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The interaction of maternal and infant vulnerabilities on developing attachment relationships

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Abstract
The present study sought to document an example of how maternal and infant vulnerabilities interact in contributing to the quality of early attachment relationships. Maternal depressive symptoms, neonatal health characteristics, and infant–mother attachment were assessed for 42 preterm, low birth weight infants and 42 full-term infants at 12 months postterm. Results indicated that preterm birth moderated the relation between maternal depressive symptoms and quality of infant–mother attachment, even controlling for level of neonatal health complications. Preterm infants with more symptomatic mothers were most likely to be classified as insecurely attached to their mothers, whereas no direct relation between subclinical depressive symptoms and attachment was found for full-term infants.

Attachment theory emphasizes the importance of parental sensitive responsiveness in the development of patterns of attachment (Ainsworth, Blehar, Waters, & Wall, 1978; Bowlby, 1982; Goldberg, Perrotta, Minde, & Corter, 1986; Vondra, Shaw, & Kevenides, 1995). Sensitive, competent parenting is conducive to the development of secure attachment relationships for infants and young children, whereas compromised parenting is more likely to lead to insecure attachment relationships (Teti & Nakagawa, 1990). In addition to parental sensitive responsiveness, infant characteristics also may play a role in the formation of attachment relationships (Goldsmith & Alansky, 1987). In his seminal work on attachment theory, John Bowlby (1982) stated, "The finding that the quality of care received influences the pattern of attachment developing excludes in no way the infant playing a part too" (p. 367). Likewise, transactional theories of development acknowledge that parent and child characteristics are important for relationship formation (Sameroff, 1993) and recognize that infant–mother relationships develop in a reciprocal, bidirectional manner over time (Sameroff & Fiese, 1990, 2000).

The present study examined the interaction between subclinical maternal depressive symptoms[1] and infant preterm birth as an example of how vulnerabilities from the child and caregiver interact on the development of early attachment relationships. Vulnerabilities can be defined as conditions or processes associated with increased risk for negative outcomes only when combined with other vul-

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1. Throughout this paper, the term "subclinical depressive symptoms" means scoring below the clinical cutoff on a self-administered depression questionnaire.

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nerabilities or during times of high stress (Cowan, Cowan, & Schulz, 1996).

A growing body of literature has documented associations between maternal clinical depression, decreased maternal sensitivity, and adverse child outcomes (Murray & Cooper, 1997; Murray, Fiori–Cowley, & Hooper, 1996), including behavior problems (Cummings & Davies, 1994; Spieker, Larson, Lewis, Keller, & Gilchrist, 1999), parent–infant interaction difficulties (Hart, Field, del Valle, & Pelaez–Nogueras, 1998), and insecure attachment relationships (e.g., Chisholm, Carter, Ames, & Morison, 1995; Lyons–Ruth, 1992; Radke–Yarrow, 1998). Compared to nondepressed parents, depressed parents have been found to show decreased responsiveness and involvement (Downey & Coyne, 1990), parenting skills deficits (Teti, Gelfand, Messinger, & Isabella, 1995), more negative affect expression, less positive engagement (Field, 1992), and less sensitive maternal care (Lyons–Ruth, Zoll, Connell, & Grunebaum, 1990).

Many of these studies have included parents who either score above the clinical cutoff on a symptom checklist (e.g., Hart, Field, & Nearing, 1998), meet clinical criteria for depression based on a diagnostic interview (e.g., Radke–Yarrow, 1998), or have sought treatment for depression (Teti et al., 1995). The severity and chronicity of parental depressive symptoms may vary based on these different definitions of depression. Moreover, studies have found that the duration and severity of parental depressive symptoms may account for much variability in children's outcomes rather than diagnosis of parental depression per se (e.g., Keller, Beardslee, Dorer, Lavori, Samuelson, & Klerman, 1986; Sameroff, Seifer, & Zax, 1982). For example, the NICHD Early Child Care Research Network (1999) found that women with chronic symptoms of depression were the least sensitive in play interactions with their children from infancy to 3 years of age. Campbell, Cohn, and Meyers (1995) studied a group of relatively low-risk depressed mothers and found that for women who experienced depression at their infants' 2-month assessments, there were no differences between depressed and nondepressed mothers or their babies in interaction during feeding, face to face interaction, or toy play. However, women whose depression lasted through 6 months were less positive in these settings than women whose depression was of shorter duration, and their babies were less positive during face to face interactions. Furthermore, Teti and colleagues (1995) found that mothers who reported more severe depressive symptoms and experienced these symptoms over a longer period of time were more likely to have insecurely attached children than mothers whose symptoms were milder and of shorter duration. Similarly, Campbell, Cohn, Meyers, Ross, and Flanagan (1993) reported that mothers whose postpartum depression lasted beyond the first 6 months after their infant's birth were more likely to have insecurely attached infants than mothers whose depression was briefer.

