III Influence of Maternal Depression on Infant Affect Regulation

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Maternal depression is a major risk factor in a wide range of developmental domains. Within the first year to two, socio-emotional development appears most affected. Infants and toddlers of depressed mothers are at increased risk for developing an insecure attachment (Cummings & Cicchetti, 1990; Radke-Yarrow, Cummings, Kuczynski, & Chapman, 1985), problems in the regulation of affect (Gaensbauer, Harmon, Cytryn, & McKnew, 1984; Zahn-Waxler, Cummings, McKnew, & Radke-Yarrow, 1984), and lack of persistence in meeting age-appropriate cognitive challenges (Redding, Harmon, & Morgan, 1990). By 12 to 18 months, maternal depression is related to mild impairments in general cognitive ability (Lyons-Ruth, Zoll, Connell, & Grunebaum, 1986; Sameroff, Seifer, & Zax, 1982). Later in development, maternal depression is associated with increased risk of poor academic performance (Baldwin, Cole, & Baldwin, 1982), and both behavior problems and affective disorder (Beardslee, Bemporad, Keller, & Klerman, 1983; Caplan, Coghill, Alexandrin, Rosson, Katz, & Kumar, 1989; Cytym, McKnew, Zahn-Waxler, Radke-Yarrow, Gaensbauer, Harmon, & Lamour, 1984; Downey & Coyne, 1990; Zahn-Waxler, Iannotti, Cummings, & Denham, 1990).

The mechanisms responsible for the increased risks associated with maternal depression are not well understood. Especially in bipolar depression, an underlying genetic diathesis may be a contributing factor (Nurnberger & Gershon, 1984). However, the range and extent of suboptimal outcomes associated with having a depressed parent cannot be attributed simply to genetic factors either in isolation or in conjunction with particular child-rearing environments (Beardslee et al., 1983; Cytym et al., 1984). Thus, it is important to understand how parental depression is experienced by infants and young children and how that experience might contribute to increased chances of suboptimal socio-emotional and intellectual development.

Preparation of this manuscript was supported in part by NIMH Grant 40867 to the authors.
Even normal adults come to feel depressed after interacting with a depressed person (Coyne, 1976). In infants and young children, who are dependent upon their primary caregivers, the cumulative effects of depressed behavior on their development are likely to be substantial. A guiding question is this: Does depressed maternal behavior and consequent interational disturbance mediate the effects of maternal depression on infants and young children? Recent research addresses this question.

Reciprocity in the affective and social exchanges between mothers and infants is a robust finding in studies of non-depressed mothers and infants. In mother-infant interactions, the frequency, duration, and timing of infant expressive responses are closely related to those of the mother (Cohn & Tronick, 1988, 1987; Cohn & Elmore, 1988; Lester, Hoffman, & Brazelton, 1985; Symons & Moratin, 1987). Face-to-face interactions are central to the development of communicative skills, topic sharing, and the socialization of emotion expression (Kaye, 1982; Malatesta & Haviland, 1982; Schaffer, 1984), and the mother-infant relationship is believed to be crucial to the quality of infant attachment (Ainsworth, Blehar, Waters, & Wall, 1978; Belsky, Rovine, & Taylor, 1984; Egeland & Farber, 1984; Malatesta, Culver, Tesman, & Shepard, 1989). It is therefore likely that the effect of maternal depression is mediated through its influence on the mother's behavior with her infant. To test this proposition, we need to determine that: 1) infants are responsive to depressed behavior; 2) depressed behaviors in the depressed mother influence the infant; and 3) infant adaptation to a depressed caregiver's related to socio-emotional outcomes.

Affective disturbances, especially the 'postpartum blues' (Hopkins, Marcus, & Campbell, 1987) are common in the postpartum period, and it is possible that natural selection has made infants relatively immune to disturbances of this sort. Just as a 'stimulus barrier' (i.e., habituation) appears to protect babies from over-stimulation, other self-regulatory or relational mechanisms may shield them from experiencing depressed maternal behavior. Infants exert powerful effects of their own on caregivers, and it is possible that an infant can draw out even a mother who is depressed. Depressed mothers may not behave in a depressed way with their baby. This may be particularly true in middle-class, intact, well-functioning families. The demands of parenting also change with development. It is possible that depressed mothers are able to cope well with a young infant, but less so with one who is more demanding of social interaction or autonomy.

Depression also is not a unitary disorder, so the effects on infants are bound to be complex and related to variation in maternal functioning. Affective expression may be sad, depressed, flat, angry, or irritable. The normal timing of affective expressions may also be altered. They may be either slowed down and delayed (as in psycho-motor retardation) or speeded up and frenetic (i.e., hypomania). These emotional states may be relatively stable and trait-like (e.g., as in dysthymia); or they may be labile, alternating, for instance, between sad and angry. Affective expression that is sad and withdrawn may have very different effects than depressed affect that is angry or irritable. Individual differences among depressed mothers may be highly salient to infant affective behavior and development. The effects of depression may also depend on how long the episode lasts, whether it recurs, and on the presence of any lingering dysthymia or irritation. Indeed, risk status appears greatest when depression is current (Caplan et al., 1989) or chronic and severe (Sameroff, Seifer, & Zax, 1982; Seifer & Barocas, 1991) or occurs in the context of dysthymia (Frankel, Malin-Cole, & Harmon, 1991) or other risk factors (Downey & Coyne, 1990; Rutter, Yule, Quinton, Rowlands, Yule, & Berger, 1974; Rutter & Garmezy, 1983).

In this chapter we will review studies showing that infants respond in specific and characteristic ways to depressed maternal affect, and that these effects carry over to situations in which mothers no longer behave in a depressed way. Some of these data come from laboratory manipulations in which mothers distort their typical behavior and act depressed or unresponsive. The assumption in this work is that clinically depressed mothers behave in the way that is modeled in these laboratory simulations. Is this assumption valid? Do depressed mothers interact in a "depressed" way with their infants? And especially important to socioemotional development, do the effects of depressed interactions alter the pattern of infant responsiveness and carryover to new situations?

