

Early Manifestations of Childhood Depression: Influences of Infant Temperament and Parental Depressive Symptoms

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In this longitudinal study, 83 parents of infants between 3 and 12 months completed questionnaires assessing demographic information, infant temperament, and maternal depression. When these children were at least 18 months of age, parents completed follow-up questionnaires assessing toddler temperament and depression-like symptoms. We were primarily interested in the contributions of infant temperament and maternal depression to toddler depressive problems, and the analytic strategy involved controlling for toddler temperament in order to isolate the influence of infancy characteristics. The findings indicated that lower levels of infant regulatory capacity and greater severity of maternal depression were predictive of toddler depression-like symptoms. Moderator effects of infant temperament were also examined, with the negative affectivity * maternal depression interaction emerging as significant. Follow-up analyses indicated that the risk for early manifestations of depression was attenuated for children with lower negative affectivity in infancy and parents who reported lower levels of their own depressive symptoms; conversely, children exhibiting higher infant negative emotionality had higher levels of depression-like symptoms as toddlers, regardless of their parents' level of depression. The present findings further suggest that parental depressive symptoms need not be 'clinically significant' to predict toddler affective problems. Copyright © 2008 John Wiley & Sons, Ltd.

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The onset of depression has been occurring earlier in more recent decades (NIMH, 1999). Toddlers with symptoms of depression may experience lethargy, sleeping and/or eating problems, sad facial expressions, inattention, irritable,

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frequent crying, and decreased curiosity and affective responsivity (Carlson & Kashani, 1988; Field, 1984). In addition, these toddlers often display anger, complain about body symptoms, are either over- or underactive, are socially withdrawn, have separation anxiety, and express anhedonia (Carlson & Kashani, 1988). Whereas it was once thought that childhood-onset mood disorders naturally diminish over time, data now suggest that early affective disorders often remit only to reappear causing impairment. For children, this translates into struggling to meet the challenges of various developmental tasks and negotiating these competently because of the affective symptoms (Cicchetti & Toth, 1995). In fact, depressive episodes in childhood persist and recur (Harrington, 1992; Kovacs, 1989), frequently becoming more prevalent with age (Fleming & Offord, 1990), and are associated with a variety of psychiatric, psychosocial, and physical health problems in adulthood (Fleming, Boyle, & Offord, 1993). Briggs-Gowan *et al.* (2003) described considerable persistence of psychiatric symptoms, diagnosed as early as four years of age, as well as relative stability of sub-clinical symptoms. In addition, children with sub-clinical symptoms were five times more likely to progress to full disorders at follow-up compared with children without a sub-threshold diagnosis at baseline. The most common comorbid conditions in children with depression include anxiety disorders and disruptive behaviour problems (e.g. conduct, oppositional, attention-deficit, and substance use disorders; Hammen & Rudolph, 1996). Risk and protective factors implicated in the development of other forms of early appearing psychopathology (e.g. Oppositional Defiant Disorder, Attention Deficit Disorder) include child temperament and parent characteristics, most prominently parental depression, child negative affectivity (NA) and regulatory capacity (Fendrich, Warner, & Weissman, 1990; Frick & Morris, 2004; Welsh-Allis & Ye, 1988). Similarly, early developing depressive symptoms could be a function of child and parent characteristics, including infant temperament (e.g. NA, regulatory capacity) and parental depression. The present study is aimed at discerning the unique and combined contributions of these variables to early depression-like symptoms, observed in toddlers.

Temperament has been defined as constitutionally based individual differences in reactivity and self-regulation (Rothbart & Derryberry, 1981), with these characteristics demonstrating relative consistency across situations and stability over time. NA represents one such general temperament dimension with a multiplicity of manifestations/components, ranging from mood to behaviour (see Watson & Clark, 1984). It may be viewed as a temperamental sensitivity to negative stimuli (Tellegen, 1985), such that those who score high on this trait measure tend to experience a broad range of negative affect, including fear/anxiety, sadness/depression, guilt, hostility, and self-dissatisfaction (Watson & Clark, 1984). NA has been linked with psychopathology, including depression (Watson & Clark, 1984), internalizing and externalizing problems (Bates, Maskin, & Frankel, 1985). For example, results of the Bloomington Longitudinal Study indicated that frequent and intense negative affect in infants and toddlers predicted externalizing and internalizing problems from the preschool- to middle-childhood periods. Early negative reactivity to novel situations (i.e. fear) predicted internalizing problems, such as depression, more so than externalizing problems, whereas early resistance to control predicted externalizing problems over internalizing difficulties (Bates *et al.*, 1985). Behavioural inhibition (also related to fearfulness) in early childhood predicted subsequent symptoms of psychopathology, anxiety disorders in particular (Biederman *et al.*, 2001; Kagan & Snidman, 1999; Kagan, Snidman, McManis, & Woodward, 2001). In addition,

Caspi (2000) noted that children who were observed to be shy, fearful, and socially ill at ease at three years of age tended to experience internalizing problems later. Interestingly, positive affectivity, or extroversion, which includes positive emotionality, energy, affiliation, and dominance traits, has been described as inversely related to depression in adults (Clark, Watson, & Mineka, 1994).

Early in infancy, regulatory capacity reflects orienting and self-soothing, whereas later in childhood, effortful control (EC), including the ability to inhibit a prepotent response in favour of a non-dominant response, becomes the basis for self-regulation (Goldsmith *et al.*, 1987; Rothbart & Bates, 1998; Rothbart, Ellis, Rueda, & Posner, 2003). There is evidence that attentional skills associated with EC begin to 'come online' in the second half of the first year of life (Rothbart, Derryberry, & Posner, 1994). Not surprisingly, this onset coincides with the development of the anterior brain structures (e.g. prefrontal cortex and anterior cingulate) supporting higher-order attentional skills (Rothbart *et al.*, 1994; Rothbart, Ahadi, Hershey, & Fisher, 2001). Rothbart and Derryberry (1981) characterized self-regulation as a product of voluntary attention, behavioural inhibition, and self-soothing, which serve to modulate reactivity (i.e. arousability of emotional, motor, and orienting responses) (Rothbart *et al.*, 1994). There is considerable agreement regarding the importance of attentional functions' contribution to self-regulation (Block & Block, 1980; Posner & Raichle, 1994; Posner & Rothbart, 1991; Rothbart & Bates, 1998).

Whereas higher levels of early negative emotionality (NE) may serve as a risk factor, leading to more significant later depressive symptoms, child self-regulation is likely to play a protective function. Attention-based regulation may enable a child to shift focus away from stimuli eliciting negative affect, developing coping strategies for stressful circumstances not available to children with lower levels of this regulatory capacity (Rothbart, Derryberry, & Posner, 1994). Rothbart and Bates (2006) outlined the theoretical importance of interactions between child temperament and parent-related factors, recommending a moderator framework for understanding cumulative effects of child temperament characteristics, such as NA and regulatory capacity, and parent characteristics (e.g. depression). A moderator is an independent variable that affects the relationship between another independent and the dependent variables, impacting the strength and/or the direction of a given relationship; moderation is typically operationalized as an interaction effect involving the two independent variables (Baron & Kenney, 1986). In the case of the temperament-by-parent characteristic interaction, child temperament attributes have been widely conceptualized as moderating the impact of parent factors; therefore, child NE and self-regulation would be expected to moderate the impact of maternal depression on child depressive symptoms. Thus, infants with lower levels of regulatory capacity and/or higher levels of NA are likely to experience more adverse effects of maternal depressive symptoms. Children's own NE may be amplified in the context of interactions with mothers experiencing symptoms of depression; on the other hand, children with lower regulatory capacity may have difficulty organizing their emotional and behavioural responses in the context of interactions with a dysphoric mother, leading to increasing their own risk for early manifestations of depression. Although these specific temperament-by-parent characteristic interactions have not been previously evaluated, there are notable examples of other moderator effects of temperament in similar contexts (i.e. interactions between child characteristics and parent attributes). For example, Morris *et al.* (2002) found an interaction between irritability,

a component of NE, and negative parenting such that children high in irritability who experienced maternal hostility had significantly more teacher reported externalizing behaviour than children high in irritable stress who did not experience maternal hostility. Thus, the risk associated with the parent characteristic (i.e. maternal hostility) was moderated by child negative affect (i.e. irritability), accentuating the adverse impact on child behaviour problems. Similarly, Lengua, Wolchik, Sandler, and West (2000) found that maternal rejection had a more potent effect on child behavioural difficulties for children low in positive emotionality relative to those high in positive emotionality; thus child positive affectivity moderated the impact of maternal rejection.