Additional work is needed to examine potential moderators and mediators of relations between maternal depression and young children's social emotional development, particularly circumstances that may amplify the effects of mild depressive symptoms. The present study focused on mothers who experienced subclinical depressive symptoms of relatively brief duration. Because these women experienced fewer symptoms of depression than women who score above the clinical cutoff on a self-administered depression measure, depressive symptoms were not expected to relate *directly* to insecure attachment. However, elevated subclinical depressive symptoms were conceptualized as a vulnerability that may predispose the dyad to negative outcomes when combined with an additional vulnerability—in this case, infant preterm birth.

Preterm birth, a biological risk condition in infancy (Kopp, 1990), has been associated with a variety of parent–infant interaction difficulties (Barnard, Bee, & Hammond, 1984; Field, 1979; Macey, Harmon, & Easterbrooks, 1987). Premature, low birth weight infants are less alert, active, and responsive, less able to provide clear distress signals, and more easily stressed and overstimulated than full-term infants during the first few months of infancy (Bakeman & Brown, 1980; DiVitto & Goldberg, 1979; Eckerman, Oehler, Hannan, &

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Molitor, 1995; Field, 1977; Greene, Fox, & Lewis, 1983). Moreover, preterms who experience more health complications at birth typically exhibit more interactional difficulty than preterms with fewer medical complications (Buka, Lipsitt, & Tsuang, 1992). Mothers of preterm infants tend to be less actively involved with their newborns than mothers of full-term infants (DiVitto & Goldberg, 1979), and families often experience significant stress because of their infants' prematurity (Macey et al., 1987). For example, Macey and colleagues (1987) reported that 70% of mothers of preterms thought that the child's birth produced negative effects on the family that resulted in financial difficulty and marital problems, whereas 82% of mothers of full-terms thought the child's birth had induced positive changes. Bennett and Slade (1991) found that mothers of higher risk infants reported more emotional distress, more concerns about themselves and their babies, and more difficulty expressing affection towards their newborns than mothers of lower risk infants. Although several studies have documented elevations in maternal distress in mothers of preterms compared to mothers of full-terms shortly after the infant's birth (e.g., Younger, Kendell, & Pickler, 1997), when infants are 6–12 months of age, mothers of preterms and full-terms seem to experience comparable levels of distress (e.g., Segal, Oster, Cohen, Caspi, & Brown, 1995), although this may depend on severity of neonatal health complications.

Despite early interactional difficulties and increased family stress, most studies have found that preterm, low birth weight infants are not at higher risk for developing insecure attachment relationships with their caregivers compared to full-term infants (Easterbrooks, 1989; Frodi & Thompson, 1985; Goldberg et al., 1986; Macey et al., 1987; Plunkett, Meisels, Stiefel, Pasick, & Roloff, 1986; Rode, Chang, Fisch, & Sroufe, 1981), although there is at least one published exception (Wille, 1991). Van Ijzendoorn, Goldberg, Kroonenberg, and Frenkel (1992) conducted a meta-analysis comparing the relative effects of maternal and child contributions to infant–mother attachment patterns in clinical samples. Their analysis indicated that groups identified primarily by child problems, such as prematurity or physical disabilities, showed attachment distributions similar to those found in normative samples, whereas groups identified primarily by maternal problems, such as depressed or maltreating mothers, had attachment distributions that were highly divergent from normative samples. The authors concluded that in clinical samples the mother appears to play a more important role than the child in shaping the quality of the attachment relationship (Van Ijzendoorn et al., 1992). Because of these accumulated findings, preterm birth was not expected to predict increased risk for insecure attachment directly. Rather, preterm birth was conceptualized as a vulnerability that may relate to attachment security when combined with maternal depressive symptoms. Mothers of preterms may need to work harder and maintain a higher level of sensitive responsiveness to achieve interactional regulation with their infants than mothers of full-terms (Beckwith, 1999). Mothers who experience even subclinical depressive symptoms may find this higher degree of sensitivity difficult to maintain with their preterm infants, thus increasing the risk for development of insecure attachments. In other words, preterm birth was expected to moderate the relation between maternal depressive symptoms and attachment quality (see Figure 1).

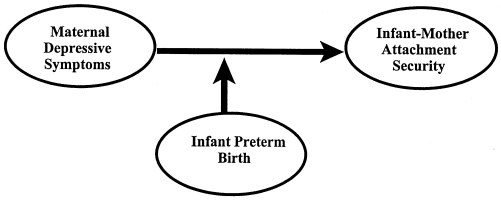


Figure 1. Preterm birth as a moderator of the relation between maternal depressive symptoms and infant–mother attachment quality.

The present study was designed to address the following questions: (a) Do preterms and full-terms differ on measures of attachment security and do their mothers differ on measures of depressive symptoms when infants are 12 months postterm? (b) What is the relation between neonatal health characteristics

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and level of maternal depressive symptoms? (c) Does the combination of vulnerabilities from the mother and infant predict increased likelihood of insecure infant–mother attachment? (d) Does controlling for neonatal health complications alter the hypothesized moderator relationship?

