Washington and northwestern Idaho through birth announcements released by hospitals and published in a local newspaper as well as the primary prevention program First Steps. First Steps provided information about this research, along with developmental information aimed at preventing child maltreatment, to all parents of newborn infants in the local hospitals. Potential participants, identified through First Steps, indicating an interest in a study addressing temperament development were contacted by project staff. None of the potential participants recruited through the help of the First Steps program declined participation, whereas seven families contacted on the basis of the published birth announcements decided not to take part in this research. Family characteristics were similar to the demographic profile of the sample obtained in Study 1 (see Table 5 for descriptive statistics; Table 6 for indices of associations obtained in Study 2), and all participants met the same

Table 5
Descriptive Statistics for Study 2: Primary Caregiver and Infant Demographics; Independent and Dependent Variables

Variable	*M*	Range	*SD*	%
Age (years)	28.67	20–42	5.27	
Ethnicity				
Caucasian				91.9%
African American				3.7%
Asian				2.9%
Hispanic/Latino				1.5%
Living arrangement				
Married				93.1%
Divorced/separated				1.6%
Single				3.8%
Remarried				1.5%
Highest education attainment	15.87 years	10–20 years	2.29 years	
Less than high school				2.8%
High school diploma				6.4%
Some college				26.2%
Bachelor's degree				39.7%
Graduate degree				24.8%
Family income				
$0–$7,000				5.2%
$7,001–$10,000				3.0%
$10,001–$13,000				5.2%
$13,001–$16,000				4.5%
$16,001–$20,000				9.0%
$20,001–$30,000				10.4%
$30,001–$50,000				29.9%
$50,001–$75,000				17.2%
Over $75,000				15.7%
Maternal ATQ Fear	3.76	1.57–6.00	0.96	
Maternal PSI Depression	18.31	9–41	4.97	
Infant sex				
Male				50.8%
Female				49.2%
8-month infant fear, $t(91) = 0.48$, $p > .05$, $d = -.10$				
Male infants	3.30		1.86	
Female infants	3.47		1.61	
10-month infant fear, $t(89) = 2.36$, $p < .05$, $d = -.49$				
Male infants	3.94		2.19	
Female infants	5.19		2.81	
12-month infant fear, $t(90) = 1.06$, $p > .05$, $d = -.22$				
Male infants	6.07		2.73	
Female infants	6.68		2.80	
24-month toddler anxiety, $t(77) = -1.24$, $p > .05$, $d = .29$				
Male infants	2.46		2.02	
Female infants	1.95		1.58	

Note. Female infants were significantly higher on laboratory evaluated fear at 10 months of age, $t(89) = 2.36$, $p < .05$; female and male infants were not significantly different on fear at 8 or 12 months of age nor was there a gender difference on 24-month toddler anxiety. ATQ = Adult Temperament Questionnaire; BDI = Beck Depression Inventory.

inclusion criteria specified in Study 1 (i.e., healthy, full-term infants were eligible to participate). Caregivers were compensated with $20 for participation in each assessment (i.e., at 4, 8, 10, 12, and 24 months of age).

Questionnaires. The ATQ (See Study 1) was used to obtain a measure of primary caregiver fear, and the Parenting Stress Index (PSI) Depression scale was used to address maternal depression. The PSI has been shown to have acceptable content, concurrent, and construct validity, with adequate internal consistency and test–retest reliability (e.g., with *r*s ranging from .88 to .96; Abidin, 1995); the instrument assesses parental characteristics other then symptoms of depression, along with some aspects of the parent–child relationship. The ability to evaluate these additional variables led to the subsequent inclusion of the PSI, rather than the BDI, as in Study 1. High scores on the PSI Depression scale have been associated with the presence of clinically significant parental depression (Webster-Stratton & Hammond, 1988) and linked to child behavior problems (Gartstein & Sheeber, 2004). The Depression scale of the PSI, utilized in this study, has also demonstrated adequate psychometric characteristics ($\alpha = .84$). Caregivers completed a demographics questionnaire, which was similar in content and scope to the questionnaire utilized in Study 1. Finally, the CBCL was administered to measure toddler anxiety problems (Achenbach & Rescorla, 2000).

Laboratory fear assessment. Study 2 used a laboratory observation procedure to evaluate infant temperament. Standardized

Table 6
Correlation Matrix of Selected Maternal Demographics/Characteristics and Infant/Toddler Attributes

	Maternal variable					Infant variable			
Characteristic	Age	Education	Income[a]	Depression	Fear	8-month fear	10-month fear	12-month fear	24-month anxiety
Maternal variable									
Age	—	.16	.33**	.13	−.10	.15	.08	.10	.09
Education		—	.01	−.01	−.02	−.01	−.20*	−.14	−.03
Income			—	−.16	−.08	.03	.11	.07	−.11
Depression				—	.31**	−.14	.01	.16	.18
Fear					—	−.05	.11	.13	.16
Infant variable									
8-month fear						—	.37**	.21*	−.14
10-month fear							—	.57**	.19
12-month fear								—	.16