For the temperament-by-temperament interaction, attention-based regulatory capacity was conceptualized as moderating the impact of NE (Rothbart & Bates, 2006). Rothbart and Bates (2006) noted that regulatory or control systems would be expected to moderate the impact of more reactive systems, so that a child with higher levels of NE would nonetheless experience adequate adjustment (and not manifest early symptoms of depression), because greater regulatory capacity would enable this youngster to exhibit more flexible, and presumably adaptive, emotional reactions. Consistent with this theoretical formulation, Eisenberg *et al.* (2001) found that children with behaviour problems were more likely to exhibit externalizing difficulties when they scored higher on anger and lower on regulation (e.g. EC). Using a longitudinal design, Belsky, Friedman, and Hsieh (2001) found that infants low in attentional persistence and high in NE experienced greater difficulties in social competence 16 months later compared with infants high in attentional persistence. Thus, child EC in one case, and attentional persistence in the other moderated the impact of child NA on behavioural difficulties, with low levels of attention/regulation being associated with increased risk for problem behaviours.

In the present investigation, emphasis was placed on evaluating infant temperament attributes in terms of their role in shaping subsequent early appearing symptoms of depression. Given the moderate correlations between infancy temperament indicators and subsequent manifestations of parallel individual difference domains typically reported in the literature (Komsis *et al.*, 2006; Putnam, Rothbart, & Gartstein, in press; Rothbart, Ahadi, & Evans, 2000), we anticipated unique effects of infant attributes, discernable even after controlling for the continuity/stability of temperament characteristics. Identifiable effects of infancy have been frequently observed in other areas of social-emotional development research, most notably in the study of attachment security. Infant attachment, generally assessed around 12 months of age, has been associated with significant influences on subsequent development, including psychopathology, behaviour problems, and social competence (Bohlin, Hagekull, & Rydell, 2000; Warren, Huston, Egeland, & Stroufe, 1997). In addition, Panksepp (2001) argued that the emotional systems development occurring in infancy is particularly influential in shaping later outcomes because of the 'valence tagging', a process wherein basic emotional systems imbue environmental events with values, unfolding during this period. According to Panksepp (2001), infants may 'initially assimilate cognitive structures only in highly affective ways', with the cognitive structure over time exerting a regulatory influence upon the emotional systems. Thus, infancy manifestations of the emotional systems not only provide the basis for later affective expressions and processing but also provide the foundation for developing self-regulation that relies on cognitive skills, continuing to advance throughout childhood and beyond. In the present study, it was hypothesized that infancy manifestations of NA, surgency/

extraversion, and regulatory capacity/orienting (RCO) would make unique contributions to early depressive symptoms, above and beyond the influence of toddler temperament attributes.

Maternal depressive symptoms were examined because these were expected to make a significant contribution to the development and maintenance of early appearing child depression. 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 depression on child emotional development, leading to internalizing behaviour problems later in childhood (Hammen & Rudolph, 1996). Mothers' depression is likely to directly affect the child's emotional expression and behaviour through characteristics such as dysphoria and unavailability. Depressed mothers may not be responsive to the child's needs, may have critical and/or rejecting interactions with their child (review by Downey & Coyne, 1990), and are likely to be withdrawn, irritable, and impatient in parent-child interactions (Hammen, Burge, & Adrian 1991).

Field, Hernandez-Reif, and Diego (2006) identified different pathways for the impact of maternal withdrawn and intrusive behaviours, associated with depressive symptoms, on the infant. Briefly, these authors suggested that depressed mothers who show a tendency to withdraw from their infants are likely under-stimulating the child, whereas mothers with depression whose approach to the infant could be described as intrusive may be providing excessive stimulation. In an earlier study of 3- to 6-month-old babies of mothers with and without depressive symptoms (Field *et al.*, 1988), not only did dysphoric mothers and their babies show less positive behaviour during their interaction when compared with the non-depressed dyads but also the infants of these mothers had the same 'depressed' style of interacting with strangers. Furthermore, when babies of dysphoric mothers interacted with strangers without depression, depression-like symptoms were seen in the strangers during their interaction with the babies. Results indicate the possibility of learned helplessness or a passive coping style on the part of the infant when faced with a repeatedly unresponsive mother (Field *et al.*, 1988). In fact, infants of caregivers with depression showed a less intense negative reaction (lower increase in frowning) in response to a non-contingent play segment, relative to infants of non-depressed mothers. Perhaps infants of mothers with depression experience less violation of expectancy in this non-contingent play situation, due to the fact that they are more accustomed to non-contingent behaviour in their mothers (Field *et al.*, 2006). The latter interpretation is consistent with results wherein interactions of depressed mothers and their infants were rated as less contingent and emotionally attuned compared with mothers considered free of postnatal depressive symptoms (Stanley, Murray, & Stein, 2004).

It should be noted that an increased risk for depression in the children of depressed caregivers is at least in part a function of an intergenerational genetic link between maternal and child psychopathology. Behavioural genetics research has documented that the risk of depression following stressful events is increased for individuals at high genetic risk (i.e. those with genetically related individuals who have been diagnosed with a mood disorder), relative to those with low levels of genetic risk (Kendler *et al.*, 1995). At the same time, the critical role of environment has also been supported by investigations with genetically sensitive designs. A recent study by Caspi *et al.* (2003) has demonstrated that a functional polymorphism in the promoter region of the serotonin transporter (5-HTT) gene moderated the influence of stressful life events on depression, wherein

individuals with one or two copies of the short allele of the 5-HTT promoter polymorphism exhibited more depressive symptoms, diagnosable depression, and suicidality in the context of stressful life events, relative to individuals homozygous for the long allele. This example of a gene–environment interaction points to the importance of the genetic risk factors, as well as environmental triggers (i.e. stressful life events) in determining the severity/frequency of depressive symptoms.

This study was designed in an attempt to improve our understanding of early manifestations of depressive symptoms in toddlers. Specifically, the impact of maternal depression and infant temperament on early depression-like symptoms was examined for a community sample. This investigation is of particular importance because depressive symptoms are most prevalent among women of childbearing age, and it has been reported that the effects of postpartum depression on children continue into the second year of life, even if maternal symptoms have decreased in frequency/severity (Stein *et al.*, 1991). The focus on temperamental influences during infancy also represents an important contribution. The nature of the longitudinal design of this investigation makes it possible to document a unique contribution of infant characteristics after accounting for the association with concurrent temperament attributes. The latter is important from the perspective of establishing plausible causal mechanisms for early psychopathology/behaviour problems, especially given concerns regarding the potential overlapping content between measures of temperament and behaviour problems (Lemery, Essex, & Smider, 2002; Lengua, West, & Sandler, 1998; Sanson, Prior, & Kyrios, 1990). That is, it has been suggested that relationships between indices of temperament and behaviour problems are most parsimoniously explained by the similarities in content of the included items, rather than the predictive contribution of temperament scores. The focus on infant temperament attributes as predictors of early depression-like symptoms has considerable methodological advantages, because internalizing and externalizing behaviour problems are generally recognized as emerging after the infancy period, and infant temperament items are vastly different in content from those addressing toddler behaviour problems for reasons related to developmental considerations (e.g. infants' limited locomotor capabilities, etc.). Thus, the contribution of infant temperament to later behaviour problems/psychopathology could not be attributed to potential content artefacts, establishing a more definitive causal pathway between temperament and early manifestations of depressive symptoms, especially after controlling for concurrent (i.e. toddler) temperament attributes.