We will show that current, moderate to severe depression negatively influences mothers and infants, that infant coping remains impaired even after mothers are no longer acting depressed, but that these effects in infants are not irreversible. We will also emphasize the importance of attending to individual differences in patterns of mother-infant adaptation.

Infants have specific and appropriate responses to depressed maternal behavior.

To learn whether infants have specific and appropriate responses to depressed maternal behavior, it is necessary to modify the mother's normal behavior and evaluate infant response. Experimental studies of this sort cannot answer questions about the cumulative effects of depressed maternal behavior, but they can discover whether infants are responsive to depressed behavior when first experienced.

As noted above, depressed behavior may take many forms. Clinical reports frequently refer to affective expression that is flat, sad, and withdrawn, or that is angry, hostile, and intrusive. Two studies have tested the hypothesis that sad or withdrawn affective expression leads to negative affect in infants. Cohn and Tronick (1983) instructed mothers of 3-month-old infants to simulate depression or behave normally while interacting with their infant. Infants responded dramatically to this manipulation. They briefly smiled at the mother and when she failed to respond, they quickly turned away. This pattern repeated several times as the infants became increasingly withdrawn and upset.
Figure 1, from Cohn and Tronick (1983), shows the difference in infants' behavior between the simulated depressed and normal interactions. The size of the circles represents the proportion of time that infants spent in each affective state. The arrows represent the probability of transitions among states.

In the simulated depressed condition, the proportion of positive affect (denoted by play) was far less than in the normal interaction. Extreme reductions in the mother's positive affect resulted in extreme reductions in the positive affect of the baby. When babies became positive, they did so only briefly (brief positive). Note, too, that the organization as well as the distribution of infant's behavior was affected. Not only were infants more negative and less positive, but they also organized their behavior differently. They no longer cycled between neutral- (denoted by monitor) and positive affective expression. Instead, they cycled between negative affective states and look away. Even after mothers again resumed non-depressed behavior, infants remained more negative and withdrawn. Thus, in this experimental manipulation, sad, flat affect reduced both concurrent and subsequent infant positive affective response.

The carry-over effect of depressed interaction found by Cohn and Tronick (1983) has been found to generalize to interactions in which the mother has had chronic depressive symptoms. Field (1984) instructed mothers with high levels of depressive symptoms and non-depressed control mothers to simulate depressed behavior with their infant. Replicating the original findings, infants of non-depressed mothers responded to simulated depression with increased negative affect and remained more negative and less responsive even after their mother resumed non-depressed behavior. Infants of mothers with high levels of depressive symptoms, however, showed little change between the normal and simulated depressed interaction. Field interpreted this finding as suggesting that infants of mothers who were actually depressed saw little change between their mother's normal behavior and a situation in which she was instructed to act sad and withdrawn. Affective expressions other than sad or constricted affect have yet to be studied experimentally.

In the simulated depression experiments, maternal affect and responsiveness were dampened. However, it is possible that depression might differentially affect one or the other aspect of the mother's behavior. For instance, clinically depressed mothers might successfully "simulate" positive affect, but have greater difficulty in coordinating the timing of their expressions. Ekman (1984) has emphasized the role of false smiles in adult interactions, but little attention has been paid to the temporal organization of disingenuous affective expression in interactions with infants and young children.

To test whether the timing as well as the quality of maternal affect influences infant behavior, Cohn and Elmore (1988) modified Tronick's (Tronick, Als, Adamson, Wise, & Brazelton, 1978) still-face procedure. In the original study, Tronick et al. asked mothers to hold a still-face and remain unresponsive while seated en face with their baby. In the modification by Cohn and
Elmore, mothers of 3-month-old babies were instructed to become still-faced for 5 seconds contingent on their infant becoming positive. This perturbation of the usual relation between mothers' and infants' affect provided a test of how closely infants monitor the temporal relationship between their own and their mother's affect.

Consistent with earlier research (Cohn & Tronick, 1987; Kaye & Fogel, 1980), mothers were almost always in a positive state when their infant became positive. But when mothers briefly became still-faced contingent on infants' positive expression, the infants became less likely to cycle between positive and neutral expression and more likely to turn away.

This study demonstrated that babies are sensitive to the reciprocity of their mother's affective behavior. However, the mismatches (cf. Tronick & Cohn, 1989) between mothers' and infants' affect in this manipulation were relatively long (5 seconds) and were defined primarily in terms of facial expression of affect. Timing violations of shorter duration and in other modalities might have less effect. The durations of maternal vocalizations are much briefer than those of maternal facial expressions, and infants may be more sensitive to their mother's latency to respond vocally.

Interactions between depressed mothers and infants are less positive and more negative than those of non-depressed mother-infant pairs

Given the strong experimental evidence that infants are sensitive to depressed maternal affective expression, at least of the type studied to date, it is important to learn whether depressed mothers behave in a "depressed" way with their infants. Do depressed mothers show distortions of affective expression and timing in their interactions? Are interactions between depressed mothers and infants less positive and more negative than those of non-depressed mother-infant pairs? The answers to these questions depend in part on how depression is defined.

Diagnostic and related issues. Most research on infants (Betts, 1988; Cohn, Matias, Tronick, Lyons-Ruth, & Connell, 1986; Cohn & Tronick, 1989; Field, 1984; Field, Healy, Goldstein, Perry, Schanberg, Zimmerman, & Kuhn, 1988) has used self-report measures of mothers' depressive symptoms rather than a standard clinical interview to diagnose depression. Commonly used self-report instruments are the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977) and the Beck Depression Inventory (BDI: Beck, Ward, Mendelson, et al., 1961). These are Likert-type scales that include items about mood and cognitive and vegetative symptoms associated with depression. High scores suggest greater severity and are considered diagnostic for screening purposes. Self-report measures in the postpartum period, however, over-diagnose depression and fail to identify some women who meet formal diagnostic criteria (Campbell & Cohn, 1991; Gotlib, Whiffen, Mount, Milne, & Cordy, 1989; O'Hara, Neumaber, & Zekoski, 1984). Elevated levels of depressive symptoms may index a range of psychiatric disorders, and not just depression (Garrison & Earls, 1986).