Note. All maternal variables were collected when infants were 4 months of age. Sample sizes vary and correlations presented are based on listwise deletion.
[a] Correlations between income and other variables are Spearman rank order correlations.
* $p < .05$. ** $p < .01$.

laboratory fear assessments were conducted with infants when they were 8, 10, and 12 months of age. The Lab-TAB (Temperament Assessment Battery) "scary masks" episode was used (Goldsmith & Rothbart, 1996), in which a series of four masks were presented to the infant sitting in a high chair in front of an enclosure with a curtain, lifted to reveal the masks in order. Each presentation lasted 10 s; the child's mother was seated to the side and slightly behind the child. All mothers were instructed not to comment on or react to the masks or to their infants' responses to the masks. This procedure has been consistently found to be reliable and valid, with interrater agreement for Lab-TAB episodes ranging from 88% to 99%. We conducted the evaluation of interrater agreement with the current sample by computing indices of agreement among pairs of coders for each individual coded behavior (e.g., distress vocalizations) used in the context of the Lab-TAB and described in detail below, providing satisfactory reliability estimates (intraclass correlations ranged from .52 to .98; mean $r = .76$). More specifically, depending on the guidelines followed for reliability estimates, the intraclass correlations obtained in this investigation ranged from "moderate" to "almost perfect" (Landis & Koch, 1977) or from "fair" to "substantial" according to more contemporary criteria recommended by Shrout (1998). The mean intraclass correlation falls within the "substantial" category (Landis & Koch, 1977) and under Shrout's "moderate" category of reliability.

Manifestation of fearful reactivity and affect, including the intensity of facial fear, distress vocalizations, bodily fear, and escape behaviors were coded by trained research assistants who were blind to the purpose of the current investigation. Intensity of body and facial fear, distress vocalizations, and escape behaviors were rated according to a predetermined set of criteria. For example, intensity of body fear was judged on the basis of the following scale: 0 = *no sign of body fear*; 1 = *decreased activity: an apparent and/or sudden decrease in the activity*; *sense of body apprehension and ambiguous body fear*; 2 = *tensing: visible tensing of the muscles, associated with decreased activity*; 3 =

Table 7
Correlation Matrices of Laboratory Infant Fear Measures

Variable	Intensity of fear	Intensity of distress, vocal	Intensity of bodily fear	Intensity of escape
		8-month infant fear		
Intensity of fear	—	.80**	.63**	.37**
Intensity of distress, vocal		—	.58**	.29**
Intensity of bodily fear			—	.25**
		10-month infant fear		
Intensity of fear	—	.61**	.49**	.28**
Intensity of distress, vocal		—	.71**	.43**
Intensity of bodily fear			—	.31**
		12-month infant fear		
Intensity of fear	—	.54**	.21*	.44**
Intensity of distress, vocal		—	.66**	.54**
Intensity of bodily fear			—	.21*

* $p < .05$. ** $p < .01$.

Table 8
Parameter Estimates and Standard Errors for Initial Fear Latent Growth Modeling in Study 2

Parameter	Coefficient[a]	*SE*
Mean intercept	3.39**	0.15
Mean slope	1.49**	0.13
Intercept variance	2.51**	0.49
Slope variance	2.05**	0.26
Covariance	−0.75**	0.23
Error variance		
8-month infant fear	0.53	0.48
10-month infant fear	4.17**	0.59
12-month infant fear	0.05	0.74

[a] Coefficients presented are not standardized.
** $p < .01$.

freezing or trembling: tensing of the entire body with no motion, or trembling due to extreme muscular tension; all ratings were assigned every 5 s and averaged over the 5-s epochs. Interclass correlations for the research assistants trained in the coding system were computed on the basis of these ratings. That is, ratings provided by pairs of observers were correlated, indicating generally satisfactory agreement. Because these indices of fear were significantly related to each other at each observation (See Table 7), indices of bodily fear, escape behaviors, intensity of fear, and distress vocalizations were summed at each time point (i.e., at 8, 10, and 12 months of age) to create a fear composite.

Procedure

Initial packets containing the ATQ, the PSI, and consent forms were sent to families when infants were 3.5 months of age. All questionnaires were completed within one week of the infant's 4-month "birthday." Infants were invited to the laboratory to complete fear assessments when they were 8 months ($n = 102$), 10 months ($n = 97$), and 12 months ($n = 107$) of age. Primary caregivers of infants enrolled in the previous evaluations ($n = 85$) completed the CBCL, which included the Anxiety Problems subscale, when their toddlers reached 24 months of age. The same analytic strategy used in Study 1 was applied in Study 2.

Results

Missing data. Families completing the 8-, 10-, and 12-month laboratory fear assessments did not differ from families that only completed the 4-month assessment of demographic and maternal characteristics (i.e., PSI Depression and ATQ Fear; all *p*s $> .05$).