Overall, child temperament and parent characteristics examined in this study were expected to independently contribute to toddler depressive symptoms, and infant NE and regulatory capacity were hypothesized to function as moderators, serving as risk and protective factors, respectively. First, it was hypothesized that NA and RCO in infancy would be predictive of early depression, with regulatory capacity playing a protective function (i.e. being associated with lower frequency and/or severity of depressive manifestations) and NA would lead to higher levels of later depression-like symptoms for toddlers. Second, we predicted that increased maternal depressive symptoms would be positively associated with toddler depression-like manifestations and account for variance in toddler symptoms, after considering the effects of infant and toddler temperament characteristics. Third, infant regulatory capacity was hypothesized to play a role of a protective factor, preventing increases in toddler depressive symptoms even

for those infants with high levels of NE. Infant regulatory capacity was also expected to serve a protective function relative to maternal depressive symptoms. That is, infants identified as exhibiting higher levels of regulation were expected to demonstrate lower levels of depressive symptoms, even when the mothers reported more severe symptoms of their own depression. Finally, infant NE was hypothesized to act as a risk factor, exacerbating the impact of maternal depressive symptoms on toddler-age manifestations of depression symptoms. Two indicators of toddler depression-like manifestations were examined as dependent variables in this study: the Anxious/Depressed Syndrome and the DSM-oriented Affective Problems scales of the CBCL. Both scales were of interest because they represent products of different measurement construction techniques, with the syndrome scale being a result of an empirically based development process and the DSM-oriented Affective Problems scale having been derived in a manner that parallels the DSM criteria for affective disorders diagnoses (e.g. Major Depressive Disorder, MDD).

METHOD

Participants Phase 1—Baseline

A group of 140 parents with infants in the first year of life was recruited in the San Francisco Bay Area. Parents were told that they were being asked to take part in a study of temperament development and early behavioural competence and difficulties and that they were selected for participation because of the age of their infant. Parents who expressed an interest in participation were asked a series of screening questions, addressing their infants' medical/neurological status. Premature infants, infants with conditions impacting the central nervous system, or chronic conditions were not included because of the potential impact of these conditions on the variables addressed in the proposed study. Only parents of infants who were 3, 6, 9, or 12 months of age (plus or minus two weeks) were invited to take part in this work. These families were equally divided across age groups: (1) 3 months of age ($n = 35$); (2) 6 months of age ($n = 35$); (3) 9 months of age ($n = 35$); (4) 12 months of age ($n = 35$), and by infant's gender (males, $n = 70$; females, $n = 70$), with boys and girls distributed about equally across the different age groups. Participants' recruitment proceeded in this manner because the initial study was conducted primarily to further evaluate psychometric properties of a recently developed questionnaire (i.e. the IBQ-R), and a representative sample of infants at distinctly different points of development in the first year of life was deemed necessary.

Three hundred and sixty-two parents were initially contacted by telephone and invited to participate in this research. Three hundred and four (84%) families agreed to participate and were mailed the questionnaires. Completed materials were received from 151 families; however, four sets of materials contained a large amount of missing data and were considered unusable. A number of participants were not able to complete the questionnaires in a timely fashion (i.e. before their infant was too mature for a particular age group). That is, each potential participant was selected because of the age of the infant, and could only participate as long as the data collection was completed by the time the child was no more than 2 weeks over the age of his/her respective age group.

Phase 2—Follow-up

Follow-up data for 83 participants from the baseline phase were collected from February 2001 to March 2002. The mean age of parents, most of who were mothers (98%), was 34.6 years, with a range from 25 to 48 years. Most respondents were married (92.8%), with some of the couples cohabitating (3.6%), others reporting being remarried (2.4%), and divorced (1.2%). The majority of participants were White (86.7%), with several minority groups being represented in the present sample: Asian (6%), Hispanic (3.6%), Filipino (1.2%), and African American (1.2%). The average level of education was 15.9 years. Most respondents completed four years of college (54.2%), followed by those with two years of college (12%). An evaluation of the SES data for this sample indicated that respondents often stayed at home with their children (36.1%); however, the majority of the caregivers (63.9%) were employed outside the home during their participation in this research. Their occupations were primarily in the areas of marketing/advertising (54%), administrative support (26%), computer systems administration (12.6%), and other computer-related occupations (7.4%).

The average toddler age during follow-up was approximately 22 months, with a range from 18 to 34 months. The average difference in time between the first and second phases was about 14 months, with a range between about 6 and 24 months. The duration of the period between the infancy and toddler assessments was a result of the age requirement for the instrument utilized to assess toddler depressive symptoms (18 months of age) and the sampling strategy for the infancy assessment (i.e. identification of different age groups). In addition, practical considerations (e.g. not being able to contact the family) occasionally contributed to increasing the duration of the inter-assessment period. Forty-two (50.6%) toddlers were female and 41 (49.4%) were male. One hundred thirty-five (96% of the baseline sample) parents were contacted when their infant was at least 18 months of age. The remaining five (4%) participants from the baseline data collection were not contacted because of the missing data necessary for the follow-up. Eighty-six questionnaire packets were returned (81.9% of sample who received packets; 61.4% of original sample), but three had to be excluded for various reasons (age limitations, a parent completing the questionnaire for a different child, and missing data crucial to the longitudinal study). Therefore, 83 (59.2% of the baseline sample, 79% of those who received packets in the follow-up phase) participants completed both sets of questionnaire materials that were used in this study.

Analyses were conducted to compare those who participated in the baseline phase only with those who completed both the baseline and follow-up assessments to ensure that the two samples were comparable. No significant differences were observed for infant gender, $\chi^2(1, N = 144) = 0.172, p = 0.68$; parent age, $t(141) = 1.39, p = 0.17$ (two-tailed); infant age, $t(142) = -1.09, p = 0.28$ (two-tailed); or SES, $t(135) = -1.33, p = 0.42$ (two-tailed). The temperament of infants whose parent participated in the baseline assessments only was generally not significantly different from the temperament of those whose parent participated in both assessments (NA, $t(144) = 0.24, p = 0.81$; positive emotionality/surgency, $t(143) = 1.09, p = 0.28$), although the t -test addressing differences in RCO approached significance ($t(144) = 1.92, p = 0.06$), suggesting lower regulatory functioning for those participating in the follow-up assessment (all are two-tailed tests). Parents who participated in both phases of this study reported more frequent/severe depressive symptoms than parents

who participated in the baseline phase only, $t(140) = -2.167, p = 0.03$ (two tailed).