Table 1. Correspondence between RDC and CES-D Score to Determine Depression's Prevalence

<table>
<thead>
<tr>
<th>CES-D Score</th>
<th>Depressed</th>
<th>Not Depressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>RDC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depressed</td>
<td>55</td>
<td>37</td>
</tr>
<tr>
<td>Not Depressed</td>
<td>77</td>
<td>838</td>
</tr>
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Note. Cut-score on the CES–D was 16. Kappa = .43. Adapted from Campbell & Cohn (in press).

Table 1 shows the correspondence between a diagnostic interview and the CES–D in a middle-class primiparous sample of about 1000 women (Campbell & Cohn, in press). Prevalence according to RDC (Spitzer, Endicott, & Robins, 1978) is 9%; prevalence according to the CES–D is about half again as much. The CES–D serves well as a screening instrument; but were depressed subjects identified with the CES–D, almost half would fail to meet diagnostic criteria. Thus, studies that do not use diagnostic criteria can be only suggestive of effects related to depression as opposed to more general distress.

More generally, little is known about the prevalence, duration, and course of depression in postpartum women. Most epidemiologic studies concentrate on community samples without particular reference to the transition to parenthood (e.g., Myers & Weissman, 1980), and diagnostic differences across studies make what data exist difficult to evaluate. With the exception of recent work by Gotlib (Gotlib et al., 1989) and by O'Hara (O'Hara et al., 1994, 1990), few studies have used standard diagnostic criteria to define depression in postpartum women. Only one study has used standard diagnostic criteria to study the course of depression beyond the postpartum period (Campbell, Cohn, Flanagan, Popper, & Meyers 1992).

Depression is an episodic disorder of variable duration. In unscreened community and clinical groups, individual episodes may last any where from several weeks to a half year or more (Akiskal, 1982; Clayton, 1983). Campbell et al. (1992) document a similar course in postpartum women. Rate of relapse is high: approximately 50% within 2 years of recovery (Belcher & Costello, 1988; NIMH/NIH Consensus Conference [1985], cited in McLean & Haktian, 1990). Thus, it is difficult to know how many infants may have a
depressed mother, how long her depression might last, or whether it is likely to re-occur. Few women might have chronic depressions, but those few may have the most significant effects on their infants.

Depression is also frequently confounded with other risk factors, such as poverty, family disruption, and child abuse and neglect. Some epidemiologic evidence suggests that depression in the absence of multiple risk factors may be of less consequence to infant or child behavior and development (Robins, 1974; Rutter et al., 1974; for review, see Rutter & Garney, 1983), although appropriate studies remain to be done. Thus, findings from studies that recruit subjects unsystematically, assess depression through self-report instruments, or confound depression with other risk factors cannot support strong inferences about the influence of depression. It is important, therefore, to make careful distinctions with respect to presence or absence of other risk factors.

High levels of depressive symptoms in the context of other risk factors. Using the BDI to assess depression in women of low SES, Field conducted a series of cross-sectional studies that suggest depressed mothers and their infants show fewer positive- and more negative facial expressions and vocalize less than non-depressed mothers and infants (Field, 1984). Depressed mother-infant pairs were more likely to share negative affect, whereas non-depressed dyads were more likely to share positive affect (Field, Healy, Goldstein, & Guthertz, 1990). Infants of depressed mothers were also more likely to respond with increased negative and less positive affective expressions during interactions with a non-depressed female stranger (Field, Healy, & Goldstein et al., 1988). These studies by Field suggest that negative affect is more common in interactions between depressed versus non-depressed mothers and infants in multi-problem families.

Individual differences. Depression is a heterogeneous disorder. In an exploratory study, we studied individual differences in the expression of negative affect in mothers with chronic depressive symptomatology (Cohn et al., 1986; Cohn & Tronick, 1989). Subjects were thirteen mothers and their 6- to 7-month-old infants. They were all part of a longitudinal study conducted by Lyons-Ruth (Lyons-Ruth et al., 1987). The mothers had moderate to severe levels of depressive symptoms, as assessed with the CES-D, and high rates of factors associated with risk of childhood behavior disorder, such as child neglect, substance abuse, and low SES (Rutter & Garney, 1983).

The behavior of these mothers was strikingly unlike that of mothers in normative studies. Mothers in well functioning families typically display positive affect about half the time and do not show expressions of angry or rough behavior. By contrast, the mothers in this clinical group were withdrawn or interacted in an aggressive, intrusive way with few positive affective expressions. Anger/poke, which refers to angry or intrusive behavior, occurred about 25% of the time (Table 2). Disengagement, such as leaning back and away from the baby and being unresponsive, occurred about 40% of the time. With few exceptions, the mothers in this study all showed at least some negative affect. Negative behavior is rare in normative studies. The infants’ behavior was also less positive.

<table>
<thead>
<tr>
<th>Table 2. Percentage of Time in Negative and Positive States.</th>
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<tbody>
<tr>
<td>Mothers</td>
</tr>
<tr>
<td>Anger/Poke</td>
</tr>
<tr>
<td>Play</td>
</tr>
<tr>
<td>Infants</td>
</tr>
<tr>
<td>Avert/Protest</td>
</tr>
<tr>
<td>Play</td>
</tr>
</tbody>
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Note. Depression data are adapted from Cohn & Tronick (1989).
Normative, comparison data are adapted from Cohn & Tronick (1987).

The number of subjects was small, but variations among mothers in type of negative affect shown was pronounced (Figure 2). At the extreme of disengagement, two mothers (M-Disengaged) showed a pattern similar to some clinical descriptions of depressed mothers (Weissman & Pankel, 1974) and what Cohn and Tronick (1983) and also Field (1984) had modeled in the simulated depression studies. These mothers were disengaged more than 75% of the time. They slouched back in their chairs, often turned away, and spoke in an expressionless voice. They were responsive only to active infant distress.

