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Depressed and Well Mothers' Emotion Interpretation Accuracy and the Quality of Mother–Infant Interaction

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The inadequate parenting associated with mothers' depression may be related to mothers' problems in interpreting infants' emotional expressions. The relations between depressed and well mothers' accuracy at interpreting babies' facial expressions and the quality of the mothers' interactions with their infants were examined. In partial support of our hypotheses, depressed mothers' level of depressive symptoms was associated with less accuracy, especially regarding positive emotions. Contrary to expectations, depressed mothers did not differ from well mothers in terms of their emotion accuracy. Furthermore, depressed mothers' accuracy at interpreting infants' emotions was not significantly related to the quality of their interaction with their infants; in contrast, well mothers' accuracy for infants' negative emotions was associated with better interaction quality. These findings provide new information about depressed mothers' emotional interpretations and their parenting. The different pattern of findings for depressed and well mothers suggests that other mediating factors are important, which are discussed.

Research has well documented the impact of early mother–infant interactions on children's development. In particular, the quality with which mothers and their young infants interact bears importance for the infants' emotional and social development (Lewis, Sullivan, & Brooks-Gunn, 1985; Sullivan & Lewis, 1989), emotional regulatory processes (Field, 1994), and attachment (Ainsworth, Bell, & Stayton, 1972; Antonucci & Levitt, 1984; Fish & Stifter, 1995; Schoelmerich, Fracasso, Lamb, & Broberg, 1995). How mothers initiate and maintain physical, emotional, verbal, and nonverbal connection to their infants and how they respond to their infants' initiations occurs through moment-to-moment interactions, which

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build over time to create a relationship that influences the infants' developing emotional and social processes. When mothers' emotional functioning is compromised, as in the case of postpartum depression, their infants are at an increased risk of negative developmental sequelae through a combination of genetic and environmental factors (for a review, see Goodman & Gotlib, 1999). Regarding the latter, research has shown that mothers struggling with depression have impaired interactions with their infants relative to nondepressed dyads (C. T. Beck, 1995).

MOTHER–INFANT INTERACTION

High-quality mother–infant interactions are comprised of a variety of characteristics, many of which are shaped by the mother. For example, mothers who use motherese speech to talk to their infants about daily tasks and who pause and respond to their infants' vocalizations create a process of interpersonal interaction that teaches infants conversational patterns involving verbal give-and-take (e.g., Fernald & Simon, 1984; Jaffe, Beebe, Feldstein, Crown, & Jasnow, 2001). Furthermore, high-quality interaction is typically characterized by maternal behaviors such as mirroring the emotional content of an infant's behavior, initiating social interaction, and responding contingently and sensitively to the infant's demands and communicative attempts (Lewis, 1987). In particular, mothers' emotional expressivity and contingent responding to infants' emotions are important as they begin an early process of socialization of emotion (Malatesta, Culver, Tesman, & Shepard, 1989; Malatesta & Haviland, 1982).

The emotional communications between mothers and their infants create a shared meaning over time, with infants receiving the most benefit when their mothers are both physically and emotionally available to their infants (Emde, 1993a). Mothers' ability to be emotionally available and respond sensitively to their infants requires mothers to pay attention to and accurately interpret their infants' emotional cues and attempts to communicate (Emde, 1993b). Furthermore, the accuracy with which mothers interpret their infants' signals influences the course of the mother–infant relationship and the capacity of the mother to direct the processes of interaction. As such, sensitivity to infant cues is an essential component of the quality of caregiving (Wendland-Carro, Piccinini, & Millar, 1999). Mothers who miss or misinterpret their infants' signals, then, are likely to respond less sensitively to their infants' needs and to maintain poorer quality interaction with their developing infants (Donovan, Leavitt, & Walsh, 1998).

DEPRESSED MOTHERS' PARENTING

Children raised by depressed women have a heightened risk of serious psychological disturbances and depression, social-emotional maladjustment, cogni-

tive-intellectual deficits, and neuroregulatory dysfunction (Gotlib & Goodman, 1999). In the model proposed by Goodman and Gotlib (1999), one mechanism by which mothers' depressive symptoms relate to harmful child outcomes involves children's exposure to mothers' inadequate parenting through their negative behaviors, affect, and cognitions. Relative to well mothers, depressed mothers have been observed to have poorer quality interactions with their infants, including engaging in less contingent responsivity to their infants, less affectionate contact, and fewer reciprocal vocalizations (Fleming, Ruble, Flett, & Shaul, 1988), showing more angry and intrusive behavior (Field, Healy, Goldstein, & Gutherz, 1990), and exposing their infants to more sad and irritable affect (Cohn, Campbell, Matias, & Hopkins, 1990). Furthermore, relative to mothers with transient depression, mothers with more severe or chronic depression have more impaired interaction with their infants (Campbell, Cohn, & Meyers, 1995) and have children with less coherent, organized attachment classifications (Teti, Gelfand, Messinger, & Isabella, 1995). Moreover, Carter, Garrity-Rokous, Chazan-Cohen, Little, and Briggs-Gowan (2001) found that associations between mothers' lifetime depression and impaired mother–infant interaction and insecure infant attachment were accounted for by mothers' comorbid diagnoses.