Measures

Infant temperament

The Infant Behaviour Questionnaire—Revised (IBQ-R) (Gartstein & Rothbart, 2003), designed for infants between three and 12 months of age, was administered in the baseline phase of the study. This measure consists of 191 items addressing infant temperament characteristics, with response options ranging from 'Never' to 'Always', on a 7-point Likert scale. The IBQ-R represents a rationally derived, fine-grained assessment tool, based on the definition of temperament proposed by Rothbart and Derryberry (1981), work with the Child Behaviour Questionnaire (Rothbart *et al.*, 1994), comparative studies, as well as other developmental research that had identified significant dimensions and associated behavioural tendencies. The development of this measure involved a multi-step process and led to the formulation of 14 IBQ-R scales, with Chronbach's Alphas ranging from 0.60 to 0.90. The IBQ-R scales have been shown to form three overarching temperament factors referred to as positive affectivity/surgency (PAS), NE, and RCO. PAS includes activity level, smiling and laughter, high-intensity pleasure, perceptual sensitivity, approach/positive anticipation, and vocal reactivity. NE was defined by distress to limitations, fear, sadness, and, negatively loading, falling reactivity. Finally, the third factor, RCA, consisted of duration of orienting, low-intensity pleasure, soothability, and cuddliness (Gartstein & Rothbart, 2003). The factor composites were formed by summing the scores for all of the relevant scales. Since its original development and introduction reliability and validity of the IBQ-R have been supported for samples from different cultures, with Chronbach's Alpha's ranging from 0.77 to 0.96 (Gartstein & Rothbart, 2003; Gartstein, Knyazev, & Slobodskaya, 2005). Chronbach's Alphas computed in the context of this study can be found in Table 1.

Toddler temperament

Toddler temperament was measured in the second phase of this study via the Early Childhood Behaviour Questionnaire (ECBQ; Putnam, Gartstein, & Rothbart, 2006) for ages 18–36 months. The ECBQ is composed of 144 items, forming 13 scales, which in turn yield a three-factor structure including positive affect (PA), negative affect, and EC. The ECBQ was developed in a manner parallel to the IBQ-R construction, with response options ranging from 'Never' to 'Always', on a 7-point Likert scale. The PA factor was defined by activity level, high-intensity pleasure, and positive anticipation. Scales primarily loading on the NE factor include sadness, anger proneness, social fearfulness, discomfort, and, negatively, soothability/falling reactivity. Finally, low-intensity pleasure, attentional shifting, inhibitory control, attentional focusing, and perceptual sensitivity comprised the EC domain. The factor composites were formed by summing the scores for all of the relevant scales. Chronbach's Alphas computed for the ECBQ scales have ranged from 0.57 to 0.90 (mean = 0.81), for children between 18 and 36 months of age (Putnam *et al.*, 2006). Internal consistency estimates for the present sample are presented in Table 1.

In addition, infant-to-toddler stability coefficients were examined for the IBQ-R and the ECBQ (Putnam *et al.*, 2004), demonstrating statistically reliable stability

Table 1. Descriptive statistics: IBQ-R, ECBQ, CBCL, and PSI

Scale	M	SD	Minimum	Maximum	Alpha ^a
<i>IBQ-R</i>					
Activity (PA) (15 items)	4.24	0.74	2.33	6.00	0.72
Approach (PA) (12 items)	4.56	1.07	2.40	7.00	0.82
High-intensity pleasure (PA) (11 items)	5.67	0.78	3.70	7.00	0.70
Perceptual sensitivity (PA) (12 items)	4.04	0.96	1.73	6.22	0.77
Smiling and laughter (PA) (10 items)	4.75	0.81	2.71	6.60	0.60
Vocal reactivity (PA) (12 items)	4.66	0.89	1.57	6.25	0.78
Cuddliness (RC) (17 items)	4.62	1.30	2.79	6.81	0.87
Duration of orienting (RC) (12 items)	3.90	0.83	1.42	6.08	0.79
Low-intensity pleasure (RC) (13 items)	4.90	0.92	2.55	7.00	0.74
Soothability (RC) (10 items)	3.62	0.63	2.56	6.00	0.63
Distress to limitations (NA) (16 items)	3.68	0.81	1.50	5.94	0.71
Fear (NA) (16 items)	2.89	1.11	1.06	7.40	0.68
Falling reactivity (NA) (13 items)	4.38	1.10	1.92	6.73	0.72
Sadness (NA) (14 items)	3.59	0.81	2.00	5.33	0.69
Positive affect (72 items)	27.92	3.48	13.04	21.42	0.92
Regulatory capacity (52 items)	17.03	2.35	14.28	22.52	0.85
Negative affect (71 items)	5.77	2.74	14.20	24.97	0.86
<i>ECBQ</i>					
Activity level (PA) (7 items)	4.36	0.95	2.00	6.29	0.71
Positive anticipation (PA) (11 items)	4.44	0.77	2.75	6.00	0.75
High-intensity pleasure (PA) (12 items)	4.81	0.81	2.20	6.45	0.79
Inhibitory control (EC) (14 items)	4.19	0.79	2.29	6.00	0.89
Attentional focusing (EC) (13 items)	4.14	0.66	2.23	5.38	0.81
Attentional shifting (EC) (8 items)	4.74	0.63	3.13	6.14	0.66
Low-intensity pleasure (EC) (10 items)	5.45	0.72	3.50	6.78	0.74
Perceptual sensitivity (EC) (13 items)	3.79	0.91	1.60	6.92	0.85
Discomfort (NA) (9 items)	2.71	0.92	1.00	5.38	0.79
Sadness (NA) (13 items)	2.91	0.66	1.83	4.54	0.80
Anger proneness (NA) (9 items)	3.47	0.76	1.43	5.14	0.59
Social fearfulness (NA) (11 items)	3.75	0.95	1.80	6.57	0.80
Positive affect (30 items)	13.61	1.78	8.65	17.91	0.82
Effortful control (58 items)	22.31	2.12	17.12	28.17	0.77
Negative affect (42 items)	7.38	2.67	1.66	13.11	0.86
^b <i>CBCL</i>					
Anxious/depressed syndrome scale (8 items)	52.70	3.95	50.50	69.00	0.72
Affective problems DSM-oriented scale (10 items)	54.36	5.70	50.00	72.00	0.65
<i>PSI</i>					
Depression (9 items)	2.00	0.67	1.00	3.89	0.82

Note: IBQ-R/ECBQ score range = 1 (never)–7 (always); PA, positive affect; RC, regulatory capacity; NA, negative affect; EC, effortful control.^aAlphas computed for the present sample.

^bCBCL score range = 0 (not true)–2 (very/often true); all scores are *T* scores with a mean of 50 and a SD of 10; borderline and clinical ranges are set at *T* scores of 65 and 69 (93rd and 97th percentile), respectively.

for all of the scales found on both the IBQ-R and ECBQ; correlations ranged from 0.18 (attentional focus) to 0.44 (perceptual sensitivity), with an average correlation of 0.30. Stability of the three overarching factor scores was also evaluated from infancy to the toddler period, yielding estimates reflecting statistically reliable stability for surgency, NA, as well as orienting capacity/EC.

The relatively small magnitude of these stability estimates was expected and can be largely attributed to the considerable developmental changes in temperament characteristics in early childhood. Overall, displays of temperament attributes tend to increase throughout early childhood (infancy and the toddler period), after which time greater stability can be observed. For example, Goldsmith (1996) noted a tendency for scores across multiple temperament domains, including activity level, pleasure, anger proneness, and interest/persistence, to increase with age. The most profound changes during this period, however, have been noted for the regulatory domain of temperament, referred to as orienting/regulatory capacity in infancy and EC thereafter. Posner and Rothbart (2000; Rothbart & Rueda, 2005) contend that the rapid development of frontal neural systems, particularly the anterior cingulate, during early childhood underlies trends toward greater control of attention and behaviour. Consistent with this formulation, the ability to exercise inhibitory control in delaying gratification dramatically increases from 18 to 30 months (Vaughn, Kopp, & Krakow, 1984) and focused attention during free play increases between 2.5 and 4.5 years (Ruff & Lawson, 1990).