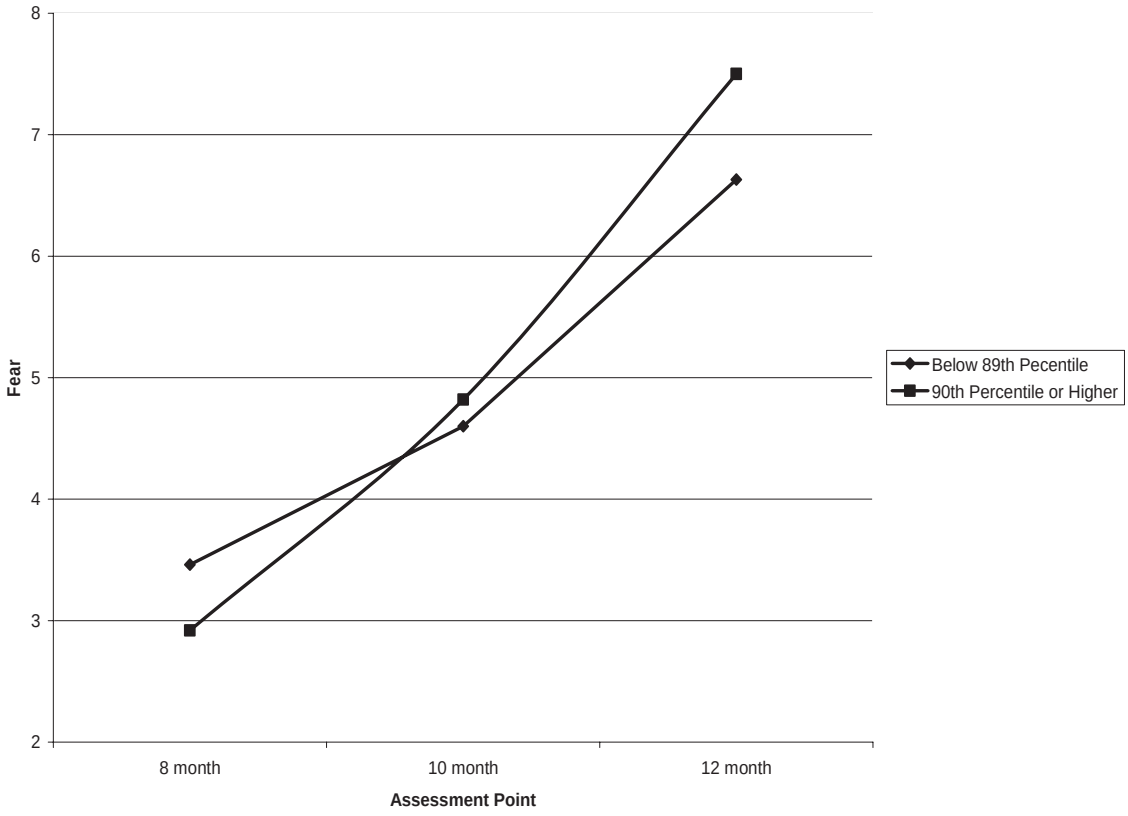

Figure 4. Developmental trajectories of laboratory-assessed fear based on level of maternal depressive symptoms. Percentiles, based on corresponding raw scores, for the Depression scale from the Parenting Stress Index were available. Those that fell at or below the 89th percentile ($n = 126$) were considered to have minimal symptoms of depression, whereas those that fell above the 90th percentile ($n = 8$) were considered to have clinically meaningful levels of depressive symptoms.