Method

Participants

Participants included 84 infant–mother dyads. Forty-two infants were preterm low birth weight, born between 23 and 36 weeks gestational age with birth weight less than 2500 g, and 42 infants were full-term, born between 37 and 42 weeks gestational age with birth weight greater than 2500 grams. The full-term group included 21 boys (50%) and the preterm group included 28 boys (67%). There were slightly more boys than girls in the preterm group, $\chi^2(1) = 3.43$, $p = .07$. At the time of the study, the mean corrected age for preterm infants and the mean age for full-term infants was 12 months, ranging between 11 and 14 months. All mothers received prenatal care and brought their infant to a pediatrician's office or pediatric clinic for well-baby examinations. Although infants with significant neonatal neurological complications were excluded from the study, 4 (10%) preterm infants and one (2%) full-term infant had Grade I (mild, without ventricular dilation) intraventricular hemorrhage at birth. Additional neonatal medical complications included bronchopulmonary dysplasia (7% preterm, 2% full-term) and apnea and bradycardia (50% preterm, 2% full-term). All infants were healthy at the time of the study.

Maternal age ranged from 20 to 38 years, with a mean age of 30 years. Most mothers were married (67% preterm, 76% full-term), and the remainder were never married (23% preterm, 12% full-term) or were separated or divorced (10% preterm, 13% full-term). Preterm and full-term groups did not significantly differ regarding maternal marital status, $\chi^2(2) = 1.00$, $p = .32$. Mothers reported a range of socioeconomic backgrounds. As classified by Hollingshead (1975), 20% of mothers were unskilled laborers (24% preterm, 17% full-term); 18% were semiskilled workers (19% preterm, 17% full-term); 27% were skilled, clerical, or sales workers (26% preterm, 28.6% full-term); 24% were medium business or technical workers (24% preterm, 24% full-term); and 11% were professionals (7% preterm, 14% full-term). Nineteen preterm infants (45%) and 17 full-term infants (41%) were firstborn. Most infants were European American (72% preterm, 86% full-term), with the remainder being African American (21% preterm, 7% full-term), Hispanic American (5% preterm, 2% full-term), or Asian American (2% preterm, 5% full-term). Ethnicity distributions did not differ by infant birth status, $\chi^2(3) = 2.54$, $p = .15$.

Infant groups were compared to determine if their neonatal or demographic characteristics differed. Infant gender was included in the analyses because there were slightly more boys than girls in the preterm group. A 2 × 2 (Infant Birth Status × Infant Gender) multivariate analysis of variance (MANOVA) was conducted on infant neonatal characteristics. As anticipated, the main effect for gender, $F(8, 73) = 0.82$, $p = .58$, and the interaction term, $F(8, 73) = 0.58$, $p = .81$, were not significant. However, the main effect for infant birth status was significant as expected, $F(8, 73) = 88.50$, $p < .001$. Follow-up univariate tests indicated that preterm infants had lower birth weight, birth length, head circumference, and 1- and 5-min Apgar scores than full-term infants. In addition, preterms were hospitalized and intubated longer than full-terms. Infant neonatal characteristics are presented in Table 1.

A 2 × 2 (Infant Birth Status × Infant Gender) MANOVA was conducted on family demographic characteristics. Main effects for birth status, $F(6, 75) = 0.94$, $p = .48$, and infant gender, $F(6, 75) = 1.13$, $p = .36$, and the interaction term, $F(6, 75) = 0.19$, $p = .99$, were not significant as anticipated, indicating that the groups did not differ significantly regarding maternal age, paternal age, parental socioeconomic status, number of siblings, and years of parents' marriage. Family demographic characteristics are presented in Table 1.

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Table 1. *Neonatal and family demographic characteristics of preterm and full-term infants*

Characteristics	Preterm (N = 42)		Full-term (N = 42)		
	M	*SD*	*M*	*SD*	*F* (1, 80)
Gestational age (weeks)	30.52	2.72	39.91	1.01	72.8*
Birth weight (m)	1488.90	496.91	3660.80	568.01	329.4*
Birth length (cm)	40.40	4.81	52.31	3.14	171.8*
Head circumference (cm)	28.20	2.99	33.83	1.09	189.6*
Hospitalized (days)	46.31	22.71	3.63	4.41	137.1*
Intubated (days)	7.12	11.39	0.43	1.50	10.9*
1-min Apgar	5.19	2.43	7.43	2.04	25.8*
5-min Apgar	7.42	1.63	8.75	1.06	21.8*
Hollingshead score	32.53	13.62	36.84	14.87	1.28
Maternal age	29.57	6.45	30.95	4.54	1.23
Paternal age	31.67	7.06	32.71	5.58	0.33
Number of siblings	0.89	1.17	1.05	1.13	0.01
Parents married (years)	4.02	4.50	5.77	3.86	3.30
Maternal work (hr/week)	16.74	18.14	12.81	16.50	1.27

*$p < .05$.

Measures

Infant–mother attachment. Security of infant–mother attachment was assessed using Ainsworth's Strange Situation (Ainsworth et al., 1978). The Strange Situation is a widely used standardized laboratory procedure consisting of seven 3-min episodes that involve brief separations from and reunions with mothers. It was designed to highlight the balance between attachment and exploratory systems (Bowlby, 1969, 1982) for infants between 12 and 18 months of age. The Strange Situation episodes were videotaped and infants were assigned to insecure–avoidant, secure, insecure–ambivalent, or insecure–disorganized categories by an expert coder[2] who was blind to maternal and infant background characteristics.