Toddler depression-like symptoms

The Child Behaviour Checklist (CBCL; Achenbach & Rescorla, 2000) for ages 18 months to five years was administered during the second phase of the study and provided two indicators serving as dependent variables. This version of the CBCL contains 100 items, which utilize the 3-point Likert scale (0, not true; 1, somewhat/sometimes true; 2, very/often true), common to all Achenbach System of Empirically Based Assessment (ASEBA) instruments. The standard scoring approach recommended by Achenbach and Rescorla (summing symptom/problem scores for the items relevant to each scale of interest) was followed, yielding two indicators of early depression-like symptoms: anxious/depressed syndrome scale and affective problems DSM-oriented scale. Raw scores were utilized in the analyses addressing hypotheses of this investigation, whereas the T-scores were reported as descriptive statistics for comparative purposes. The DSM-oriented scales represent a new addition to the ASEBA instruments. Unlike the traditional empirically derived syndrome scales, the items that make up the DSM-oriented scales have been judged by experienced mental health professionals as consistent with the DSM-IV (1994) diagnostic categories (Achenbach & Rescorla, 2000). The latter scales were developed in order to provide indicators more consistent with the dominant psychiatric classification system. The affective problems indicator includes items relevant for the major depressive and the dysthymic disorder diagnoses, which were combined into a single affective problems category because of considerable overlap in the DSM-IV diagnostic criteria. Reliability and validity of this measure have been established for children between 18 months and 5 years of age. Achenbach and Rescorla (2000) demonstrated satisfactory internal consistency for the CBCL syndrome subscales (Alphas ranging from 0.66 to 0.92), and the DSM-based scores (Alphas ranging from 0.65 to 0.86). Adequate inter-rater (r ranging from 0.40 to 0.75) and test-retest ($r = 0.80$ s and 0.90 s) reliability were also reported (Achenbach & Rescorla, 2000). Criterion-related validity of the CBCL indicators was supported by analyses addressing differences related to the children's referral status. Specifically, two age groups (1.5–3 and 4–5 years of age) of clinic-referred and non-referred youngsters were compared on the CBCL broad-band and narrow-band indicators, producing significant differences, with

medium effect sizes noted for the majority of these scores (for both age groups), including the affective problems scale (Achenbach & Rescorla, 2000). Descriptive statistics for the two CBCL depression indicators, including Cronbach's Alphas for the present sample, can be found in Table 1.

Maternal depressive symptoms

The Parental Stress Index (PSI; Abidin, 1995) was designed for parents of children between 1 month and 12 years of age and administered to parents during the baseline phase of the present study, prior to assessing the outcome variable (i.e. toddler depressive symptoms). Maternal depression was examined during the initial assessment in order to provide a longitudinal evaluation of the impact of caregivers' symptoms on child manifestations of depression. The longitudinal design was selected in order to focus on the caregivers' symptoms during the infancy period, especially important in the context of understanding the impact of parental affective symptoms/disorder on offspring functioning (Hammen & Rudolph, 1996) and in order to minimize the limitations associated with the reliance on parent-report. That is, whatever non-systematic factors may have inadvertently influenced maternal report of depressive symptoms at baseline, the factors impacting the caregivers' report of toddler depression are likely to differ at follow-up. Thus, the longitudinal nature of the evaluation of the effects of maternal depression on child symptoms provides some assurance that the indices of this association are not inflated because of the non-systematic factors potentially affecting parent-report. The PSI consists of 54 items that address seven parent-related domains. The PSI Depression scale, utilized in this study, contains nine items, summed to produce a scale score. The PSI has been shown to have acceptable content, concurrent, and construct validity, with adequate internal consistency and test-retest reliability (e.g. r 's ranging from 0.88 to 0.96; Abidin, 1995). Additional studies have shown that high scores on the PSI Depression scale were associated with the presence of clinically significant parental depression (Webster-Stratton & Hammond, 1988), and linked with child behaviour problems (Gartstein & Sheeber, 2004). Satisfactory internal consistency was demonstrated for the PSI Depression scale in the present sample (Table 1).

Procedure

Data collection

All the eligible families were contacted via telephone on the basis of birth announcements released by hospitals, and published in the local San Francisco Bay Area newspapers, and the study was described to them. In the second phase of the study, parents who participated in the baseline assessment were contacted by telephone once their children were at least 18 months of age. Those who agreed to participate were sent a check for \$5 along with the questionnaires, which they completed (taking about 1 h) and returned by mail.

RESULTS

Associations between Baseline Predictors (Demographic Characteristics, Infant and Toddler Temperament, Maternal Depression) and Follow-up Indicators (Toddler Depressive Symptoms)

Descriptive statistics were computed for all of the included variables (Table 1). Next, Pearson product-moment correlation coefficients were computed for all of

the continuous variables addressed in this study. A point-biserial correlation was utilized to examine the association between child gender (a dichotomous variable) and the remaining continuous variables. Consistent with the first hypothesis, there were a number of significant correlations between temperament factors and toddler depression-like symptoms. Infant regulatory capacity was significantly negatively correlated with both the traditional syndrome and the newer DSM-oriented scales; toddler negative affect was significantly positively correlated with both scales. Toddler EC was negatively and significantly correlated with the DSM-oriented scale only (Table 2). Six demographic variables were generally not significantly correlated with the temperament factors, emerging child depressive symptoms, or maternal depression, with some notable exceptions. For example, maternal depression was significantly negatively correlated with the socio-economic status indicator; infant age was positively correlated with baseline PAS. Thus, these demographic variables were initially included in the subsequent regression analyses, despite frequently observed non-significant relationships.

Hierarchical Multiple Regression Analyses

Infancy negative emotionality and regulatory capacity/orienting predicting toddler depression-like symptoms

Negative affect and RCO in infancy were expected to predict early depression-like symptoms, with NE being associated with higher levels of depression symptoms and regulatory capacity expected to be negatively associated with later depression. This hypothesis was partially confirmed in regards to the infancy RCO (Tables 3 and 4). Higher levels of RCO in infancy were predictive of lower severity/intensity of the depression-like manifestations during the toddler period. This effect was statistically significant for the anxious/depressed syndrome score of the CBCL, approaching significance for the DSM-based indicator. Demographic variables were 'trimmed' from the equation due to a non-significant contribution to explaining the variance in the dependent variables, and the presented results reflect these final equations (i.e. omitting the non-significant demographic characteristics).

The relationship between maternal depression and toddler depression-like symptoms

We hypothesized that maternal depression would predict toddler depressive symptoms, independently of the contribution of infant and toddler temperament characteristics. This hypothesis was supported by the analyses conducted for both dependent variables: the anxious/depressed syndrome and the DSM-oriented depression indicators. Maternal depression assessed in infancy was predictive of more depression-like symptoms emerging during the toddler period (Tables 3 and 4).