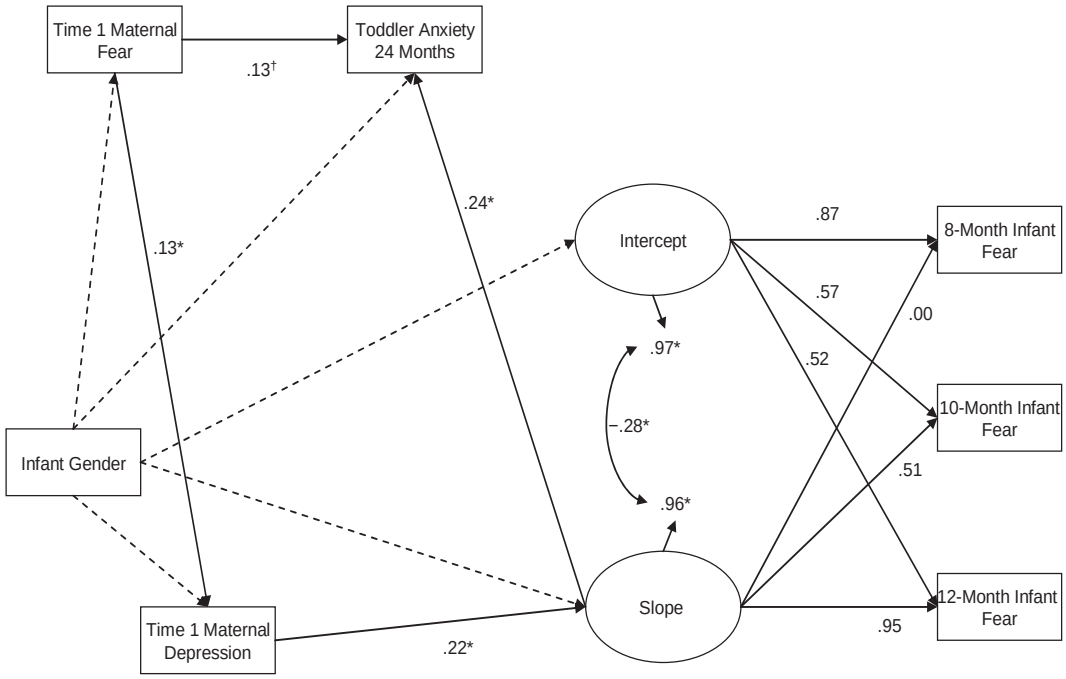

Figure 5. Final standardized LGM of laboratory assessed infant fear from 8 to 12 months of age with maternal depression as predictor of change and toddler anxiety outcome. For clarity, the constant and residuals associated with each fear time point and the predictors have been omitted. Pathways that were not significant were also omitted for clarity. Dashed lines from gender to other variables are included to signify that gender was controlled for. Significant relationships between gender and other variables were not observed. † $p < .10$. * $p < .05$.

Infants who completed the 10- and 12-month fear laboratory assessments were not different from infants who did not complete the 10- and 12-month fear laboratory assessments in terms of 8-month laboratory assessed fear (all *p*s > .05). Families/toddlers completing the 24-month toddler Anxiety Problems scale of the CBCL did not differ from families who failed to complete the 24-month CBCL evaluation in terms of infant gender, maternal age, education, depression, or fear nor did they differ on any of the laboratory fear assessments when infants were 8, 10, or 12 months of age (all *p*s > .05). Thus, the same missing data procedure, MLE, used in Study 1 was used in Study 2.

Latent growth modeling analyses. Consistent with findings in Study 1, infant fearfulness demonstrated increases from 8 to 12 months of age (8 months: $M = 3.43$, $SD = 1.75$; 10 months: $M = 4.66$, $SD = 2.62$; and 12 months: $M = 6.36$, $SD = 2.84$). The initial LGM examining the development of laboratory-assessed infant fear from 8 to 12 months of age provided a good fit to the data, robust $\chi^2(df = 1) = 0.88$, $p = .35$; *CFI* = .98; *RMSEA* = .00 (90% *CI* = .00 to .24); *AIC* = −1.11. Identical to the findings in Study 1, significant variance in initial status of infant fear ($z = 5.10$, $p < .01$) and change in infant fear ($z = 7.82$, $p < .01$) were present, indicating significant interindividual differences in initial levels and change in fearfulness across time (Table 8 displays unstandardized coefficients and standard errors for the Study 2 initial fear model).

The final LGM, with maternal predictors and toddler anxiety problems outcome, controlling for infant gender, also fit the data well: $\chi^2(df = 6) = 9.26$, $p < .001$; *CFI* = 1.00; *RMSEA* = .06 (90% *CI* = .00 to .15); *AIC* = −2.74. Consistent with findings in Study 1, greater number/intensity of maternal depressive symptoms predicted steeper increases in infant fear from 8 to 12 months of age after controlling for infant gender, $z = 2.30$, $p < .05$[2] (see Figure 4). Infant gender, maternal fear, and maternal depressive symptoms did not account for significant variance in the initial levels of infant fear (i.e., intercept; *z*s = −1.19, 0.63, and −1.78, *p*s > .05, respectively), and infant gender and maternal fear did not account for variance in changes in infant fear over time (i.e., slope; $z = -0.45$ and 0.73 *p*s > .05, respectively). Also consistent with findings from the first study, the slope of infant fearfulness was a significant predictor of toddler anxiety symptoms, $z = 2.08$, $p < .05$, with faster increases in fearfulness predicting greater frequency/intensity of mother-reported toddler anxiety symptoms. There was a trend for higher maternal fear to predict increased toddler anxiety

[2] Similar to the approach we took in Study 1, to address the question of the effects of demographic variables on the association between maternal depressive symptoms and the slope of infant fear, we conducted analyses on a reduced model containing only family income (above/below $30,000 per year necessitated by the ordinal nature of the available data), maternal education, and maternal depressive symptoms, which we found to fit the data well, robust $\chi^2(6) = 10.09$, $p = .12$; *CFI* = .97; *RMSEA* = .05 (90% *CI* = .00 to .15); *AIC* = −1.91. Consistent with the results reported for Study 1, Study 2 findings also indicated that the effects of maternal depressive symptoms on the slope of infant fear remained after accounting for the potential influence of relevant demographic variables, $z = 2.58$, $p < .05$.