Because depressed mothers have poorer quality interaction with their infants, and because maternal sensitivity to infant cues is essential to high-quality interaction, it is important to determine whether depressed mothers have poorer detection of infant signals relative to nondepressed mothers, including either missing signals altogether or misinterpreting them. Such potential difficulty at detecting infant cues, especially infant expressions of emotion, may be part of a larger difficulty among depressed individuals of recognizing facial emotional cues in general. Persad and Polivy (1993), for example, found that female college students and depressed psychiatric patients made more errors in recognizing adult facial emotional expressions than a group of nondepressed female college students. Similarly, depressed psychiatric patients had impaired recognition of facial expressions of emotion relative to nondepressed individuals (Mikhailova, Vladimirova, Iznak, Tsusulkovskaya, & Sushko, 1996; Rubinow & Post, 1992), and depressive symptoms and errors in identifying facial expressions of emotion were positively correlated in a sample of college students (Carton, Kessler, & Pape, 1999). Furthermore, Free, Alechina, and Zahn-Waxler (1996) found that depressed mothers without psychotherapy were less accurate at interpreting infants' emotional expressions than were depressed mothers who had received treatment.

Even with samples unselected for depression, few researchers have examined mothers' ability to interpret infant cues in association with their quality of caregiving. In particular, mothers' ability to accurately interpret infants' emotional expressions may be important in terms of the quality with which they maintain interaction and respond to their infants' needs. One reason few studies

have examined these relations likely relates to the lack of standardized instruments to assess mothers' interpretation of infants' facial expressions. An important remedy to this problem was the development of the IFEEL pictures (Emde, Osofsky, & Butterfield, 1993), which presents participants with 30 pictures of infants expressing different types of emotions and requires them to identify the emotion being expressed. As part of a longitudinal study on child abuse and neglect prevention, mothers' responses to the IFEEL pictures were related to their sensitivity observed during 5-min free-play mother–infant interactions (Lodge, Blackwood, Kveton, McDowell, & Rountree, 1993). In addition, depressed mothers saw more fear and anxiety expressions and fewer joy expressions in these pictures than did well mothers (Zahn-Waxler & Wager, 1993). These findings suggest that mothers' responses on the IFEEL pictures might provide a useful means of better understanding how mothers' interpretations of infant emotional expressions and cues are related to depression and the quality of mother–infant interaction.

HYPOTHESES

Two primary hypotheses were made regarding differences between depressed and well mothers in conjunction with their interpretation of infants' facial expressions and their quality of mother–infant interaction. First, given associations between depression and poorer detection of emotional expressions (Carton et al., 1999; Free et al., 1996; Mikhailova et al., 1996; Persad & Polivy, 1993; Rubinow & Post, 1992), we expected depression in mothers of infants to be associated with lower accuracy at interpreting babies' facial expressions. We generally expected that depressed mothers as a group would be less accurate at interpreting babies' facial expressions than well mothers, and we particularly expected that higher levels of depressive symptoms among clinically depressed mothers would be associated with lower accuracy at interpreting babies' facial expressions. Second, mothers' higher accuracy at interpreting babies' facial expressions was expected to be associated with better quality interaction with their infants. We expected this relation to hold for both the depressed and well mothers such that regardless of diagnostic status, mothers who interpret infants' emotional expressions with less accuracy were predicted to interact more poorly with their own infants.

METHOD

Participants

Participants were 61 mothers and infants from the metropolitan area of Atlanta, Georgia. Mothers ranged from 18 to 44 years of age ($M = 30$ years, $SD = 5.7$). All

participants were drawn from a larger longitudinal study designed to investigate the effects of mothers' depression on infants before and after mothers were treated for their depression. Depressed mothers for this study were referred by university-affiliated psychiatrists or were recruited from the county hospital obstetrics clinic; they participated prior to beginning treatment for their depression. The comparison group of well mothers was recruited from a general participant pool maintained in the psychology department. The participants were contacted by phone and asked specifically to participate in a study on maternal depression and infants' emotional and social development (the depressed group) or in a study of infants' emotional and social development (the comparison group). The final sample had 27 women in the depressed group and 34 women in the well mothers group. A modified version of the Structured Clinical Interview for DSM–IV (SCID; First, Spitzer, Gibbon, & Williams, 1997) diagnoses was administered to the mothers by trained clinicians to confirm diagnoses of major depressive disorder in the mothers and to confirm that the comparison group contained well mothers only. The SCID was modified by adding questions to clarify that symptoms of depression were not a reflection of typical experiences of the postpartum period (e.g., sleep loss related to infant's schedule, expected weight loss, etc.).