The relationships between infant temperament, maternal depression, and toddler-onset depression-like symptoms: infant temperament characteristics as moderators

The third hypothesis addressed the proposed moderator effects of infant temperament, operationalized through three interaction effects: negative affect * RCO; negative affect * maternal depression; and RCO * maternal depression. Terms involved in these moderation effects (i.e. interactions) were centred prior to their inclusion in the analyses (Aiken & West, 1991). Interaction effects were all

Table 2. Zero-order correlations between all of the independent and dependent variables (N = 83)

Scale	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 IBQ NE	1														
2 IBQ RCO	-0.31**	2													
3 IBQ PAS	0.00	0.37**	3												
4 ECBQ NE	0.19	0.02	0.11	4											
5 ECBQ EC	0.00	0.26*	0.27*	-0.11	5										
6 ECBQ PA	-0.04	0.16	0.22*	0.13	-0.17	6									
7 AD	0.15	-0.35**	-0.07	0.48*	-0.13	-0.01	7								
8 DSM-S	0.18	-0.27*	-0.03	0.43*	-0.24*	0.03	0.71**	8							
9 MDEP	0.22*	-0.27*	-0.09	0.27*	-0.19	0.07	0.42**	0.40**	9						
10 MAGE	-0.10	0.02	-0.11	-0.11	0.11	-0.16	0.07	0.04	-0.20	10					
11 IAGE	0.24*	-0.20	0.52**	0.10	-0.04	0.03	0.02	0.15	0.05	-0.08	11				
12 TAGE	0.13	-0.24*	-0.08	0.25*	0.09	0.04	0.13	0.04	-0.03	-0.03	0.23*	12			
13 AGE DIFF	-0.11	-0.01	-0.51**	0.10	0.09	0.00	0.08	-0.10	-0.06	0.05	-0.68**	0.05	13		
14 SES	0.07	-0.02	0.00	-0.05	-0.01	-0.10	-0.04	0.03	-0.26*	0.07	0.08	-0.05	-0.12	14	
15 CGENDER	-0.04	0.00	0.13	0.02	0.06	0.19	-0.14	-0.10	-0.15	0.07	0.22	0.16	-0.07	0.07	15

Note: NE, negative emotionality; RCO, regulatory capacity orienting; PA(S), positive affect/(surgency); EC, effortful control; AD, anxious/depressed syndrome scale; DSM-S, DSM-oriented affective problems scale; MDEP, maternal depression; AGE, mothers' age; IAGE, infants' age; TAGE, toddlers' age; AGE DIFF, difference in children's age from baseline to follow-up; SES, socio-economic status; CGENDER, children's gender; * $p < 0.05$; ** $p < 0.01$.

Table 3. Hierarchical multiple regression analyses of infant and toddler temperament, maternal depression: moderator effects of infant temperament as predictors of toddler-onset depressive symptoms ($N = 83$)

Variable	R	Adjusted R^2	Adjusted R^2 change	F change	Beta ^a	Effect size ^b
<i>Toddler anxious/depressed mood-dependent variable (syndrome scale)</i>						
Toddler temperament	0.49	0.21	0.21	8.36**		
NE					0.48 ** (0.45**)	0.16
EC					-0.09 (0.07)	0.00
PAE					-0.09 (0.01)	0.00
<i>Infant temperament</i>						
NE	0.60	0.31	0.10	4.65**	-0.06 (-0.05)	0.02
RCO					-0.38** (-0.36**)	0.08
PAS					0.01 (-0.03)	0.00
Maternal depression	0.64	0.35	0.04	6.09*	0.24* (0.20*)	0.03
Infant NE \times RCO	0.70	0.42	0.07	4.09*	-0.13	0.01
Infant NE \times MDEP					0.17 ¹	0.02
Infant RCO \times MDEP					-0.13	0.01

Note: NE, negative emotionality; EC, effortful control; PAE, positive affectivity/extraversion; RCO, regulatory capacity; PAS, positive affectivity/surgency.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.10$. All are two-tailed tests.^a Beta weights from the initial step of entry are presented first, followed by the coefficients from the final model (in parentheses).

^b Effect sizes are represented by semi-partial correlations.

Table 4. Hierarchical multiple regression analyses of infant and toddler temperament, maternal depression: moderator effects of infant temperament as predictors of toddler-onset depressive symptoms ($N = 83$)

Variable	R	Adjusted R^2	Adjusted R^2 change	F change	Beta ^a	Effect size ^b
<i>Toddler affective problems-dependent variable (DSM-oriented scale)</i>						
Toddler temperament	0.48	0.20	0.20	7.77**		
NE					0.42** (0.33**)	0.27
EC					-0.20* (-0.14)	0.00
PAE					-0.06 (-0.02)	0.00
<i>Infant temperament</i>						
NE	0.53	0.23	0.03	1.94***	0.02 (-0.09)	0.00
RCO					-0.20*** (-0.19***)	0.02
PAS					0.05 (0.07)	0.00
Maternal depression	0.57	0.27	0.04	5.12*	0.24* (0.25*)	0.05
Infant NE \times RCO	0.51	0.29	0.02	1.75	0.14	0.01
Infant NE \times MDEP					0.23*	0.04
Infant RCO \times MDEP					-0.01	0.00

Note: NE, negative emotionality; EC, effortful control; PAE, positive affectivity/extraversion; RCO, regulatory capacity; PAS, positive affectivity/surgency.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.10$. All are two-tailed tests.^a Beta weights from the initial step of entry are presented first, followed by the coefficients from the final model (in parentheses).

^b Effect sizes are represented by semi-partial correlations.

entered into the regression equations simultaneously (as a block), following the toddler and infancy temperament indices, entered as blocks, respectively, as well as the baseline maternal depression score. Hierarchical multiple regression

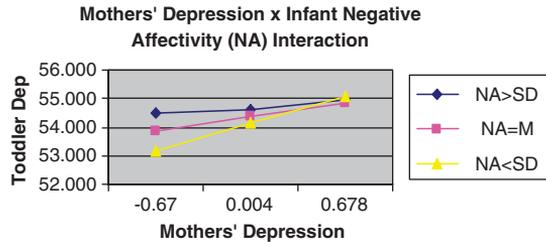


Figure 1. Illustration of an interaction between infant negative emotionality and maternal depression: predicting early depression-like symptoms. This figure is available in colour online at www.interscience.wiley.com/journal/icd

analyses were conducted for the anxious/depressed syndrome (Table 3) and the DSM-oriented (Table 4) CBCL indicators as dependent variables, demonstrating that toddler NE, infancy RCO, maternal depression, as well as the NE * maternal depression interaction explained significant amounts of variance for these toddler period outcomes.

In order to produce a more conservative test of the hypothesized interaction effects, these were considered simultaneously and entered into the regression as a single block. That is, the contribution of each moderator effect was evaluated while controlling for the effects of all hypothesized moderator relationships. The significant interaction effect (negative affect * maternal depression) observed for the DSM-oriented Affective Problems scale (Table 4) in the context of the simultaneous evaluation of all three interaction terms was followed-up through a schematic representation approach (Aiken & West, 1991; Cohen & Cohen, 1983), recommended for continuous variables.

On the basis of these recommendations, three cutoff scores for the independent variables were chosen: (1) the mean; (2) one standard deviation above the mean; and (3) one standard deviation below the mean, and the moderator was subjected to a categorization procedure wherein three groups were created: (1) children exhibiting NA at a level at least one standard deviation above the mean (NA > SD); (2) children demonstrating average levels of NA; and (3) children who were reported to have lower levels of NA, at least one standard deviation below the mean. Regression lines representing each of these three groups (i.e. their depression-like symptom scores) across different levels of maternal depression were plotted to reflect the significant infant NA * maternal depression interaction (Aiken & West, 1991; Cohen & Cohen, 1983). Children with different levels of NA exhibited equivalent high levels of depressive symptoms when their caregivers reported high levels of depression (Figure 1); however, children in the high NA group (NA > SD) continued to present with more significant depressive symptomatology, even when their mothers reported lower levels of their own depression.