At the other extreme was the largest group (M-Intrusive): six mothers with high proportions of angry or intrusive behaviors, such as rough handling, poking at their babies, and speaking in an angry tone. Two others (M-Mixed) also showed anger/poke, although less so, together with some play and much elicit (attempts to get the baby's attention). A small group of three mothers (M-Positive) showed high rates of positive expression, comparable to those found among non-depressed mothers (Cohn & Tronick, 1987; Kaye & Fogel, 1980).

Maternal disengagement and intrusiveness had quite different effects on infants. Infants of disengaged mothers had the highest proportions of protest, which suggests that the most distressing behavior for infants may be the pattern of maternal disengagement (Figure 3). Infants of intrusive mothers had the highest proportions of look away, which is consistent with previous work indicating that increases in maternal intensity are unsuccessful in re-establishing mutual interaction when infants are looking away (Cohn & Tronick, 1987; Kaye & Fogel, 1980). The infants of the most positive mothers had the highest proportions of play. These individual differences were unrelated to any particular combination of risk factors. Within this clinical group, depressive symptoms and other risk factors did not predict maladaptive...
interaction patterns in a simple one-to-one fashion. Infants' affective behavior was specific to the affective quality and reciprocity of mothers' behavior.

High levels of depressive symptoms in the absence of multiple risk factors. Some studies indicate that depression has an impact on mothers and infants in low-SES, multi-problem families. Even subclinical levels of depression may influence mother's interactive behavior significantly. But what about depression when it occurs in the absence of other risk factors? Do mothers behave in a less positive, more negative way?

Using the BDI to assess depression in middle-class mothers, Betts (1988) studied the timing and acoustic contours of mothers' vocalizations to 3-month-old infants. The mothers she studied had subclinical to mild depression according to the BDI. Depressed mothers were slower to respond to their infant's vocalizations, and were less likely to use the expanded intonation contours that are typical of infant-directed speech. Depressed mothers also used vocal utterances and pauses of more variable duration. Predictable utterance and pause durations and exaggerated contours are believed to promote dyadic interaction. Although differences in vocal behavior between depressed and non-depressed mothers in this study were striking, Betts reported no differences in infant behavior. One reason may be the low levels of depression; or that measurements of infant behavior were limited to vocal utterances and pauses and measures of mothers' behavior were limited to the vocal expression. It is possible that maternal facial expression, in particular, did not vary between depressed and non-depressed groups. Alternatively, the influence of depression on infant behavior in the absence of multiple risk factors may be less pervasive.

Depression assessed according to diagnostic criteria

The studies reviewed in the preceding section all used self-report symptom ratings to assess depression; depression often co-occurred with other risk factors; with few exceptions assessments were not longitudinal; and because subjects were recruited informally or through service providers, little was known about how representative subjects were of other mothers and infants.

To pursue these and related issues, we (Campbell & Cohn, 1991; Campbell et al., 1992; Cohn et al., 1990, 1992) are studying the prevalence and course of depression in the postpartum period, its influence on the developing relationship between mothers and infants, and the infant's capacity to regulate affect in response to age-appropriate stressors. We will first present findings based on telephone screening of approximately 1000 postpartum mothers at 6 postpartum weeks. We will then present initial findings based on intensive longitudinal study of our initial subjects (n with complete data to date ranges from 50 to 65 at each age).

Subject recruitment and study design. We recruit mothers from delivery records at Magee Women's Hospital, the major obstetrics hospital in Pittsburgh. Mothers are then interviewed over the phone at 6 weeks postpartum to
determine whether they meet diagnostic criteria for depression. To be included in the screening population, mothers and infants must meet criteria intended to minimize the occurrence of other risk factors. Diagnostic screening interviews are scored according to modified Research Diagnostic Criteria. We also obtain from each mother a self-report measure of depression (CES-D). Scores above 16 are considered to reflect severe symptoms (Myers & Weissman, 1980).

Women meeting screening criteria for depression and non-depressed controls are interviewed in their homes at 2 months. For diagnoses, we administer the SADS-L (Endicott & Spitzer, 1978) as modified by O'Hara (O'Hara et al., 1984) for postpartum women. Women are asked about mood and the major symptoms of depression (sleep disturbance, appetite changes, fatigue, loss of interest or anhedonia, concentration difficulties, guilt, agitation or retardation, and thoughts of suicidal ideation).

Mood and symptoms are rated on 6-point scales, from 1 (not present or present to a normal degree) to 6 (serious and incapacitating). Only ratings of 3 and above are considered clinically significant. Further, since this is a postpartum sample in which changes, especially in sleep, fatigue, and appetite are expected (Campbell & Cohn, in press; O'Hara et al., 1984), sleep disruptions that are accounted for by the baby waking up are not counted as a symptom. Similarly, increases in appetite are considered a normal reaction to the birth of a baby and are coded as clinically significant only in extreme cases, especially in the first few postpartum months, and for breast-feeding women. Loss of interest in sex is not included as a symptom, but women who reported loss of interest in the baby are considered to evidence loss of interest. The duration of mood and symptoms is also recorded.

Sad mood and anhedonia and at least three symptoms must be present together for at least two weeks to meet criteria for a diagnosis of depression. Further, women must endorse the SADS questions about help seeking and/or functional impairment to receive a diagnosis. Women with three symptoms rated as clinically significant are considered to meet criteria for minor depression; those with four symptoms are considered as probable major depression; and women with five or more symptoms are considered to meet criteria for definite major depression. So far, 86% of the depressed women have met criteria for probable or definite major depression.