Twenty percent of the women in both the depressed and well groups were African American, and 73% and 80% of women in the respective groups were White. Most of the women were married, with a slightly but not significantly lower percentage among depressed (75%) than well (91%) women. In addition, about one third of the women in both groups were working outside of the home (35% for depressed group and 31% for well group). The overall annual income of the families who participated ranged from the $10,000 to $15,000 category (16% of depressed group and 6% of well group) to over $100,000 per year (16% of both groups), and education levels ranged from having completed some high school (12% of depressed group and 6% of well group) to having earned a graduate school degree (12% of depressed group and 18% of well group). Depressed and well mothers did not significantly differ with regard to education level, income, ethnicity, marital status, or work status outside the home. There was a slightly but not significantly higher percentage of male infants in the depressed (67%) as compared to the well (56%) group. Finally, infants in the depressed group ($M = 3.0$ months, $SD = 1.7$) were slightly but significantly younger than infants in the well group ($M = 3.9$ months, $SD = 1.7$), $t(59) = -2.07$, $p < .05$. Participation in the study was limited to those women who provided informed consent and who had lived continuously in the same household with their infant prior to inclusion.

Procedure

Women who were eligible for the study were contacted by phone and invited to participate in a longitudinal study. Arrangements were made for the mothers and

their infants to visit our laboratory for a 2-hr procedure four times over the course of the year. The second, third, and fourth visits occurred 3, 6, and 12 months after the initial visit, respectively. This report includes data obtained from the first visit only because we were interested in how mothers' emotion accuracy and the quality of their interaction with their infants were related in depressed and well women and because the follow-up visits occurred after the depressed women had received treatment for their depression.

At the beginning of the visit, participants were brought into a room with sparse furniture and few distractions and were encouraged to become comfortable with the setting. After we obtained informed consent, mothers filled out several questionnaires and completed other tasks not relevant to this study. They were then videotaped for four 5-min segments doing various tasks with their infants—structured, age-appropriate tasks; free play; separation and reunion; and feeding. During the structured task segment, mothers were asked to change their babies' diapers. They were instructed to try and interest their babies in a rattle when they finished changing the diaper. During the free-play segment, mothers were asked to play with their infants using a bag of toys that the researcher provided. For the separation and reunion segment, mothers were asked to separate from their infants and stand outside of the room for 2 min. Mothers who expressed discomfort about being away from their infants were allowed to return to the room prior to the end of the 2 min, although only 3 mothers did so. After the separation, mothers returned to the room and were videotaped interacting with their infants for the remaining 3 min. During the feeding task, mothers were asked to feed their babies as they normally would at home, which may have included breast- or bottle-feeding. The researchers were out of the room during all four segments. Following these tasks, mothers completed a measure of their depressive symptoms and were asked to identify infants' emotional expressions in a free-response format using a standardized set of pictures. All mothers followed the same procedure and completed the measures in the same order. Videotaped segments were then rated by trained raters who were not involved in the data collection and who were blind to any information about the families or the mothers' depression status.

Measures

Mother–infant interaction quality. Mother–infant interaction quality was measured using the instructions, procedures, and rating scales from the Parent–Child Early Relationship Assessment (ERA; Clark, 1985). Both mothers and infants were observed and videotaped during the four 5-min segments: structured task, free play, separation and reunion, and feeding. The ERA specifies rating scales for each mother–infant interaction segment on 65 characteristics pertaining to parental, child, and dyadic behaviors. Each characteristic is rated using 5-point Likert scales ranging from 1 (*area of concern*) to 5 (*area of strength*). Higher

scores on all of the subscales, then, are indicative of better functioning. Clark (1999) derived eight separate subscales from these 65 items. Three subscales describe maternal characteristics, and another three delineate child characteristics. Two subscales relate to the dyadic relationship of the mother and child. Given our interest in mothers' depression, their emotional accuracy, and how they interact with their infants, only the three maternal and two dyadic subscales were used in this study. Furthermore, for each of these five ERA subscales, ratings from the four different segments (structured task, free play, separation and reunion, and feeding) were averaged to yield a single score. We found high internal consistency for Clark's three maternal subscales: Parental Positive Affective Involvement and Verbalization ($\alpha = .90$); Parental (Lack of) Negative Affect and Behavior ($\alpha = .89$); and Parental (Lack of) Intrusiveness, Insensitivity, and Inconsistency ($\alpha = .92$). In addition, we found good internal consistency for Clark's two dyadic subscales: Dyadic Mutuality and Reciprocity ($\alpha = .75$), and Dyadic (Lack of) Disorganization and Tension ($\alpha = .72$).