Table 9
Parameter Estimates and Standard Errors for Maternal Predictors of Fear Development and Toddler Anxiety Outcome in Study 2

Parameter	Coefficient[a]	Standard error
Mean fear intercept	5.70**	1.12
Intercept fear variance	1.99**	0.37
Gender to intercept	−0.35	0.29
Maternal fear to intercept	0.11	0.17
Maternal depression to intercept	−0.54	0.30
Mean fear slope	−0.90	1.01
Slope fear variance	1.64**	0.23
Gender to slope	−0.12	0.25
Maternal fear to slope	0.10	0.14
Maternal depression to slope	0.52**	0.22
Covariance	−0.51**	0.19
Mean of gender	1.48**	0.04
Mean of maternal fear	4.01**	0.29
Infant gender to maternal fear	−0.16	0.18
Mean of maternal depression	3.13**	0.29
Gender to maternal depression	0.19	0.10
Maternal fear to maternal depression	0.21**	0.06
Toddler anxiety		
Path from gender	0.29	0.37
Path from maternal fear	0.24	0.18
Path from maternal depression	0.16	0.27
Path from fear intercept	−0.10	0.12
Path from fear slope	0.33*	0.16
Error variance		
Gender	0.25**	0.02
Maternal variable		
Fear	0.87**	0.11
Depression	0.26**	0.04
Infant variable		
8-Month infant fear	0.69	0.43
10-month infant fear	3.09**	0.61
12-month infant fear	0.96	0.67
Toddler anxiety	2.74**	0.36

[a] Coefficients presented are not standardized.
* $p < .05$. ** $p < .01$.

symptoms ($z = 1.31$, $p < .10$), whereas, infant fear intercept, child gender, and maternal depressive symptoms did not account for a significant amount of variance in the toddler anxiety symptoms ($zs = -0.81$, 0.78, and 0.59, $ps > .05$, respectively). Collectively, predictors in this model accounted for 12.5% of the variance in toddler CBCL Anxiety Problems ratings (see Figure 5 and Table 9).

Discussion

The findings of Study 1 were largely replicated in Study 2, in which we used laboratory-assessed infant fear rather than relying solely on maternal report. In Study 2, steeper increases in laboratory-evaluated infant fearfulness were predicted by higher maternal scores on the PSI Depression scale; maternal depressive symptoms did not predict initial levels of laboratory-assessed infant fear. Consistent with findings in Study 1, maternal fear did not contribute to the development of infant fearfulness in the first year of life. Lastly, although initial levels of laboratory-evaluated infant fear did not predict toddler anxiety, a steeper change (i.e., more rapid acceleration) in laboratory-evaluated infant fear between 8 and 12 months of age emerged as a significant predictor of increased toddler anxiety symptoms, consistent with the findings obtained in Study 1.

The converging results obtained in the present investigation are particularly noteworthy given the difference between evaluation of infant fearfulness in Study 1 and 2 and the fact that associations between parent report and observation-based methods are typically low to moderate (Kochanska, Murray, & Coy, 1997; Rothbart & Goldsmith, 1985). In addition, the second investigation relied on a different measure of maternal depressive symptoms. Although the latter could be viewed as a limitation, the consistent nature of observed results appears even more compelling in light of this discrepancy.

General Discussion

The two studies reported in the current investigation make important contributions to understanding infant fear development, maternal characteristics that affect individual differences in developing infant fearfulness, and, consistent with the recognized importance of early unfolding developmental trajectories (e.g., Crockenberg & Leerkes, 2000), the impact of individual differences in fear development on early anxiety problems. Additional methodological contributions of this research, a function of our use of the LGM analytic strategy and different measurement approaches across the two studies, should also be noted. Each of these identified contributions is therefore discussed below, followed by suggestions for extending the present findings, which would address the limitations of this research while capitalizing on the strengths of the analytic approach used in this investigation.

Fear Development

Fear, evaluated with mother report (i.e., Study 1) and laboratory observations (i.e., Study 2), increased in a linear fashion over the first year of life. Lower levels of fearfulness observed earlier in the first year of life gave way to steady increases in fear over time. These findings are largely consistent with previous studies (e.g., Carnicero et al., 2000; Rothbart, 1986, 1988; Scarr & Salapatek, 1970), which demonstrated mean level increases in fear, particularly in the latter half of the first year of life, extending prior work by examining individual differences in the developmental trajectory of infant fear. Results of the first study suggest that infants initially lower in fearfulness at 4 months of age experienced steeper increases in fear from 4 to 12 months of age relative to infants with initially higher levels of fear, as indicated by the significant, negative covariance between fear intercept and slope. This same pattern of results was observed in the second study. Although we did not generate a priori hypotheses regarding the relationship between the initial levels of fearfulness and subsequent growth of this attribute, it is a convention in the LGM framework to include the covariance between the slope and the intercept unless theoretical or conceptual reasons dictate otherwise, as important individual differences may be captured by this parameter. In the context of the present investigation, it may be that this association identifies variability in behavioral manifestations of fear that reflect individual differences in the developmental time frame of the underlying physiological mechanisms associated with the fear response, for example, the "coming online" of