In some of the analyses we distinguish between two groups of depressed mothers — those with current and acute depression and those whose depression was already remitting by 2 months postpartum. Twenty-seven mothers met modified RDC and also had CES-D scores above 16. These women were both clinically depressed, as determined by psychiatric interview and diagnosis, and reported subjective feelings of acute distress. Ten women met RDC only. Their depressions in many cases had remitted by the time of the 2-month assessment. Thirty-one mothers were non-depressed control subjects. We excluded women who had clinically significant CES-D scores (i.e., 16) but who did not also meet criteria for depression. Thus, we distinguish two groups of depressed mothers: those meeting Research Diagnostic Criteria at some time during the first two postpartum months and also experiencing high levels of self-reported distress, and those mothers who meet RDC only. By defining these subgroups, we were able to determine whether psychiatric criteria alone, or psychiatric criteria together with high levels of self-reported distress, was crucial for mediating mothers' and infants' behavior.

Behavioral observations are conducted in the families' home at 2, 4, and 6 months and in the laboratory (Strange Situation assessment) at 12 months. Observations include structured and spontaneous mother-infant interactions and infant response to the mother remaining unresponsive (still-face). We also conduct a telephone assessment of depression at 9 months.

During the structured and still-face interactions, mothers and infants behavior is videotaped and later coded on a 1-5 time base by staff blind to mothers' diagnosis. (See Cohn et al., 1990 for details). Home visitors, who are not blind to diagnosis, complete rating scales descriptive of mothers' and infants' behavior during the 2- to 3-hour interview and observation period. The scales are derived from previous research on maternal sensitivity (Ainsworth, Blehar, Waters, & Wall, 1978), maternal affect and engagement (Lyons-Ruth, Connell, Zoll, & Stahl, 1987; Vaughn, Taraldson, Crichton, & Egeland, 1980), and infant responsiveness (Vaughn et al., 1980). In all, 12 maternal, infant, and dyadic behaviors were rated. These ratings were then subjected to a principal components analysis with varimax rotation. Two factors, affect and sensitivity accounted for about 60% of the variance in mothers' behavior at each age. An affect factor also accounts for about 60% of the variance in infant behavior at each age. (See Cohn et al., 1990 for details).

To summarize, we assess depression, mother-infant interaction, infant response to age-appropriate stressors (still-face at 2 through 6 months and Strange Situation at 12 months), and other features of mothers' and infants' adjustment longitudinally over the course of the first year. (Assessments through 30 months are in progress, but are not described here.)

Demographic comparisons between depressed and non-depressed mothers. In the screening sample (Campbell & Cohn, 1991) we find minor but significant differences in SES between postpartum depressed and non-depressed subjects. SES in both groups is middle class, but is slightly lower quantitatively on the Hollingshead scale in depressed women. Minor pregnancy and delivery complications, also tend to be slightly more common in the depressed mothers. Thus, even in an otherwise low-risk population, depression still tends to occur together with other risk factors. As Downey and Coyne emphasize (1990), findings such as these suggest caution in making inferences specific to depression.

Reports of pregnancy experiences. Depressed mothers in the longitudinal sample (Campbell et al., in press) reported higher rates of psychological distress during pregnancy. Postpartum depressed mothers more often hadn't planned their pregnancy. Not surprisingly, they also reported a much higher prevalence of negative thoughts about their pregnancy. These group
Course of Depression in Primiparous Mothers Meeting RDC at 2 Months

![Graph showing percentage of initially depressed women who were still depressed or showed subclinical symptoms of depression through 12 months.]

Figure 4. Percentage of initially depressed women who were still depressed or showed subclinical symptoms of depression through 12 months.

Differences suggest that the antecedents of postpartum depression may be found within the pregnancy period.

**Course of depression.** Depression remitted in about 80% of depressed mothers by 6 months, although depressed mood or related symptoms continued in about half of all remitted cases. Figure 4 shows the percentage of mothers who were still depressed through 12 months. Also shown is the percentage who, while no longer meeting criteria for depression, continued to experience subclinical levels of depressed mood or symptoms.

**Stability of mothers’ and infants’ behavior**

To assess the stability of mothers’ and infants’ affect over time, we computed stability coefficients for both the face-to-face interactions and the home ratings. In both sets of analyses, we found evidence of moderate stability. The test-retest correlation between a 2- and 4-month composite for positive affect (high and low positive) was approximately .5; from 4- to 6 months, this correlation increased to about .7. From 4 to 6 months negative affect in mothers became more stable. This was due to increasing negativity in some depressed mothers. Infant behavior was less stable but also showed an increase in stability for negative affect. Figure 5 shows the stability coefficients for mothers’ and infants’ affect in face-to-face interaction between 4 and 6 months.

**Stability Coefficients:**

Four to Six Months

![Graph showing stability coefficients for percentage of time mothers and babies spent in affective states.]

Figure 5. Stability coefficients for percentage of time mothers and babies spent in affective states.

These stability coefficients are much larger than those reported in another context by Bakeman and Brown (1980). One reason may be the wide range of mothers we studied. It may also be the case that mothers’ and infants’ behavior during even brief interactions is far more stable than has previously been assumed (Kaye, 1982).

The same pattern was found in the home ratings. Mothers’ behavior showed moderate stability, increasing over time. Infant stability coefficients were low but significant from 4 to 6 months. Thus, mothers provided a consistent affective environment to which their infant responded, and we see evidence that a possible cumulative effect was to bring about increasing stability in infant behavior.

**Reciprocity of affect.** A consistent finding in previous studies is that mothers and infants reciprocate affect. We have conducted two analyses of mother-infant reciprocity. First, we have correlated the distributions of mother and infant negative and positive affect during face-to-face interactions. This analysis tells us whether mother-infant pairs are matching affective level over time. The second analysis is a time-series regression to assess synchrony and mutual influence. A consistent finding at each age is that mothers and infants matched each other’s level of positive and negative affect. We find a moderate correlation between mothers’ and infants’ affect at each age.

Moment-to-moment synchrony, or coherence, increases from 2 to 4 months, but is unrelated to diagnostic status. In our analyses so far, we have...
found no differences in synchrony related to depression (Cohn et al., 1990). Mutual influence appears equal in each group. Mothers and infants respond contingently to each other's affective displays.