Independent raters completed ratings for each videotaped interaction segment. To use the ERA reliably, raters were required to review didactic material, become familiar with the manual, and rate and review several videotapes with the trainer. Rating discrepancies with the trainer were discussed and resolved during the training. During this study, initial training with Clark's laboratory occurred over the phone with the exchange of videotapes and ratings. Raters were tested for reliability with the trainer according to the reliability criteria outlined by Clark (1985). Reliability is established for this scale on a 3-point basis. A scale rating of 4 is considered reliable with a rating of 5, and both indicate that the mother is demonstrating an area of strength in the variable being rated. Similarly, a rating of 2 is considered reliable with a rating of 1 because both indicate that the mother is demonstrating an area of weakness or an area of concern from a clinical viewpoint in terms of the variable being rated. A 3 on the scale is considered separate and indicates that the mother is neither demonstrating an area of strength nor an area of weakness on the variable being measured. Thus, raters are considered to be in agreement if they both assigned a 1 or 2, both assigned a 3, or both assigned a 4 or 5. For the four different 5-min segments, the percentage agreement between raters ranged from .76 to .98, with the more conservative kappa coefficients ranging from .60 to .83.

Mothers' accuracy at identifying infant emotional expressions. To assess mothers' accuracy at identifying infants' facial expressions of emotion, mothers completed the IFEEL pictures task (Emde et al., 1993). For this task, mothers were asked to look at a booklet containing 30 pictures of infant emotional expressions developed by Emde and colleagues. Background information, description of the measure, and instructions for use are provided in the IFEEL pictures manual (Butterfield, Emde, & Osofsky, 1987). All pictures, arranged in a booklet so that

only one is seen at a time, are framed so that only the infant's face and shoulders are shown without providing other context. The pictures are in color and include a range of intensities of emotional expression as well as numerous "blends" of emotion. Approximately one fifth of the infants pictured are African American, and four fifths are White. Mothers were asked to label the emotions displayed on the infants' faces in one word using a free-response format. Specifically, all mothers were given the instructions: "Here are some pictures of babies' facial expressions. Please tell us, in one word if possible, the strongest and clearest feeling that each baby is expressing" (Butterfield et al., 1987).

Responses to the pictures were encoded using an extensive lexicon of emotion-related words for infants, developed by Emde and his colleagues, which allows each word to be placed into one of 12 categories: surprise, interest, joy, content, passive, sad, cautious–shy, disgust–dislike, anger, distress, fear, and other. Then, for purposes of this study, mothers' responses to each picture were categorized as accurate or not accurate. Specifically, for each picture, if the emotion label specified by a mother had been endorsed by over 20% of the Emde et al. (1993) norming sample, then her response was considered accurate. Any response that did not meet this criterion was considered not accurate. Using this criterion, for one half (i.e., 15) of the pictures, the mother could only specify one particular emotion category to be considered accurate, and for another 11 pictures the mother could specify only one of two particular emotion categories to be considered accurate. For two pictures, the mother could specify one of three particular emotion categories to be considered accurate. The remaining two pictures were discarded because no single emotion label was specified by at least 20% of the norming sample. When more than one category was considered an accurate response according to these criteria, the emotion categories were of the same valence. For example, for Picture 117, any response that fell into the categories of sad, anger, or distress was considered accurate because over 20% of the norming sample had given responses to that picture in each of those emotion categories. Mothers' accuracy was assessed separately for IFEEL pictures depicting positive and negative emotions. Based on the Emde et al. norming sample responses, 19 of the pictures were categorized as positive (e.g., interest, joy, content), and 9 were categorized as negative (e.g., disgust–dislike, anger, distress). Thus, the scores for mothers' accuracy at identifying infants' emotional expressions were for the percentage of pictures of positive emotions and the percentage of pictures of negative emotions, ranging from 0% to 100%.

Mothers' depressive symptoms. Mothers completed the Beck Depression Inventory (BDI; A. T. Beck, 1987) to assess their current level of depressive symptomatology. The BDI was designed to measure severity of depressive symptoms in adults. The measure contains 21 items that respondents rate on a 4-point scale ranging from 0 to 3 to describe how they have been feeling in the past week. Total scores range from 0 to 63, with higher scores indicating more severe de-

pressed mood. The BDI has been widely used with both patients and nonpatients and has been shown to have good internal consistency, discriminant validity, construct validity, and high correlations with other questionnaire and clinical ratings of depression (A. T. Beck, Steer, & Garbin, 1988).