the behavioral inhibition system, linked with fear reactivity (Gray, 1991). That is, infants who experience later maturation of these underlying mechanisms, and thus lower levels of fearfulness at 4 months of age, may quickly make up for this lagging fear development, as evidenced by steeper trajectories of fear in the first year of life. Alternatively, this pattern of results may indicate that infants with higher fear at 4 months are those who are temperamentally inclined to fearfulness very early in life, regardless of environmental influence, and may further indicate that this inclination does not undergo a great deal of change relative to other infants. These and other potential interpretations of the association between initial levels of and changes in infant fearfulness over the first year of life await future investigation. However, consistent findings pertaining to this association observed in the two studies relying on different methods in assessing fear make measurement-related explanations, such as an insufficient ceiling or regression to the mean, appear less plausible. It should be noted that models including effects that explain individual differences in initial fearfulness and in changes in fear over time statistically account for the covariation between the intercept and slope; thus, the intercept–slope association does not appear to diminish the effect of the examined predictors (i.e., maternal depression).

The effect of gender, although not central to the hypotheses of the present investigation or observed consistently across the two studies, deserves some discussion. In Study 1, gender accounted for a significant portion of the variance in interindividual differences in the slope, but not the intercept, indicator of fearfulness. Steeper increases in fear reactivity were demonstrated for female, relative to male, infants. A similar trend was observed in Study 2; however, the latter effect of gender on individual differences in the slope of fearfulness did not reach statistical significance. We are not aware of prior studies demonstrating gender differences in the trajectories of fear, but results of this study are consistent with prior research noting higher levels of fearfulness for female infants. It may be that this noted gender difference is at least, in part, a function of the methodological approach utilized in temperament assessment. That is, parent report has been shown to produce higher fearfulness scores for female, relative to male, infants, whereas this difference did not emerge in laboratory observations (Self et al., 2006). On the other hand, the gender difference noted in the study may parallel considerable evidence demonstrating that anxiety levels tend to be higher for females than males across development, independent of the measurement approach (Bijl et al., 1998; Degnan & Fox, 2007; U.S. Department of Health and Human Services, 1999). Insofar as such differences have been understood to involve a biologically based sex-linked vulnerability, this type of a predisposition may also contribute to the pattern of findings observed in this study.

Maternal Influences

Results of the present investigation provided information not only regarding interindividual differences in fear growth trajectories in infancy but also concerning predictors contributing to these fear trajectories. Specifically, support was found for the effect of maternal depressive symptoms on fear development, after accounting for the association between initial fear and changes in fear over time. Higher scores on measures of maternal depressive symptoms were linked with steeper slopes/increases in infant fearfulness over time. However, maternal depression was not linked to the initial level of infant fearfulness, and caregiver fear was not associated with infant fear (initial levels or changes over the first year of life). These findings are consistent with earlier studies indicating the importance of maternal depressive symptoms in relation to child fearfulness (e.g., Pauli-Pott et al., 2004; Sugawara et al., 1999) and extend existing research by addressing a number of earlier methodological limitations. For example, Sugawara et al. (1999), relying exclusively on parent report, included only two temperament evaluations (at 6 and 18 months of age). Thus, the investigators were not able to examine developmental trajectories of fear reactivity or generalizability of their results to sources of information other than primary caregivers. Although Pauli-Pott et al. (2004) included observational and parent-report indices of infant temperament, obtained at three time points during the first year of life, these authors examined the contribution of maternal characteristics to static temperament ratings, rather than to growth indices, and did not address relationships between fearfulness ratings and later child anxiety symptoms. Thus, the present study addresses methodological limitations in prior investigations by directly modeling change in infant fear and the effects of maternal depressive symptoms on infant fearfulness over time, with inclusion of toddler anxiety symptoms as an outcome.

The link between maternal depressive symptoms and changes in infant fear is potentially an important key to gaining greater understanding into developmental processes related to fearfulness. At the physiological level, underlying mechanisms have been suggested for the process whereby infants of depressed mothers become increasingly negative and fearful. Nelson and Bosquet (2000) suggested that exposure to increased levels of maternal negative affect may lead to enhancement of neuronal groups associated with withdrawal behavior and negativity, a process that likely takes a considerable amount of time to unfold, which may explain findings in the current study related to the effects of maternal depressive symptoms on infant fear development that emerge over the first year of life.