**Generalizability of affect expression during face-to-face interactions.** Significant correlations between behavior in the two settings were found in the larger sample at 2 and at 4 months, although not at 6 months. Thus, the two assessments, structured interaction and naturalistic observation, showed moderate stability and also low to moderate concurrent validity.

**Depressed mothers and infants are more negative and less positive than non-depressed mothers.** RDC/CES–D mothers, those both meeting psychiatric criteria and having high levels of subjective distress, more clearly differed from both RDC only and control subjects (Figure 6). RDC/CES–D mothers had a narrower range of positive affect (lower percentages of high positive/exaggerated expressions). The amount of negative affect at 2 months in RDC/CES–D mothers, while not significant, signalled an important developmental trend. With development, prevalence of negative rather than positive affect more consistently discriminated depressed from non-depressed mothers.

The infant data parallel those for the mothers. Infants of depressed mothers had lower proportions of low positive, or interest, and more negative affect. These differences were due to the infants of RDC/CES–D mothers (Figure 7).

In the subjects we have studied to date, we have not found strong differences in face-to-face interaction among any of the groups at 4 or 6 months, with the exception of the increase in the number of depressed mothers who show negative affect.

In the home ratings, we again found that RDC/CES–D dyads accounted for depression effects at 2 months. We also found evidence of continued impairments in this group at 4 months. Maternal sensitivity, which primarily reflected negative affect, differentiated these groups at 2 and 4 months. Thus, both the structured face-to-face interaction and in the home ratings we found an increase in maternal negative affect over time in RDC/CES–D mothers.

**Infants' response to age appropriate stressors.** Both the still-face and attachment assessments stress the infant's resources to cope with challenges around salient developmental issues. A central developmental issue for infants 2 through 6 months is the sharing of positive affect and the regulation of face-to-face exchanges. When mothers fail to match infant affect, the infant's task is to initiate a change in her behavior. Positive elicits in response to the still-face demonstrate the infant's ability in this regard. At 12 months the attachment relationship is a central developmental issue. The infant must regulate negative affect through an adaptive working model of the attachment relationship and the use of the mother when distressed. Thus, both assessments tap the infant's expectations about the mother's responsiveness and the infant's ability to cope when stressed. Maternal depression is believed to decrease the likelihood of both positive elicits during the still-face (Field, 1984) and attachment security (Cicchetti & Aber, 1986; Cummings & Cicchetti, 1990). We wanted to test these hypotheses and also learn whether positive

![Mother Affect Profiles at Two Months](image)

**Figure 6.** Percentage of mothers' time spent in affective states at 2 months.

![Infant Affect Profiles at Two Months](image)

**Figure 7.** Percentage of babies' time spent in affective states at 2 months.
elicits predict attachment security. An early pilot study (Tronick, Ricks, & Cohn, 1982) suggested this might be true.

Consistent with the findings of Field (1984), infants of RDC/CES-D mothers had lower frequencies of positive elicits at 4 months, although not at 2 or 6 months. Differences between groups at those ages were in the expected direction, and may achieve statistical significance once our sample is complete. Diagnostic status at 2 months did not contribute to the prediction of attachment; however, we have found a trend suggesting that chronicity of depression is associated with increased insecurity. Of six mothers who were still depressed at 6 months, five had infants who were classified as avoidant or resistant.

Experience with alternative caregivers may have moderated a depression effect. Non-maternal care was common by six months: about 20 hours per week on average. In infants of mothers who were depressed at 2 months, increased time in non-maternal care was associated with an increased probability of secure attachment at 12 months. Using a logistic regression, positive elicits at 6 months and the interaction of 2-month depression status with hours in non-maternal care predicted 68% of the 12-month attachment classifications (odds ratio = 6.84). Ambivalent classifications could not be predicted. When they were omitted from the logistic regression, 72% of avoidant and secure classifications were correctly predicted (odds ratio = 3.55) (Cohn et al., 1992).

Discussion

Infants of non-depressed mothers respond dramatically to simulated depressed affect and to distortions in the timing of their mother's behavior in relation to their own. In response to simulated depression, infants become wary, they try to positively elicit their mother to change, and, when unsuccessful, they become increasing negative and unresponsive (Cohn & Tronick, 1983). This increased negative affect and lack of responsiveness then carries over into situations in which the mother is no longer acting depressed. These data suggest that were the mothers to behave continually with depressed affect, infant's affect would come to resemble the mother's. Indeed, in the studies by Field (1984), this seemed to be the case. Infants of mothers with high levels of depressive symptoms were more negative and less responsive than infants of non-depressed mothers, and their behavior varied little between simulated depressed and 'normal' interactions.

Depressed affect may include anger and irritation. Depressed mothers may also be highly intrusive. The experimental study of "simulated" depression has so far been restricted to sad and flat affective expression. Cohn et al. (1986) speculated that restricted maternal affect and lack of responsiveness led to increased infant distress, whereas maternal anger and intrusiveness led to increased avoidance. In the absence of further experimental studies, we do not know whether variation in the type of negative affect mothers show will lead to qualitative differences in infant response. However, studies do indicate that earlier maternal intrusiveness is related to the development of avoidant attachment (Belsky et al., 1984; Egeland & Farber, 1984; Malatesta et al., 1989).

Infants have dramatic reactions to violations of the expected temporal relationship between their own and their mothers' positive affect. Cohn and Elmore (1988) found that when mothers sobered in response to their infant's becoming affectively positive, the infant's response was to sober and look away. Inappropriate timing of affective displays is a likely concomitant of maternal depression. Bettes (1988), for instance, found that in mothers with mild to moderate levels of depressive symptoms, vocal utterances were more variable and turns were of longer duration than in non-depressed mothers. The primary focus to date has been on the affective aspects of depression. Temporal aspects may be equally important to infant behavior and development.