RESULTS

Descriptive Statistics

Means and standard deviations for the mothers' depressive symptoms, emotion interpretation accuracy, and quality of mother–infant interaction are listed in Table 1 for the groups of mothers with and without depression. In addition, zero-order correlations among these variables for the depressed and well groups of women can be found in Table 2. Consistent with previous research, depressed mothers generally had poorer quality interaction with their infants than did well

TABLE 1
Descriptive Statistics Regarding Depressive Symptoms, Emotion Accuracy, and Observed Quality of Mother–Infant Interaction for Depressed and Well Mothers

	Depressed Mothers[a]		*Well Mothers*[b]		*Effect Size*
	M	*SD*	*M*	*SD*	*(r)*
Depressive symptoms	26.54	10.62	6.94	5.70	.77***
% accuracy for positive emotions	61.40	16.90	64.55	12.72	.11
% accuracy for negative emotions	53.91	14.02	56.21	17.07	.07
Mothers' Positive Affective Involvement	3.53	0.68	3.94	0.51	.31**
Mothers' (Lack of) Negative Affect and Behavior	4.73	0.30	4.78	0.26	.10
Mothers' (Lack of) Intrusiveness and Insensitivity	4.23	0.48	4.48	0.37	.29*
Dyadic Mutuality and Reciprocity	3.12	0.45	3.37	0.44	.27*
Dyadic (Lack of) Disorganization and Tension	3.95	0.34	4.08	0.32	.19

Note. Depression scores range from 0 to 63, with higher scores indicating more depressive symptoms. Accuracy scores are based on the percentage of emotion pictures accurately identified (out of 19 for positive emotions and 9 for negative emotions). The five observation scales have a possible range of 1 to 5, with higher scores indicating better functioning. Full scale names are Parental Positive Affective Involvement and Verbalization; Parental (Lack of) Negative Affect and Behavior; Parental (Lack of) Intrusiveness, Insensitivity, and Inconsistency; Dyadic Mutuality and Reciprocity; and Dyadic (Lack of) Disorganization and Tension.

[a] $n = 27$. [b] $n = 34$.

*$p < .05$. **$p < .01$. ***$p < .001$.

TABLE 2
Zero-Order Correlations Among Depressive Symptoms, Emotion Accuracy, and Observed Quality of Mother–Infant Interaction for Depressed and Well Mothers

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Depressed mothers[a]								
1. Depressive symptoms	—	−.45*	−.22	−.39*	−.06	−.30	−.45*	−.24
2. % accuracy for positive emotions		—	.01	.08	−.16	.09	.11	−.03
3. % accuracy for negative emotions			—	−.22	−.22	−.30	.08	.09
4. Mothers' Positive Affective Involvement				—	.59**	.80***	.72***	.66***
5. Mothers' (Lack of) Negative Affect and Behavior					—	.72***	.43**	.53**
6. Mothers' (Lack of) Intrusiveness and Insensitivity						—	.71***	.73***
7. Dyadic Mutuality and Reciprocity							—	.91***
8. Dyadic (Lack of) Disorganization and Tension								—
Well mothers[b]								
1. Depressive symptoms	—	.10	−.07	−.04	−.16	−.03	.05	.18
2. % accuracy for positive emotions		—	−.03	.01	.06	−.08	−.13	−.08
3. % accuracy for negative emotions			—	.35*	.62**	.53**	.43**	.51**
4. Mothers' Positive Affective Involvement				—	.48**	.79***	.80***	.59***
5. Mothers' (Lack of) Negative Affect and Behavior					—	.72***	.50**	.59***
6. Mothers' (Lack of) Intrusiveness and Insensitivity						—	.69***	.66***
7. Dyadic Mutuality and Reciprocity							—	.87***
8. Dyadic (Lack of) Disorganization and Tension								—

Note. Underlined numbers approach significance ($p < .10$).
[a]$n = 27$. [b]$n = 34$.
*$p < .05$. **$p < .01$. ***$p < .001$.

mothers (see Table 1). Specifically, depressed mothers showed significantly lower scores than did well mothers on two of the three quality-of-parenting scales and on one of the two dyadic scales on the ERA: the Parental Positive Affective Involvement Scale, $t(59) = -2.66$, $p < .05$; the Parental (Lack of) Intrusiveness and Insensitivity Scale, $t(59) = -2.32$, $p < .05$; and the Dyadic Mutuality and Reciprocity Scale, $t(59) = -2.16$, $p < .05$. As expected, women with depression scored significantly higher than the well mother group on their level of depressive symptoms, $t(59) = 8.51$, $p < .001$. Specifically, women with depression scored on average in the severe range on the BDI, whereas well mothers scored in the nondepressed range. Furthermore, even among the group of clinically depressed women, there was a wide range in the level of depressive symptoms, from 12 to 47, whereas the group of well women had, not surprisingly, little variability.