Alternatively, a mechanism underlying the relationship between maternal depressive symptoms and increases in child fearfulness may involve the mother–child interactional context. Field et al. (1988), for example, found that dysphoric mothers and their babies showed less positive behavior during interactions, and infants whose mothers experienced symptoms of depression displayed a depressed style of interacting with strangers compared with babies of nondepressed parents. Consistent with Field's observations, Cohn, Campbell, Matias, and Hopkins (1990) reported that depressed mothers were described as more negative (i.e., irritable, disinterested, etc.) in their interactions with infants. Other investigators have also found that interactions of depressed mothers and their infants were less contingent and emotionally attuned in comparison with mothers considered free of postnatal depressive symptoms (e.g., Stanley, Murray, & Stein, 2004). Existing studies indicate that on the one hand, sensitive/emotionally attuned mother–infant interactions provide a context wherein the child's signals of distress lead to soothing and care; on the other hand, when the child is distressed and the caregiver is not responsive (i.e., the child does not experience a world in which his or her signals lead to soothing), more intense negative reactions can be expected from the infant in fear-inducing situations. Thus, nonresponsive parent–child interactions may serve as the mechanism, or at least represent one of the pathways, by which maternal symp-

toms of depression influence the developmental trajectories of infant fear (e.g., Crockenberg & Leerkes, 2006). Collectively, the current findings and prior research suggest that the effects of repeated, nonresponsive caregiving in the context of infant emotional distress and fear reactivity, which results from maternal depressive symptoms, accumulate over time, leading to steeper than typical increases in infant fearfulness and reactivity. Future investigations will need to extend the findings of the current study by examining changes in parent–infant interactions, maternal depressive symptoms, and infant fearfulness over time, in a single study or in a series of studies, to conclusively evaluate the role of the potential mechanisms discussed above. Other possible mechanisms, involving marital discord and/or multiple demographic correlates (e.g., socioeconomic status, education) previously linked with depression (e.g., Cummings & Davies, 1994; Downey & Coyne, 1990) should also be incorporated into future studies investigating changes in infant fearfulness, as well as other emotion and emotion regulation attributes. In particular, although in the current study, we were able to demonstrate that the effects of maternal depression on the trajectory of infant fear remained after accounting for these demographic variables, lower levels of educational attainment and socioeconomic status/family income background were not widely represented in our community samples. If demonstrated, these mechanisms would provide further support for the psychobiological temperament theory, as described by Rothbart and colleagues (e.g., Rothbart & Derryberry, 1981), as well as other accounts of temperament, which suggest an openness of temperament development to environmental influences.

It should also be noted that the present study failed to yield significant findings for maternal fear, despite the fact that this maternal attribute is most proximal, phenotypically and genotypically, to infant fearfulness. It is possible that caregiver anxiety, the clinical condition most closely linked with fearful temperament (e.g., Crockenberg & Leerkes, 2006; Moffitt et al., 2007), represents a more viable predictor of infant fear and its development. Alternatively, this domain of parent functioning (i.e., fear and/or anxiety symptoms) may not be as important as maternal depression in explaining infant fear development; however, these explanations await future research.

Psychopathology

Implications of the present findings for developmental psychopathology should also be noted. Our results are consistent with prior reports noting that early manifestations of fearfulness are predictive of internalizing symptoms emerging later in childhood. Schwartz, Snidman, and Kagan (1999), for instance, reported that inhibited temperament observed in the second year of life predicted increased levels of generalized social anxiety. Infants described as "high reactive" in this domain of temperament were also at elevated risk for overall anxiety symptoms in the preschool period (Kagan et al., 1999). Similarly, Crockenberg, and Leerkes (2006) found that high reactivity to novelty in infancy predicted anxious child behavior later; however, this effect was noted in conjunction with child withdrawal and poor attention control, and only when mothers were less engaged or less sensitive. Lengua (2006) also examined the contribution of fear, along with other temperament domains, to psychopathology in school-age children, demonstrating that higher levels of fear and irritability, along with decreases in effortful control, were linked to internalizing and externalizing behavior problems. Fear, in particular, was strongly related to higher levels of internalizing difficulties. The current investigation extends prior work by examining the effects of a developmental process, operationalized as changes in infant fear over time, rather than predictors based on static indices of this domain of reactivity, to early manifestations of anxiety. In doing so, this research contributes to the growing literature suggesting that temperament represents a key set of child related risk and protective factors in models of developmental psychopathology (e.g., Frick, 2004; Muris & Ollendick, 2005) and also contributes to the emerging literature suggesting that change in temperament constructs is critical to understanding the role of temperament in models of psychopathology (e.g., Lengua, 2006). Future research may be able to establish a range of fearfulness that leads to clinical levels of anxiety problems predictably enough to warrant early identification of at-risk infants and intervention efforts.

Evidence obtained in the current investigation suggests that more frequent and severe symptoms of maternal depression, even at largely subclinical levels in a community sample, nonetheless contribute to increases in infant fear reactivity over the course of the first year of life, which in turn, leads to increased symptoms of toddler anxiety. Thus, results of the present study suggest some pathways for addressing fear acceleration and its adverse effects (i.e., increased risk for later anxiety) indirectly, through parent/parenting attributes. First, alleviating symptoms of maternal depression and related difficulties may help to prevent rapid, nonnormative increases in infant fearfulness. The parent–child interaction dynamic linked with maternal depression could also be addressed directly, in an attempt to improve the quality of early social exchanges. A number of interventions have been documented as effective in increasing parental sensitivity and child attachment security (van IJzendoorn, Bakermans-Kranenburg, & Juffer, 2005) and may also prove effective in preventing increases in infant fearfulness. Treatment outcome research conducted by van den Boom represents one of the most widely cited examples of this type of an intervention (Ziv, 2005). Although this program was aimed at increasing the security of attachment in irritable infants (van den Boom, 1994, 1995), similar positive results have been reported for interventions in which children were not selected on the basis of temperament profiles (e.g., Berlin, 2005).