Seventy-nine infants were assigned to attachment categories. One infant–mother dyad in the preterm group was not videotaped due to equipment difficulties and 2 preterm and 2 full-term infants were deemed unclassifiable due to procedural errors or poor videotape quality; thus, these cases were excluded from analyses. In addition, 10 videotapes (12% of the sample) were randomly selected and rated by a trained coder[3] who was blind to infant and maternal background characteristics. Cohen's kappa for the 10 tapes was .85 for the 4 attachment groups and .80 for the 2-group insecure–secure classification. Disagreements were resolved in favor of the primary coder.

Maternal depressive symptoms. The Depression scale of the Symptom Checklist-90-Revised (SCL-90-R; Derogatis, 1977, 1994) was used to assess mothers' experience of depressive symptoms during the past 2 months. The SCL-90-R is a self-report instrument that contains 90 items regarding symptoms that are rated on a 5-point scale of distress ranging from "not at all" (0) to "extremely" (4). The 13 items on the Depression scale ask the respondent about symptoms of dysphoric mood and affect, signs of withdrawal of life interest, lack of motivation, loss of vital energy, hopelessness, thoughts of suicide, and other cognitive correlates of depression. Raw scores were calculated and converted into *T* scores based on normative data (Derogatis, 1977, 1994). Internal consistency coefficients for the SCL-90-R range from .77 to .90, with the Depres-

2. Brian Vaughn served as our primary coder.

3. The secondary coder was trained in Susan Spieker's lab.

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sion dimension at .90, and test–retest reliability ranges from .78 to .90, with the Depression dimension at .82 (Derogatis, 1977, 1994). Cronbach's alpha for the Depression scale in the present study was .87. Because the present study focused on subclinical depressive symptoms, 4 cases (2 preterm and 2 full-term) were excluded from the study because the mother scored in the clinical range (above the 90th percentile) on the SCL-90-R. For the remaining 80 women, SCL-90-R *T* scores ranged from 41 to 67 with a mean of 54.86 and median of 54. It should be noted that elevated *T* scores on the SCL-90-R are an indication of depressive symptoms and not equivalent to a clinical diagnosis of depression.

Procedure

Participants were recruited from pediatricians' offices, a hospital-based pediatric clinic, and a hospital follow-up clinic for preterm infants. Mothers were approached by a researcher during their infants' 6-month well-baby exam, and the study was described. Mothers who were interested in the study were contacted when their infants were 12 months old; mothers of preterms were contacted when their infants were 12 months, corrected for gestational age (DiPietro & Allen, 1991). Eighty-five percent of the mothers initially approached participated in the study. Neonatal characteristics, including gestational age, birth weight, and health complications were obtained from infants' medical charts with parental consent. Gestational age was estimated by a neonatologist at the time of the infant's birth. At 12 months, mother–infant dyads were videotaped in the Strange Situation laboratory procedure and mothers completed self-administered questionnaires and were paid $40 for participating in the study.

Results

Group differences

Of the 77 cases for which all data were available, 43 (56%) infants were classified as securely attached and 34 (44%) were classified as insecurely attached to their mothers. Of the insecure infants, 15 (44%) were classified as avoidant, 15 (44%) as ambivalent, and 4 (12%) as disorganized. In the full-term group, 24 (62%) infants were classified as secure, 8 (20%) as avoidant, 5 (13%) as ambivalent and 2 (5%) as disorganized, whereas in the preterm group 19 (50%) were classified as secure, 7 (19%) as avoidant, 10 (26%) as ambivalent, and 2 (5%) as disorganized. The proportion of secure–insecure infants was similar to distributions reported in previous studies (Ainsworth et al., 1978, Rode et al., 1981; Susman–Stillman, Kalkoske, Egeland, & Waldman, 1996; Vondra et al., 1995). Chi-square analysis indicated that the distribution of secure–insecure infants did not significantly differ for full-terms and preterms, χ^2 (1) = 1.04, p = .31. In addition, a one-way ANOVA indicated that maternal depressive symptoms, F (1, 78) = 0.64, p = .43, did not differ for full-term and preterm groups.

Depressive symptoms and neonatal health

A correlation matrix (see Table 2) was generated to determine bivariate relations between maternal depressive symptoms and neonatal health indices. Statistically significant correlations of modest magnitude indicated that infants with more neonatal health complications tended to have more symptomatic mothers.