In addition, both groups of women were accurate on about two thirds of the positive emotion pictures (61% for depressed mothers and 65% for well mothers) and on slightly more than half of the negative emotion pictures (54% and 56%, respectively). A 1-between (depressed vs. well), 1-within (positive vs. negative emotions) mixed analysis of variance was conducted to determine if depressed and well mothers differed on the percentage of accuracy for positive versus negative emotions. The results indicated a significant main effect for emotion valence, $F(1, 59) = 8.00$, $p < .01$, whereas the main effect for depression status and the Depression Status × Emotion Valence interaction were not significant. These findings suggest that depressed and well mothers combined were significantly more accurate at identifying positive ($M = 63.16$, $SD = 14.67$) than negative ($M = 55.19$, $SD = 15.71$) emotions, which reflects a medium effect size (Cohen's $d = 0.52$) according to Cohen's (1992) specifications.

Hypothesis Testing

To test the first hypothesis, that mothers' depression would be associated with lower accuracy at interpreting infants' facial expressions of emotions, two analyses were performed. First, a *t* test was conducted to test the prediction that the group of mothers with depression would be less accurate than well mothers at interpreting infant expressions of emotion. As shown in Table 1, contrary to expectations, results demonstrated that there were no significant differences between the depressed and well mothers on accuracy for negative and positive emotions separately. Second, the relation between levels of self-reported depressive symptoms and accuracy at identifying infants' facial expressions was assessed using correlational analyses. As predicted, among depressed women, higher levels of depressive symptoms were associated with less accuracy at interpreting infants' facial expressions of positive ($r = -.45$, $p < .01$) but not negative ($r = -.22$, *ns*) emotions, as shown in Figure 1.

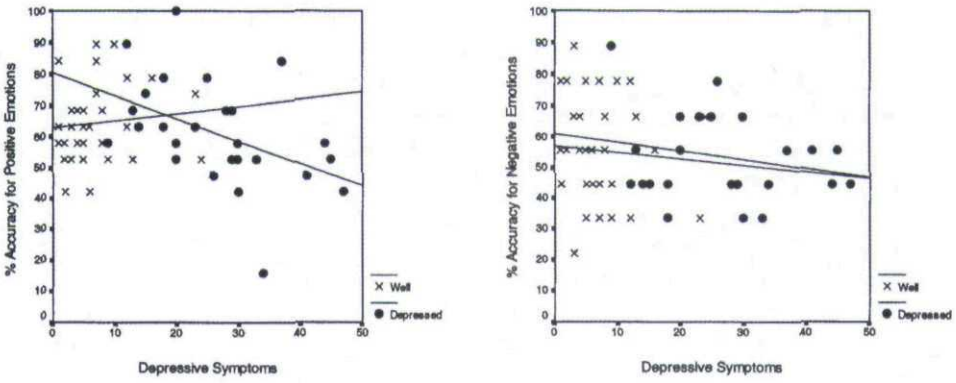

FIGURE 1 Associations between depressive symptoms and percentage accuracy for positive and negative emotions among depressed and well mothers.

Next, five hierarchical multiple regression analyses were conducted to test the second hypothesis, that mothers' higher accuracy at interpreting infants' facial expressions of emotions would be associated with better quality interaction with their infants. Specifically, for each of the five scales of observed mother and dyadic interaction quality, the following predictor variables were entered in a stepwise fashion: mothers' depression status, mothers' accuracy at interpreting negative emotions, mothers' accuracy at interpreting positive emotions, the interaction of depression status with accuracy for negative emotions, and the interaction of depression status with accuracy for positive emotions. As expected, the results showed that the interaction of mothers' depression status and accuracy for negative emotions significantly predicted the quality of mothers' interaction with their infants, specifically regarding their positive affective involvement, their lack of negative affect and behavior, and their lack of intrusiveness, insensitivity, and inconsistency (see Table 3). In other words, the interaction of depression status and accuracy for negative emotions accounted for a significant amount of the variance in mothers' interaction quality beyond that accounted for by depression or emotion accuracy alone. Follow-up simple regression analyses for depressed and well mothers separately indicated that accuracy at identifying negative emotions significantly predicted well but not depressed mothers' interaction quality on all three scales for which there was a significant interaction term in the multiple regression analyses. The standardized regression coefficients for these follow-up analyses are identical to the correlation coefficients shown in Table 2 (.35, .62, and .53 for well mothers vs. –.22, –.22, and –.30 for depressed mothers, respectively). Contrary to our expectations, the interaction of depression status and accuracy for positive emotions did not significantly predict mothers' interaction quality on any of the scales in the multiple regression analy-