With few exceptions, research about the influence of maternal depression during the first year has tended to ignore diagnostic criteria and to confound depression with other risk factors. Results from these studies suggest that depressed mothers and their babies are more negative and less positive than non-depressed mother-infant pairs. In the study by Cohn (Cohn et al., 1986; Cohn & Tronick, 1989), negative affect was characteristic of almost all of the depressed mothers, although there were substantial individual differences in how negative affect was expressed. In families that have fewer risk factors the influence of depression appears moderated. Bettes (1988), for instance, found consistent effects in mothers' vocal behavior but no differences in infant behavior related to depression. In our ongoing investigation of depression in postpartum mothers, we find more moderate effects on maternal behavior in mothers who are depressed in the absence of other risk factors. In the absence of multiple and severe risk factors, depression appears to have reduced impact on mothers and infants.

A necessary question to ask is whether our current findings must be qualified by the postpartum status of the mothers in our study. More specifically, is depression in the postpartum period different from or more heterogeneous than depressions occurring at other times? Stated differently, it is possible that postpartum depression is distinct from other depressions, and that some or all of the depressed women we studied were experiencing postpartum rather than "true" depression. Neither the RDC nor DSM make a distinction between depression in the postpartum and other times; nor have prospective studies found differences between depression in the postpartum period and at other times (Gottlib, Whiffen, Wallace, & Mount, 1991). None the less, it is possible that had we been able to differentiate among postpartum depressions, we might have found stronger effects of depression.

Our data contraindicate this interpretation. First, we followed the RDC in
defining depression, and were careful to take into account the normal changes of parturition in applying the criteria for clinically significant symptoms. Eighty-six percent of the women we studied met criteria for probable or definite major depression, and all either experienced functional impairment or sought help for their depression. Second, depression is an episodic disorder, and approximately half the depressed mothers in our study had experienced at least one or more previous episodes of depression. Among those for whom the present depressive episode was their first, there is no way of knowing what proportion will go on to experience additional episodes. However, the age of the women in our study is well within the period in which first episodes occur (Boyd & Weissman, 1981). Third, if postpartum depression is more heterogeneous than depressions at other times, one might expect an increased prevalence relative to community samples. We did not find this to be the case. Others have found no difference in prevalence rates between postpartum women and demographically matched non-postpartum women (Gotlib et al., 1991; O'Hara, Zekoski, Phillips, & Wright, 1990). We did find a high remission rate for depression. However, that finding is consistent with what is known about depressions occurring at other times. Depression is an episodic disorder of variable duration. Thus, we find no evidence to indicate that differences about depression in the postpartum period must be qualified by the uniqueness of depression at this time. On the other hand, the experience of being depressed and having a new baby is, of course, specific to this period (Campbell et al., 1992).

Also consistent with what is known about depression at other times in the life cycle, depression was associated with small but significant increases in rates of other risk factors. These include marital distress during pregnancy, higher prevalence of minor delivery complications, and increased infant difficulty (Campbell et al., 1992; Sameroff, Seifer, & Zax, 1982; cf. Zuckerman, Bauchner, Parker, & Cabral, 1990). Downey and Coyne (1990) have emphasized that depression often co-occurs with marital distress, which may independently influence child outcomes. Because experimental designs are of limited feasibility, it may be difficult to disentangle reliably the unique effects of maternal depression from those of other risk factors. Studies that include non-depressed psychiatric and also medical control groups (e.g., Gotlib, 1990) may be informative in this regard. Our work suggests that the influence of depression is attenuated in the absence of other severe risk factors.

An important factor mediating infant effects may be infant's age. Over the age range from 2 through 6 months, incidence of negative affect in depressed mothers increased steadily. Reasons for this increase are unclear. Older infants may require more active social engagement, which a mother who is depressed finds difficult to manage. Older infants are also more demanding of autonomy. The phenomenology of depression may also change over time. When the increasing demands of parenting an older child are concurrent with the emotional strain of enduring depression, adverse child outcomes may become more likely.

A mother's subjective feelings of distress were more important than her diagnostic status alone. Mothers' self-reported level of subjective distress was a central factor in mediating mothers' and infants' affect through six months. A mother's experience of her own distress was more important than her having met diagnostic criteria within the first 8 weeks postpartum. On most measures, women who met RDC without having high levels of subjective distress were indistinguishable from non-depressed controls. Mothers who met criteria and had higher subjective distress, clearly differed on almost all measures at two months, and continued to be more negative through six months. Negativity in fact increased over this time period. Thus, in mothers with high levels of initial symptoms, the continuing effect of depression may be more evident in negative rather than positive affect expression. Alternatively, it may be stability in low levels of positive affect that proves more influential. We are not yet ready to distinguish between these alternatives.

We did not find a relationship between a brief depressive episode within the first 8 weeks and infant attachment at one year. However, preliminary data suggest that longer lasting depressive episodes were associated with an increased rate of insecure attachment. Infants of mothers who remained depressed through 6 months were more likely to be classified as insecurely attached at 12 months than infants of mothers whose depression remitted. This finding is preliminary and so must be interpreted with caution, but it does suggest that chronicity and currency of depression are more important than prior diagnosis. A chronicity effect would also be consistent with the view of Cicchetti and colleagues (Cicchetti & Aber, 1986; Cummings & Cicchetti, 1990). They have theorized that insecure attachment is more likely in infants who have experienced maternal depression during their second year, as would be likely in the case of chronic or frequently occurring maternal depression.

Other data are consistent with the hypothesis that chronicity and currency of depression are of more consequence than is past diagnostic status. Consider Radke-Yarrow et al.'s (1985) study of depression history and toddler attachment. (Depression was defined according to life-time history. In some women, episodes predated the child's birth. The percentage of current depressions was not reported.) Radke-Yarrow and colleagues reported an increased prevalence of insecure attachment in the depressed group. A close reading of their findings, however, shows that the relationship between attachment and depression was due entirely to the inclusion of bipolar subjects in the depressed group. Diagnosis of unipolar depression (Major or Minor Depression) alone was unrelated to attachment. This can be seen by reanalyzing the tabular data in the published report (Table 3).