Moderator analysis

To test the hypothesis that preterm birth would moderate the relation between maternal depressive symptoms and attachment, logistic regression analysis was conducted. The dichotomous outcome variable of attachment security was regressed on mean-centered (Aiken & West, 1991) SCL-90-R scores and the dichotomous variable of infant birth status in the first step and the interaction (or product term) in the second step (Baron & Kenny, 1986; Holmbeck, 1997). Results indicate that the overall equation was significant, model $\chi^2(3) = 8.52$, $p < .05$. The product term significantly predicted attachment security, controlling for the main effects of depressive symptoms and infant birth status, which is consistent with a moderator interpretation (see

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Table 2. *Correlations between neonatal health characteristics and maternal depressive symptoms*

	1	2	3	4	5	6	7
1. Depressive symptoms	—	–.26*	–.26*	.22*	.27*	.22*	.10
2. 1-min Apgar		—	.86**	–.44**	–.38**	–.35**	–.10
3. 5-min Apgar			—	–.44**	–.39**	–.30**	–.02
4. Hospitalized (days)				—	.66**	.69**	.05
5. Intubated (days)					—	.45**	–.05
6. Respiratory complications						—	.20
7. Intraventricular hemorrhage							—

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

Table 3. *Logistic regression results for the interaction of maternal depressive symptoms and infant birth status on attachment security* ($n = 77$)

Variable	*B*	*SE*	Wald	Odds Ratio
Depressive symptoms	–0.96	0.45	4.45*	1.60
Birth status	0.47	0.52	0.78	0.38
Interaction	1.61	0.63	6.56*	4.99
Constant	0.42	0.36	1.31	

*$p < .05$.

Table 3). In addition, the main effect for depressive symptoms was a significant predictor of attachment.

Neonatal health complications

The above analysis was repeated using neonatal health indices as control variables for several reasons: (a) infants in the study were heterogeneous regarding neonatal health indices; (b) there was a modest relation between health complications and maternal depressive symptoms; and (c) because preterm infants experienced more health complications than full-terms, neonatal health variables (such as length of time separated from mother due to hospitalization) are a potential confound in the moderator analysis. Results indicated that, controlling for 1- and 5-min Apgar scores, days of neonatal hospitalization, days of intubation, and presence of intraventricular hemorrhage and respiratory complications, relations among infant birth status, maternal depressive symptoms, and attachment remained virtually unchanged, model χ^2 (9) = 17.37, $p < .05$ (see Table 4).

One approach to facilitating interpretation of this moderator effect involves conducting separate regressions for preterms and full-terms (Aiken & West, 1991; Holmbeck, 1997). This analysis (which included neonatal health variables as covariates) revealed that the model for preterms was significant, model χ^2 (7) = 14.38, $p < .05$. Examination of the odds ratio indicated that for every 1 standard deviation increase in maternal depressive symptoms, preterms experienced 3.5 times the odds of being classified as insecurely attached to their mothers. However, the model for full-terms was not significant, model χ^2 (7) = 6.24, $p = .51$, indicating no relation between subclinical depressive symptoms and attachment for full-terms.

An alternative approach to interpreting the moderator finding involves examining the frequency of secure and insecure attachment for preterms and full-terms of mothers with varying levels of depressive symptoms. These results,

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Table 4. *Logistic regression results for the interaction of maternal depressive symptoms and infant birth status on attachment security, controlling for neonatal health complications* ($n = 77$)

Variable	*B*	*SE*	Wald	Odds Ratio
1-min Apar	–0.13	0.27	0.24	0.88
5-min Apgar	0.62	0.49	1.61	1.86
Hospitalized (days)	0.03	0.02	1.65	1.03
Intubated (days)	0.04	0.04	0.73	1.04
Respiratory complications	0.93	0.95	0.96	0.15
Intraventricular hemorrhage	–1.87	1.31	2.03	2.53
Depressive symptoms	–1.25	0.56	4.95*	3.02
Birth status	1.11	1.12	0.97	0.29
Birth × Depression interaction	1.92	0.72	7.21**	6.82
Constant	–3.82	3.17	1.31	

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

Table 5. *Percentages of secure and insecure attachments for preterms and full-terms with more or less symptomatic mothers*

Infant Birth Status	Attachment Security	Fewer Depressive Symptoms	More Depressive Symptoms
Full-term infants	Secure	61% ($n = 14$)	62% ($n = 10$)
	Insecure	39% ($n = 9$)	38% ($n = 6$)
Preterm infants	Secure	75% ($n = 12$)	32% ($n = 7$)
	Insecure	25% ($n = 4$)	68% ($n = 15$)

based on a median split of SCL-90-R scores for the full sample, are presented in Table 5.

Discussion

The present study examined maternal and infant vulnerabilities (i.e., maternal subclinical depressive symptoms and infant preterm birth) and how the combination of vulnerabilities affected developing infant–mother attachment relationships. Vulnerabilities were conceptualized as conditions or processes associated with increased risk for negative outcomes when combined with another vulnerability or during times of high stress (Cowan et al., 1996).