TABLE 3
Results From Five Hierarchical Regression Analyses for Mothers' Depression Status and Emotion Accuracy Predicting Their Observed Quality of Mother–Infant Interaction

Quality of Mother–Infant Interaction	*B*	*SE B*	β	$R^2/\Delta R^2$
Mothers' Positive Affective Involvement and Verbalization				
DEP	0.41	0.15	0.33	.11*
NEG	0.00	0.01	0.08	.01
POS	0.00	0.01	0.05	.00
DEP × NEG	0.02	0.01	1.36	.07*
DEP × POS	–0.00	0.01	–0.18	.00
Mothers' (Lack of) Negative Affect and Behavior				
DEP	0.06	0.07	0.10	.01
NEG	0.01	0.00	0.26	.07*
POS	–0.00	0.00	–0.06	.00
DEP × NEG	0.01	0.00	2.03	.14**
DEP × POS	0.00	0.01	0.64	.01
Mothers' (Lack of) Intrusiveness, Insensitivity, and Inconsistency				
DEP	0.25	0.11	0.29	.08*
NEG	0.00	0.00	0.14	.02
POS	0.00	0.00	0.02	.00
DEP × NEG	0.02	0.01	1.97	.14**
DEP × POS	–0.00	0.01	–0.41	.01
Dyadic Mutuality and Reciprocity				
DEP	0.25	0.12	0.27	.07*
NEG	0.01	0.00	0.28	.08*
POS	–0.00	0.00	–0.01	.00
DEP × NEG	0.01	0.01	0.72	.02
DEP × POS	–0.01	0.01	–0.61	.01
Dyadic (Lack of) Disorganization and Tension				
DEP	0.13	0.09	0.19	.04
NEG	0.01	0.00	0.33	.11**
POS	–0.00	0.00	–0.05	.00
DEP × NEG	0.01	0.01	0.86	.03
DEP × POS	–0.00	0.01	–0.13	.00

Note. DEP = depression status; NEG = % accuracy for negative emotions; POS = % accuracy for positive emotions.

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

ses. For depressed mothers, then, there was no significant association between their accuracy regarding either positive or negative emotions and the quality of their observed interaction with their infants. In contrast, well mothers who were more accurate at identifying infants' negative emotions were observed to engage in better quality interaction with their infants and had better quality dyadic interaction.

DISCUSSION

Although research has documented both the importance of early mother–infant interactions for children's socioemotional development and the poorer quality interaction depressed mothers have with their infants relative to well mothers (C. T. Beck, 1995), less is known about the specific mechanisms by which depressed mothers' interactional quality with their infants suffers (Goodman & Gotlib, 1999). This study examined the accuracy with which mothers interpreted pictures of babies' emotional expressions as a means to assess the likely accuracy with which they detect their own infants' signals and, in turn, the quality with which they sensitively respond to their infants. Results somewhat supported the expectations that depression would be related to lower accuracy and that lower accuracy would be related to poorer quality mother–infant interaction. Nonetheless, two surprising findings suggest that the role of mothers' accuracy at identifying infant emotional expressions may be more complicated than originally thought.

Although depressed and well women did not differ significantly from each other on emotion accuracy, higher levels of depressive symptoms among depressed women were associated with lower accuracy. Depressed mothers, as a group, do not appear to have a receptive nonverbal deficit regarding interpreting facial expressions in infants. This optimistic result appears in contrast to previous research that has found depressed individuals to make more errors in recognizing facial expressions (e.g., Carton et al., 1999; Mikhailova et al., 1996; Persad & Polivy, 1993; Rubinow & Post, 1992). One important difference between this study and previous ones is that the former focused on facial expressions of infants, whereas the latter tested depressed individuals' ability to recognize facial expressions in adults. Mothers, even depressed ones, may be able to accurately detect positive and negative emotional states in infants, whose emotional displays likely have more intensity than the subtle variants often expressed in adults. To that end, future research should test whether depressed mothers are better at distinguishing more intense than more subtle emotional expressions. Moreover, positive and negative emotional states in babies are particularly salient for mothers of young infants, who have a greater investment in identifying and understanding the emotional displays of their babies' needs and wants so they can meet them.