DISCUSSION

This longitudinal study was designed to predict early development of depression-like symptoms by considering the independent influences of infant temperamental and maternal depression, as well as interactions among these variables, while controlling for concurrent (i.e. toddler) temperament. A number of hypotheses evaluated in the context of this study were supported. Infant

temperament factors addressed in the present investigation, RCO and NA in particular, were uniquely related to toddler depressive symptoms after controlling for their stability/continuity (i.e. parallel toddler temperament attributes). RCO emerged as the only significant main effect for infant temperament, predictive of toddler depression-like presentation, even in the context of interaction effects that involved infant temperament characteristics and maternal depression. Although significant main effects of infant NA were not observed in the present analyses, this infant temperament factor was associated with a significant interaction effect, reflecting the role of infant NE as a moderator. Specifically, infants who were perceived as exhibiting high levels of NE in infancy were rated as presenting with more frequent/intense early depression-like symptoms, despite having their mothers report lower levels of their own depression.

Thus, higher levels of early depressive symptoms for toddlers who had exhibited more NE in infancy occurred in the absence of more pronounced maternal depression, whereas infants demonstrating lower levels of NA were described as exhibiting greater toddler depression-like symptoms only when their mothers reported more severe depressive symptoms themselves. The relationship between infant NE and early depression-like symptoms revealed in this study further supports existing research linking different aspects of NA with internalizing problems and depression in particular. For example, Greenspan (1997) and Bates *et al.* (1985) described early negative reactivity to novel situations, a component of NA, along with deficits in self-regulation as the basis for later emotional difficulties and internalizing problems, such as depression. Previous research also indicated that NA exacerbated individuals' vulnerability to the development of anxiety and depression (Clark *et al.*, 1994).

It should be noted that the observed pattern of findings makes it unlikely that the elevations in toddler depression-like symptoms were a result of 'biased' maternal perception (i.e. a tendency to over-report child behaviour problems). That is, over-estimation of child psychopathology/behaviour problems has been linked with higher levels of maternal depression in the past (Fergusson, Lynskey, & Horwood, 1993; Schaughency & Lahey, 1985), and in this study toddler depression-like symptoms remained relatively elevated for children with higher NE, regardless of the mothers' own depressive symptoms. Furthermore, these results suggest a unique contribution of infant NA in shaping early appearing depressive symptoms, even in the absence of important parent risk factors (i.e. maternal depression). Thus, markers of high infant negativity may be important for early intervention efforts, which could target children presenting with this temperament profile in order to prevent/reduce early appearing symptoms of depression. Results of this study await replication and extension, with research incorporating additional sources of information and participants of different backgrounds; however, the present findings already indicate that although maternal depression is an important predictor of early childhood depressive symptoms, infant NE is important in its own right, and thus should be addressed in the early intervention/prevention efforts.

Results of this study contribute to the existing research in so far as temperament factors assessed in infancy, namely those aspects of temperament related to regulatory capacity (e.g. soothability, duration of orienting), were predictive of toddler depressive symptoms. The significant contribution of infant regulatory capacity to the toddler depression-like symptoms remained even after the maternal depression indicator was allowed into the equation, which is of particular importance, given the frequent concerns with the influence of maternal

mood on temperament and child behaviour ratings, and the possibility that maternal dysphoria accounts for the relationship between child temperament and behaviour problems. Our findings suggest that the attention-based regulatory capacity becomes important as early as the first year of life and serves a protective function in terms of lowering the risk for early manifestation of depressive symptoms. Furthermore, this protective role was not simply a function of infant RCO contributing to later EC (Gartstein, Slobodskaya, & Kinsht, in press), which in turn appears to play a protective function with respect to early manifestations of depression. Because of the analytic scheme wherein toddler temperament, including EC, was statistically controlled, the present findings indicate an independent contribution of infant regulatory capacity. Why should this early regulatory capacity be so important to later mood disorder(s)/ symptoms? Perhaps this early self-regulation sets the stage for later developing control systems (i.e. EC), which in turn affords protection from early manifestation of mood related symptoms. Recent findings suggest that infant regulatory capacity is indeed predictive of later EC, across different cultures (Gartstein *et al.*, in press), and the results of this study provide support the protective role of EC relative to early symptoms of depression, as assessed by the DSM-oriented scale of the CBCL. Another possible explanation of the protective effect associated with infant orienting/regulatory capacity may involve more optimal parent–infant interactions, facilitated by higher levels of infant regulation, which ultimately lead to greater protection from psychopathology/behaviour problems. Perhaps parents of infants with greater regulatory capacity are able to offer more emotionally attuned, reciprocal interactions, because they have infants whose advanced self-regulation enables the parents to structure their interactions in more contingent/synchronous manner. That is, the protective function of infant regulatory capacity may be due to the positive evocative child effects, leading to more positive/supportive parent–child interactions. These more positive and supportive parent–child interactions could also lead to mothers feeling more efficacious in their parenting and possibly to being less likely to experience symptoms of depression. Considerable evidence points to the fact that negative child behaviour (e.g. temperament characteristics deemed difficult by the caregiver) contribute to lower levels of parenting competence, as well as depressive symptoms (Gartstein & Sheeber, 2004; Hyde, Else-Quest, Goldsmith, & Biesanz, 2004). Higher levels of child regulatory capacity would be expected to lower levels of negative behavioural and emotional expressions, and thus could be expected to lead to higher levels of parenting competence and lower the risk of depressive symptoms for caregivers. One parent–child interaction dynamic likely to contribute to the hypothesized protective effect in early childhood, especially infancy, is reciprocity/synchrony. Reciprocity/synchrony represents a good candidate for the expected protective function because it has been linked with a variety of positive outcomes in early childhood (Kochanska, 1997a; Sumner & Spietz, 1995); however, additional interaction factors (e.g. scaffolding) may emerge as important in future research (Leve & Fagot, 1997). In summary, results of this study further add to the literature demonstrating the importance of self-regulation, starting in the first year of life, in the context of protection from early appearing mood symptoms, and should be re-examined by future research expanding on the methodological framework of this investigation.

Although this study did not examine clinical depression, that is problems with depression that meet the DSM-based MDD diagnosis, maternal depressive symptoms during infancy were predictive of toddler depression-like manifestations.

These community sample data support the findings from research with mothers diagnosed with MDD, suggesting that parental depression during infancy need not be at a 'clinically significant' level to have an impact on toddler emotional development. Our results are consistent with the previously reported findings from clinical samples. For example, Murray (1992) conducted a longitudinal study with infants of mothers with postpartum depression, examining children at six weeks of age and retesting 18 months later. At follow-up these toddlers of depressed mothers had frequent/severe symptoms of depression, including behaviour difficulties, severe sleep disturbance, eating problems, and temper tantrums (Murray, 1992). Field (1987, 1989) noted that consistent infant imitation of a depressed mother's dysphoria, hostility, and withdrawal might, over time, contribute to the development of infant affective disorders, which may explain how maternal depressive symptoms contribute to child problems with depression. Cohn and Tronick (1983), Tronick (1982), and Zekoski, O'Hara, and Wills (1987) noted the influence of maternal depressed affect on dyadic behaviour with infants, and the subsequent negative changes in child emotional reactions (e.g. helplessness, negative affect), which may also account for the effects of maternal depressive symptoms observed in this study. Alternatively, the impact of maternal depression on subsequent toddler depression-like symptoms may be explained by a genetic transmission mechanism. That is, mothers reporting symptoms of depression may be simply transmitting the risk for depression genetically to their offspring, with that risk manifesting as early symptoms during the toddler period. The design of the present study does not allow for a differentiation of genetic versus environmental pathways of influence for maternal depression; however, it should be noted that extensive reviews of the literature addressing the impact of maternal depressive symptoms have recognized both genetic and environmental influences (Cummings & Davies, 1992, 1994; Downey & Coyne, 1990).