The primary finding of this investigation was that preterm birth moderated the relation between maternal depressive symptoms and attachment. The combination of subclinical maternal depressive symptoms and infant preterm birth predicted infant–mother attachment, even after controlling for neonatal health complications. Preterms whose mothers reported elevated depressive symptoms during the previous 2 months were most likely to be classified as insecurely attached to their mothers. This result is consistent with attachment (Bowlby, 1982) and transactional (Sameroff & Fiese, 1990, 2000) theories because it suggests that both maternal and infant characteristics contribute to the quality of developing dyadic relationships. Mothers of preterms may require a higher level of sensitive responsiveness to achieve interactional regulation with their infants than mothers of full-terms (Beckwith, 1999). Mothers who experience relatively mild disruptions in their sensitivity and responsiveness to their preterm infants' cues, such as depressive symptoms that are below the clinical range on a symptom checklist, may develop interactional patterns that increase the risk for insecure in-

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fant–mother attachment. This study is also consistent with previous research demonstrating no direct link between preterm birth and quality of attachment (e.g., Van Ijzendoorn et al., 1992).

Although mothers of preterms and full-terms did not significantly differ in their report of depressive symptoms, individual neonatal health indices (Apgar scores, days of hospitalization, etc.) showed moderate positive associations with maternal depressive symptoms. Previous studies have found increased initial distress in families of preterms (e.g., Macey et al., 1987; Younger et al., 1997), especially when infants are higher risk (Bennett & Slade, 1991). Based on these findings, one could speculate that the birth of a preterm, medically fragile infant may initiate a transactional process in which the early arrival and ensuing health complications of the infant may lead to increased maternal distress and decreased responsivity. Moreover, the behavioral cues of preterm, medically fragile infants may be difficult to read, thus requiring a high level of parental sensitivity to achieve interactional regulation. If maternal depressive symptoms continue (even at a subclinical level), interactional problems and insecure attachment relationships may follow. In other words, contributions from both the mother and infant over time seem to influence the quality of dyadic relationships. However, longitudinal data are needed to examine this process in detail.

The present results also are consistent with the growing body of research documenting negative associations between maternal depression and attachment relationships in young children (Murray et al., 1996; Teti & Gelfand, 1997), particularly studies emphasizing the severity and chronicity of parental depressive symptoms (e.g., Campbell et al., 1993, 1995; NICHD Early Child Care Research Network, 1999). In the present study, elevated but subclinical maternal depressive symptoms related to insecure attachment for the preterm group only. This finding shows the potential association between relatively mild maternal depressive symptoms of relatively short duration and infant emotional development when combined with an additional vulnerability (i.e., infant preterm birth). By contrast, this finding suggests that for full-term infants, quality of attachment relationships appears robust even for mothers experiencing relatively mild depressive symptoms of brief duration.

Although the present study has several strengths, including consideration of both maternal and infant characteristics and a socioeconomically diverse sample, it also has notable limitations. Limitations include lack of measurement of maternal depressive symptoms over time, a relatively small sample size, and lack of direct measurement of maternal sensitivity. Recent research has demonstrated that maternal sensitivity may mediate some of the negative effects of depression on young children (NICHD Early Child Care Research Network, 1999). In addition, it should be noted that the effects reported were subtle and rather modest in magnitude.

Nevertheless, results of the present study add to the literature regarding contributions of maternal depressive symptoms and infant birth status to the development of infant–mother attachment. Results suggest that researchers and clinicians should consider both infant and maternal characteristics when examining early relationships. Results also suggest that even subclinical maternal depressive symptoms, if combined with additional vulnerabilities, may increase a child's risk for developing unfavorable patterns of attachment. Nevertheless, further studies are needed to clarify the role of parental and child contributions to the social emotional development of infants experiencing environmental and biological risks, including the identification of protective processes that lead to resilience.

References

Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions.* Newbury Park: Sage.

Ainsworth, M. D. S., Blehar, M. C., Waters, E., & Wall, S. (1978). *Patterns of attachment: A psychological study of the Strange Situation*. Hillsdale, NJ: Erlbaum.

Bakeman, R., & Brown, J. V. (1980). Early interaction: Consequences for social and mental development at three years. *Child Development, 51,* 437–447.

https://doi.org/10.1017/S0954579401001018 Published online by Cambridge University Press

Barnard, K. E., Bee, H. L., & Hammond, M. A. (1984). Developmental changes in maternal interactions with term and preterm infants. *Infant Behavior and Development, 7,* 101–113.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research. *Journal of Personality and Social Psychology, 51,* 1173–1182.

Beckwith, L. (1999, April). Infants born at-risk: Their parents and their development. Paper presented at the biennial meeting of the Society for Research in Child Development, Albuquerque, NM.

Bennett, D. E., & Slade, P. (1991). Infants born at risk: Consequences for maternal post-partum depression. *British Journal of Medical Psychology, 64,* 159–172.

Bowlby, J. (1969). *Attachment and loss: Vol. 1. Attachment*. New York: Basic Books.

Bowlby, J. (1982). *Attachment and loss: Vol. 1. Attachment* (2nd ed). New York: Basic Books.

Buka, S. L., Lipsitt, L. P., & Tsuang, M. T. (1992). Emotional and behavioral development of low-birth weight infants. In S. L. Friedman & M. D. Sigman (Eds.), Annual Advances in Applied Developmental Psychology: Vol. 6. *The psychological development of low-birth weight children* (pp. 187–214). Norwood, NJ: Ablex Publishing.