Bipolar depression is a chronic disorder characterized by cycles of mania and depression and is not always well controlled. Unipolar depression, on the other hand, is characterized by depression only and it may or may not be chronic. In unipolar depression impairment is much less severe, on average. It is not possible to say from this study whether chronicity, currency, or an index
Table 3. Toddler Attachment by Mothers’ Diagnosis

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Percent Insecure</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Depressed</td>
<td>9/31 (29%)</td>
<td></td>
</tr>
<tr>
<td>Bipolar + Unipolar</td>
<td>30/55 (55%)</td>
<td>.025</td>
</tr>
<tr>
<td>Bipolar only</td>
<td>11/14 (79%)</td>
<td>.005</td>
</tr>
<tr>
<td>Unipolar only</td>
<td>19/41 (46%)</td>
<td>N.S.</td>
</tr>
</tbody>
</table>

Note. Adapted from Yarrow-Radke et al. (1985).

of severity over time, was more important, but it is clear that a diagnosis of major depression was unrelated to insecure attachment.

Strongly related to attachment in the Radke-Yarrow et al. study were contemporaneous observations of mothers’ affect with her child. Reduced positive affect and involvement were associated with insecurity. Similar findings have been reported at 12 months by Lyons-Ruth (et al., 1987) and at about 20 months by Teti, Gelfand, Messinger, & Isabella (1991). Sameroff, Seifer, and Zax (1982) found that chronicity and severity of depression were of more consequence to a range of developmental outcomes than diagnostic status alone. Future studies should differentiate past from current and chronic episodes of depression and should examine more carefully the relative contribution of diagnostic variables and affective behavior over time.

Mother-infant interactions are regulated through a process of bidirectional influence (Cohn & Tronick, 1988; Lester, Hoffman, & Brazelton, 1985). The contributions of each partner, however, may not be equal. When we consider the very sizable stability of maternal positive affect over time, and the increasing stability of infant negative affect, it is clear that maternal affect is potentially more influential in determining infant response. The mother’s affect and sensitivity are a consistent environment within which the infant develops. Spitz (1965) emphasized the cumulative nature of affective exchanges in shaping infant personality. Mothers with chronic or recurrent episodes of depressed mood may represent a high-risk environment for young children.

In this regard, it may not only be a question of whether a mother has at one time been diagnosable, but rather that she experience currently significant negative or reduced positive mood. As Tronick and Cohn (Cohn & Tronick, 1989; Tronick, 1987) have argued, infants don’t experience diagnoses; they don’t directly experience many of the symptoms of depression, such as mothers’ sleep disruption or changes in appetite. But they do have daily interchanges mediated by affect and timing. And infants are exquisitely sensitive to these components, and by their dependence on caregivers, extremely vulnerable to distorted affect or timing. A mother with persistent irritable or sad mood, who is intrusive and rough in her handling, will increase the chances of impaired infant affect regulation, including avoidant attachment.

In a previous report (Cohn et al., 1990), we found that mothers’ work status had a positive effect on mother-infant interaction at 2 months in the depressed group. A similar but more profound effect emerged here. In infants of depressed mothers, hours of non-maternal care were positively related to secure attachment. Time with alternative caregivers may have provided babies of postpartum depressed mothers with emotionally corrective experiences at a time when their mothers were either depressed or in the process of recovering. Alternatively, it may be that work outside of the home independently contributes to a mother’s ability to relate to her baby. The isolation of rearing a young baby, when coupled with depression, may be a particularly difficult stressor for the mother-infant relationship. Opportunities for social support and more varied responsibilities may contribute to a sense of greater efficacy than would otherwise be the case in depressed mothers. Teti and Gelfand (1990) found that the effect of depression on mother-infant interaction was mediated through a mother’s sense of efficacy. Fathers also may be more supportive of the mother and more involved with their babies when the mother is working outside of the home. Further research on this topic is needed. In particular, it is important that we consider circumstances in which non-maternal care may lead to increased security. Past research has focused on the relationship between non-maternal care and avoidance (Belsky, 1988; Clarke-Stewart, 1989), without considering possible beneficial effects of non-maternal care on attachment security.

Research on the influence of maternal depression on infant adaptation has important implications for clinical practice. Mothers with brief depressions who recover relatively soon should be reassured. Anticipatory guidance in these cases should emphasize that the baby may take some time to show normal responsiveness, but that no long term impairment is expected. Mothers with more chronic depressions, or who have histories of dysthymia or other chronic mood disorders, on the other hand, should be encouraged to seek treatment. Help with the baby and opportunities that enhance feelings of efficacy may be essential to the well-being of mother and baby. The role of maternal employment and non-maternal care is not clear, but care from a sensitive alternative caregiver for infants of severely depressed mothers may be a protective factor.

Mothers with similar risk factors may behave dissimilarly with their babies. Past diagnosis of depression or any combination of other risk factors may be predictive only weakly of mothers’ and infants’ behavior. It may be more important to focus on maternal affect and patterns of mother-infant adaptation than on group differences related to past diagnostic status.

Mother-infant interaction assessment can provide the clinician with valuable information about how symptomatology is related to caregiving behavior and infants’ response. Although treatment efforts commonly focus on the individual patient, a broader focus may be warranted when the patient is a woman with a young child. Depressive symptoms, especially in the presence of other risk factors, may have dramatic effects on infant affective behavior and...
development. Medication or other treatments may successfully treat some aspects of symptomatology. We do not know whether successful treatment also remedies the kinds of maternal behavior of salience to infants. Maladaptive patterns of interaction may continue even after clinically significant symptoms remit. Insecure attachment is a potential outcome. Thus, clinicians should be alert to the possibility of directing intervention efforts to the mother-infant dyad, as well as to the mother herself. Increased attention to patterns of mother-infant adaptation would guide clinicians in this direction.

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