Our reliance on a community sample also indicates that more frequent and severe depressive symptoms in nonclinical, relatively low-risk populations are nonetheless important in understanding social–emotional functioning of offspring, suggesting that preventative efforts should not be limited to groups of families already identified as at-risk (e.g., clinical samples, federal assistance recipients, families with documented child protective service contacts). In the absence of these additional family risk factors, because of the nature of our sample, infant fearfulness nonetheless emerged as an important risk factor for later internalizing type difficulties.

Methodological Contributions

The current investigation adds to the growing literature using LGM and is one of the few studies to date to use LGM to examine temperament development (see Bridgett et al., 2009; Lengua, 2006; and Partridge & Lerner, 2007, for other examples). This

study also demonstrates the usefulness of a developmental process–oriented type of modeling approach. Using LGM to understand factors influencing fear development and how fear development influences the emergence of anxiety symptoms addresses questions related to the mechanisms underlying developmental change. The present study also has measurement implications. Namely, the IBQ-R, a parent-report measure, captured fear development similarly to laboratory-assessed infant fear, and both measurement procedures demonstrated remarkable consistency in their predictions of later toddler anxiety problems. These convergent results suggest that the IBQ-R is a promising instrument to use in conjunction with laboratory-based indicators of temperament or, when such observational indicators are not available, at least in the domain of fearfulness. It should be noted, however, that the generalization of support for the validity of the IBQ-R and its laboratory counterpart provided in the context of this study should be exercised with care for populations dissimilar from the present sample.

Limitations

A number of limitations of the present study should be discussed. First, the assessments carried out in the two studies were not entirely consistent in terms of the type of measurement of fear, time of assessment, or evaluation of maternal depressive symptoms. However, in some respects, these dissimilarities make the consistent findings linking increased symptoms/severity of depression to increases in/steeper slopes of fear during infancy observed in the present investigation even more compelling. Second, although some of the most salient maternal characteristics were included in the predictor–outcome models, additional parent characteristics and parent–child interaction factors (e.g., anxiety, sensitivity/responsiveness) were not examined in this study but may be potentially important in understanding the development of infant fearfulness and risk for early manifestations of anxiety and should be considered in future research. Inclusion of parent–child interaction and parenting constructs would enable researchers to examine mechanisms involved in control-focused theories of anxiety disorder etiology (Chorpita & Barlow, 1998). For example, Chorpita and Barlow suggested that greater frequencies of sensitive, contingent parent–child interactions produce multiple opportunities for the child to experience control in this interactional context, potentially reducing the risk for the development of anxiety symptoms.

Limitations associated with the sample utilized in the present investigation should also be noted. First, although families participating in this research are representative of the included geographic regions, our results should be generalized with care to more diverse populations, and future research should include a larger proportion of minority families and those experiencing socioeconomic challenges. The latter would permit future studies to examine the contribution of demographic factors linked with depression to the relationships examined in this study. Second, attrition represents another limitation and is a function of the longitudinal nature of this study. However, it is important to note that there were minimal differences between families who remained in the study and those choosing to discontinue their participation. Given the converging findings in Studies 1 and 2, it appears that LGM may be robust to moderate levels of missing data when missing data is handled with MLE. Additional limitations involve the instruments used in the assessment of fearfulness. For example, the evaluation of infant fearfulness could be expanded to include both parent-report and observational measures, forming multimethod constructs, along with physiological measurements, which may be particularly important in increasing our understanding of the role of the development of the underlying fear circuits. Moreover, in the present study, we did not address maternal negative emotionality other than symptoms of depression and maternal fearfulness nor did we compare clinically depressed mothers with nondepressed mothers, and future research should examine whether negative emotionality in general, or a diagnosed depressive disorder, play the same role in shaping the growth of infant fear trajectory. In addition, parental anxiety, and possibly other forms of symptoms and psychopathology, should be incorporated in future research. Developmental trajectories of additional domains of temperament (e.g., positive emotionality) should be examined, possibly in conjunction with parent and family characteristics, in future research.

Conclusion

Despite some of the limitations noted above, the present study makes several notable contributions to the current understanding of early fear development and the ways in which maternal characteristics, such as depressive symptoms, can shape early development of emotions over time. Furthermore, these findings have important implications for the role of fear development in the emergence of early anxiety problems and illustrate the importance of using statistical and methodological techniques (e.g., LGM) that can capture complex developmental processes. Building on these findings and incorporating recommendations outlined above, future research will further enhance understanding of early fearfulness and developmental processes associated with increased risk for internalizing problems, collectively leading to improved early intervention and prevention efforts conducted with the appreciation for the complex interplay between parental, family, and social factors affecting early manifestations of temperament and subsequent risk for psychopathology.

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