Results of the tests of interaction effects, examining infant temperament attributes as moderators, provided evidence for the importance of interaction terms that address contributions of both child and parent characteristics. As already noted, infant NE emerged as an important risk factor, operating in the context of a parent contributor to risk (i.e. maternal depression) for toddler depression-like symptoms, as well as additional interaction effects examined simultaneously in this study. Previous studies including interactions between child and parent characteristics noted significant contributors of these effects to several domains of childhood adjustment (e.g. behaviour problems, social competence, etc.), with the majority of studies addressing temperament as a moderator. For example, Kochanska (1991, 1995, 1997b) and Colder, Lochman, and Wells (1997) have linked aggression and impaired conscience to harsh parenting for fearful/inhibited children, but not uninhibited children. In addition, more global child NA was reported to moderate the influence of parenting, with more detrimental effects of dysfunctional parenting noted for more negative children (Belsky, Hsieh, & Crnic, 1998). Results of this study further contribute to the existing findings, demonstrating moderation involving child NA and maternal depression. Specifically, infant NE increased the child's risk for early manifestations of depression, even when the mothers reported lower levels of depression. Conversely, at lower levels of infant NA, children were most protected from toddler-age depression when their mothers experienced lower levels of depressive symptoms.

In considering results of the present study from the standpoint of effect sizes, toddler NE emerged as a single most influential independent variable.

This predictor was associated with the largest effect size across both depression-related-dependent variables (Tables 3 and 4). However, taking into account the longitudinal design of this study, it is perhaps more impressive that infancy regulatory capacity, as well as one of the moderator effects examined in this study, was associated with small effect sizes, after accounting for the contribution of toddler temperament. The latter findings are particularly compelling, given that the content overlap potentially inflating concurrent relationships between temperament and early manifestations of depression would not be expected to operate in the context of infancy period predictors, especially after controlling for toddler temperament. The attenuation of concerns with content overlap is also a function of the fact that developmental considerations make the infancy period items drastically different from those most appropriate for evaluations of toddlers, and because it is widely accepted that behaviour problems and psychopathology can be reliably identified after the infancy period. In addition, it should be noted that positive affectivity was not associated with notable effects, regardless of the assessment period. Thus, toddler depression-like symptoms appeared to be independent of child positive emotionality assessed concurrently and in infancy. Of course, this lack of significant effects of positive affectivity could be a result of power limitations of the present investigation. The final equations considered in the context of this study each consisted of nine predictors, and were associated with the power of 0.63 to detect medium effect sizes. However, for small effect sizes, the power of the same regression equations was substantially lower (0.11; Cohen, 1988).

Alternatively, the negligible effect size associated with this set of temperament attributes may be indicative of the limited role played by positive affectivity in the development of depression-like symptoms in early childhood. Although, similar to the adult literature, studies including children and adolescents have generally found that low PA was associated with increases in depressive symptoms (Anthony, Lonigan, Hooe, & Phillips, 2002; Jacques & Mash, 2004; Joiner & Lonigan, 2000; Lonigan, Phillips, & Hooe, 2003; Phillips, Lonigan, Driscoll, & Hooe, 2002), these investigations were conducted with older (i.e. school age) children. Perhaps propensity towards the experience of positive emotions becomes more central to depressive symptoms later in childhood, when the youngsters are no longer engaged by their caregivers in a manner that produces high levels of PA (i.e. in play).

The limitations of this work should also be noted, along with future directions in research that could address these shortcomings. Perhaps most importantly, the variables addressed in this study were operationalized through parent-report. This reliance on mothers as the source of information regarding infant temperament, their own depression, and toddler depression-like symptoms may have inflated the associations observed between these variables. While the latter problem is somewhat mitigated by the longitudinal design utilized in this study and by our focus on the infancy period predictors of toddler depressive manifestations, future research should include additional sources of information, such as observation-based temperament indicators and reports of secondary caregivers.

The differences observed between parents and children who participated in the follow-up evaluations, and those who chose not to take part in additional assessments, deserve additional consideration. Specifically, parents participating in the follow-up evaluation reported higher levels of depression, and marginally lower levels of infant regulatory capacity, relative to non-participants. Although concerns have been raised about the fact that more disturbed or dysfunctional

individuals would be over-represented in the samples of participants, compared with those refusing to volunteer for participation in research, the data have not consistently provided support for this position. For example, analyses of personality characteristics of those who volunteered to take part in research and those who ultimately chose to abstain have shown that participants described themselves as demonstrating greater levels of agreeableness and openness to experience, generally viewed as positive personality attributes (Dollinger & Leong, 1992). Certain areas of research (e.g. maltreatment, sexuality) are faced with having to pay particular attention to the characteristics of participants, and the potential impact of volunteer bias. However, even in these particularly sensitive domains of scientific inquiry with critical questions regarding the profiles of those deciding to take part in research, the findings have not consistently supported such concerns. For example, Mandel, Weiner, Kaplan, Pelcovitz, and Labruna (2000) examined potential volunteer bias in an in-depth study of child abuse, wherein extensive information was available concerning the non-participant pool from which the sample engaged in the comprehensive evaluation was eventually assembled. Comparisons of the two groups (i.e. non-participants and those taking part in subsequent research) did not support the hypothesis that the participating families represented a more dysfunctional population, with the two groups displaying greater similarity than disparity. Despite this somewhat elevated risk profile, families participating in the present investigation represent a community sample; thus, generalizations of these findings should be limited to other groups representative of the general community, and not selected because of clinically significant difficulties. The latter point is further illustrated by the fact that only two of the participating children were in the borderline range for the Anxious/Depressed Syndrome scale of the CBCL. Future work should extend the results of the present study by including a group of families with documented clinical levels of difficulties, further validating and expanding our findings.

This study was focused on infancy predictors of toddler depression-like symptoms; therefore, the impact of maternal depression in the first year of life was evaluated. Because of our interest in maternal depression in infancy, information regarding caregivers' symptoms was not obtained at follow-up. Thus, estimates of the association between concurrent maternal depression and toddler depression-like symptoms were not examined in this study, and should be evaluated more closely in future investigations. Finally, future research will need to address relationships examined in this study for more diverse samples of families, taking the role of paternal characteristics into account. It is possible that the risk and protective factors identified for predominantly Caucasian groups of children would not generalize to children/families with different ethnic backgrounds, and that paternal symptoms of depression make unique contributions to early manifestations of mood related symptoms in children. It will also be important to examine the potential buffering effect of available/non-symptomatic fathers on child affective symptoms, in the context of mothers experiencing depression/dysphoria.

In conclusion, results of this study have clinical implications for those working with families of young children. In particular, our findings suggest that early intervention efforts could benefit from targeting not only maternal depression as a risk factor for early manifestations of child depressive symptoms but also considering infant NE and regulatory ability, in an effort to improve subsequent adjustment and ensure that manifestations of behaviour problems and/or psychopathology are minimized. Although research examining outcomes of

treatment approaches relying on temperament evaluations has not been wide spread, some notable examples deserve closer consideration. Blair (2002) found that low birth weight infants demonstrating high levels of overall NE, whose parents were provided with psycho-educational parenting oriented interventions showed significant reductions in both NE and behavioural difficulties, relative to a non-intervention comparison group. Notably, van den Boom (1994) utilized a brief intervention aimed at parents of irritable infants, starting when children were six months of age, in an attempt to increase maternal sensitivity and improve the overall quality of the mother–child interaction. Relative to non-intervention groups, the intervention groups obtained higher scores on self-soothing behaviours, exploration, and sociability and displayed reductions in crying relative to non-intervention groups at 12 months of age. Consistent with Blair's (2002) findings, these results suggest that interventions targeting parenting for caregivers of children with specific temperament profiles (associated with risk for later behavioural difficulties/psychopathology) may lead to beneficial outcomes for these youngsters. Given that the initial intervention research has been promising, additional work in this area should be undertaken in the future.

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