Campbell, S. B., Cohn, J. F., & Meyers, T. (1995). Depression in first-time mothers: Mother–infant interaction and depression chronicity. *Developmental Psychology, 31,* 349–357.

Campbell, S. B., Cohn, J. F., Meyers, T., Ross, S., & Flanagan, C. (1993, April). Chronicity of maternal depression and mother–infant interaction. Paper presented at the biennial meeting of the Society for Research in Child Development, New Orleans.

Chisholm, K., Carter, M. C., Ames, E. W., & Morison, S. J. (1995). Attachment security and indiscriminately friendly behavior in children adopted from Romanian orphanages. *Development and Psychopathology, 7,* 283–294.

Cowan, P. A., Cowan, C. P., & Schulz, M. S. (1996). Thinking about risk and resilience in families. In E. M. Hetherington & E. A. Blechman (Eds.), *Stress, coping, and resiliency in children and families* (pp. 1–38). Mahwah, NJ: Erlbaum.

Cummings, E. M., & Davies, P. T. (1994). Maternal depression and child development. *Journal of Child Psychology and Psychiatry, 35,* 73–112.

Derogatis, L. R. (1977). *SCL-90: Administration, scoring and procedures manual for the revised version*. Unpublished manuscript, Johns Hopkins University, Baltimore, MD.

Derogatis, L. R. (1994). *SCL-90-R administration, scoring and procedures manual*. Minneapolis, MN: National Computer Systems.

DiPietro, J. A., & Allen, M. C. (1991). Estimation of gestational age: Implications for developmental research. *Child Development, 62,* 1184–1199.

DiVitto, B., & Goldberg, S. (1979). The effects of newborn medical status on early parent–infant interaction. In T. M. Field, A. M. Sostek, S. Goldberg, & H. H. Schuman (Eds.), *Infants born at risk: Behavior and development*. New York: Spectrum.

Downey, G., & Coyne, J. C. (1990). Children of depressed parents: An integrative review. *Psychological Bulletin, 108,* 50–76.

Eckerman, C. O., Oehler, J. M., Hannan, T. E., & Molitor, A. (1995). The development prior to term age of very prematurely born newborns' responsiveness in *en face* exchanges. *Infant Behavior and Development, 18,* 283–297.

Easterbrooks, M. A. (1989). Quality of attachment to mother and to father: Effects of perinatal risk status. *Child Development, 60,* 825–830.

Field, T. M. (1977). Effects of early separation, interactive deficits, and experimental manipulations on mother–infant face-to-face interaction. *Child Development, 48,* 763–771.

Field, T. M. (1979). Interaction patterns of preterm and term infants. In T. M. Field, A. M. Sostek, S. Goldberg, & H. H. Schuman (Eds.), *Infants born at risk: Behavior and development*. New York: Spectrum.

Field, T. M. (1992). Infants of depressed mothers. *Development and Psychopathology, 4,* 49–66.

Frodi, A., & Thompson, R. (1985). Infants' affective responses in the Strange Situation: Effects of prematurity and quality of attachment. *Child Development, 56,* 1280–1290.

Goldberg, S., Perrotta, M., Minde, K., & Corter, C. (1986). Maternal behavior and attachment in low-birth-weight twins and singletons. *Child Development, 57,* 34–46.

Goldsmith, H. H., & Alansky, J. A. (1987). Maternal and infant temperamental predictors of attachment: A meta-analytic review. *Journal of Consulting and Clinical Psychology, 55,* 805–816.

Greene, J. G., Fox, N. A., & Lewis, M. (1983). The relationship between neonatal characteristics and three-month mother–infant interaction in high-risk infants. *Child Development, 54,* 1286–1296.

Hart, S., Field, T., & Nearing, G. (1998). Depressed mothers' neonates improve following the MABI and a Brazelton demonstration. *Journal of Pediatric Psychology, 23,* 351–356.

Hart, S., Field, T., del Valle, C., & Pelaez–Nogueras, M. (1998). Depressed mothers' interactions with their one-year-old infants. *Infant Behavior and Development, 21,* 519–525.

Hollingshead, A. B. (1975). *Four factor index of social status*. Unpublished manuscript, Yale University, New Haven, CT.

Holmbeck, G. N. (1997). Toward terminological, conceptual, and statistical clarity in the study of mediators and moderators: Examples from the child–clinical and pediatric psychology literatures. *Journal of Consulting and Clinical Psychology, 65,* 599–610.

Keller, M. B., Beardslee, W. R., Dorer, D. J., Lavori, P. W., Samuelson, H., & Klerman, G. R. (1986). Impact of severity and chronicity of parental affective illness on adaptive functioning and psychopathology in children. *Archives of General Psychiatry, 43,* 930–937.

Kopp, C. B. (1990). Risk in infancy: Appraising the research. *Merrill–Palmer Quarterly, 36,* 117–140.

Lyons–Ruth, K. (1992). Maternal depressive symptoms, disorganized infant–mother attachment relationships and hostile–aggressive behavior in the preschool classroom: A prospective longitudinal view from infancy to age five. In D. Cicchetti & S. Toth (Eds.), *Rochester Symposium on Developmental Psychopathology: Vol. 4. A developmental approach to affective disorders* (pp. 131–171). Rochester, NY: University of Rochester Press.

Lyons–Ruth, K., Connell, D., Grunebaum, H. U., & Botein, S. (1990). Infants at social risk: Maternal depression and family support services as mediators of in-

https://doi.org/10.1017/S0954579401001018 Published online by Cambridge University Press

fant development and security of attachment. *Child Development, 61,* 85–98.

Macey, T. J., Harmon, R. J., & Easterbrooks, M. A. (1987). Impact of premature birth on the development of the infant in the family. *Journal of Consulting and Clinical Psychology, 55,* 846–852.

Murray, L., & Cooper, P. J. (1997). Postpartum depression and child development. *Psychological Medicine, 27,* 253–260.

Murray, L., Fiori–Cowley, A., & Hooper, R. (1996). The impact of postnatal depression and associated adversity on early mother–infant interactions and later infant outcome. *Child Development, 67,* 2512–2526.

NICHD Early Child Care Research Network. (1999). Chronicity of maternal depressive symptoms, maternal sensitivity, and child functioning at 36 months. *Developmental Psychology, 35,* 1297–1310.

Plunkett, J. W., Meisels, S. J., Stiefel, G. S., Pasick, P. L., & Roloff, D. W. (1986). Patterns of attachment among preterm infants of varying biological risk. *Journal of the American Academy of Child Psychiatry, 25,* 794–800.

Radke–Yarrow, M. (1998). *Children of depressed mothers: From early childhood to maturity*. New York: Cambridge University Press.

Rode, S. S., Chang, P., Risch, R. O., & Sroufe, L. A. (1981). Attachment patterns of infants separated at birth. *Developmental Psychology, 17,* 188–191.

Sameroff, A. J. (1993). Models of development and developmental risk. In C. H. Zeanah, Jr. (Ed.), *Handbook of infant mental health*. New York: Guilford Press.

Sameroff, A. J., & Fiese, B. H. (1990). Transactional regulation and early intervention. In S. J. Meisels & J. P. Shonkoff (Eds.), *Handbook of early childhood intervention*. New York: Cambridge University Press.

Sameroff, A. J., & Fiese, B. H. (2000). Models of development and developmental risk. In C. H. Zeanah (Ed.), *Handbook of infant mental health* (2nd ed.). New York: Guilford Press.

Sameroff, A. J., Seifer, R., & Zax, M. (1982). Early development of children at risk for emotional disorder. *Monographs of the Society for Research in Child Development, 47*(7).

Segal., L. B., Oster, H., Cohen, M., Caspi, B., Myers, M., & Brown, D. (1995). Smiling and fussing in seven-month-old preterm and full-term Black infants in the still-face situation. *Child Development, 66,* 1829–1843.

Spieker, S. J., Larson, N. C., Lewis, S. M., Keller, T. E., & Gilchrist, L. (1999). Developmental trajectories of disruptive behavior problems in preschool children of adolescent mothers. *Child Development, 70,* 443–458.

Susman–Stillman, A., Kalkoske, M., Egeland, B., & Waldman, I. (1996). Infant temperament and maternal sensitivity as predictors of attachment security. *Infant Behavior and Development, 19,* 33–47.

Teti, D. M., & Gelfand, D. M. (1997). The preschool assessment of attachment: Construct validity in a sample of depressed and nondepressed families. *Development and Psychopathology, 9,* 517–536.

Teti, D. M., Gelfand, D. M., Messinger, D. S., & Isabella, R. (1995). Maternal depression and the quality of early attachment: An examination of infants, preschoolers, and their mothers. *Developmental Psychology, 31,* 364–376.

Teti, D. M., & Nakagawa, M. (1990). Assessing attachment in infancy: The Strange Situation and alternate systems. In E. D. Gibbs & D. M. Teti (Eds.), *Interdisciplinary assessment of infant: A guide for early intervention professionals* (pp. 191–214). Baltimore: Paul H. Brookes.

Van Ijzendoorn, M H., Goldberg, S., Kroonenberg, P. M., & Frenkel, O. J. (1992). The relative effects of maternal and child problems on the quality of attachment: A meta-analysis of attachment in clinical samples. *Child Development, 63,* 840–858.

Vondra, J. I., Shaw, D. S., & Kevenides, M. C. (1995). Predicting infant attachment classification from multiple, contemporaneous measures of maternal care. *Infant Behavior and Development, 18,* 415–425.

Wille, D. E. (1991). Relation of preterm birth with quality of infant–mother attachment at one year. *Infant Behavior and Development, 14,* 227–240.

Younger, J. B., Kendell, M. J., & Pickler, R. H. (1997). Mastery of stress in mothers of preterm infants. *Journal of the Society of Pediatric Nurses, 2,* 29–35.

https://doi.org/10.1017/S0954579401001018 Published online by Cambridge University Press

https://doi.org/10.1017/S0954579401001018 Published online by Cambridge University Press