Among the depressed group, the association between depressive symptoms and lower accuracy at identifying infants' positive emotions supports the hypothesis that depression is related to lower accuracy at identifying emotions, although only at the highest levels of depression severity. Future research should replicate this finding. It is worth noting that the association between depressed mothers' level of depressive symptoms and their accuracy at interpreting infants' negative emotional expressions was not significant. Thus, severely depressed mothers may be so mired in their own negative emotional experience that they are less likely to notice and identify positive emotions than negative emotions expressed by infants. This finding is consistent

with cognitive theories of depression in that higher levels of depressive symptoms may be associated with a negative bias and, thus, a tendency to misperceive positive emotions (A. T. Beck, Rush, Shaw, & Emery, 1979). It is worth remembering that depressed and well mothers were more accurate at identifying pictures of infants' positive than negative emotions, suggesting that babies' positive emotions may have been easier to detect than their negative ones, which is compatible with previous research. Matias and Cohn (1993), for example, found that infants' negative emotional expressions were more likely to involve blends, and thus be more difficult to interpret, than their positive emotional expressions. Furthermore, the lower accuracy for positive than negative emotions is not likely to be a result of the disparity in the number of positive (i.e., 19) and negative (i.e., 9) emotion pictures, which might suggest that having fewer negative emotion pictures increases the potential for error and the likelihood of having lower accuracy on them. It is all the more striking, in fact, that depressed mothers' higher levels of depressive symptoms were associated with lower accuracy of positive, but not negative, emotions.

These correlational findings do not provide evidence of the directionality of the relation between depressive symptoms and inaccuracy. In other words, preexisting poor emotion accuracy may contribute to women becoming depressed, especially as they feel inept at identifying their infants' emotions, or depression may cause women to have poor emotion accuracy that is state dependent. Regardless of the onset of the cycle, the depressive symptoms and poor emotion accuracy likely feed off of one another and create a negative downward spiral. Future investigation should seek to better understand this process and test the efficacy of interventions at different points in the process. Interestingly, one study found that the poorer quality parenting of depressed mothers with their infants, relative to well mother–infant dyads, was diminished to a nondetectable level after the women were treated for their depression (Goodman, Broth, Hall, Tully, & Stowe, 2002). If the parenting deficits of depressed mothers are in fact state dependent, then the inaccuracy of detecting infants' emotional expressions may be dependent on a severe depressive state as well. Future research should test this hypothesis.

The second surprising finding pertains to the different pattern of results found for depressed and well mothers in terms of the association between their emotion accuracy and the quality of interaction with their infants. Specifically, as expected, well mothers' accuracy at identifying infants' negative emotions was related to their better quality interaction with their infants. Perhaps among well mothers, being more aware of and sensitive to their infants' distress facilitates their engaging with their infants with better quality. This association between accuracy for negative emotions and the quality of mother–infant interaction among well mothers appears in a larger context of research that attests to the value of children being exposed to a range of emotions, including a moderate amount of negative emotions (e.g., Denham & Grout, 1992; Garner, Jones, & Miner, 1994; Izard, Haynes, Chisholm, & Baak, 1991). In contrast, depressed mothers' accuracy for negative or positive infant emo-

tions was not significantly associated with their quality of parenting. In fact, among depressed women, although not significant, several of the associations suggested that higher accuracy was related to poorer quality parenting. Because depressed and well mothers did not differ in terms of accuracy regarding emotions, it may be that when depressed mothers, already feeling emotionally compromised, accurately perceive negative emotions in their infants, they feel overwhelmed and have difficulty responding effectively and sensitively, a hypothesis that should be tested in future research. These findings also suggest a potential target of preventive intervention, to help depressed women to interpret their infants' negative emotions in a way that facilitates their positive engagement with a distressed infant.

In addition, the association between mothers' emotion accuracy and interaction quality may not be direct; that is, it may be an indirect association that involves mediating factors such as mothers' cognitions. For example, mothers' depressive symptoms have been found to be associated with their parenting inefficacy (Fox & Gelfand, 1994), and mothers' negative perceptions of the maternal role fully mediated the association between mothers' depressive symptoms and their use of punishment (McLoyd, Jayaratne, Ceballo, & Borquez, 1994). Depressed and well mothers who accurately identify their infants' negative emotions need to believe that they can respond in an effective way to actually do so, which severely depressed mothers may have difficulty doing. In addition, maternal attributions for their infants' emotional expressions (e.g., Lieberman, 1999) may play an important role in the link between mothers' emotion accuracy and interaction quality. Mothers' ability to accurately recognize negative emotions in their infants, then, may be insufficient to ensure a sensitive, effective response. Future research should test these potential cognitive mediators.

Although this study provides novel information about depressed and well mothers' emotion accuracy and interaction quality, several of its limitations must be addressed. As part of a treatment outcome study, the clinically depressed women were those willing to seek treatment for their depression. Accordingly, the generalizability of the findings to women with subclinical levels of depression in the community or to those who choose not to seek treatment is limited. In addition, the observed mother–infant interaction took place at one point in time, which may or may not be reflective of the mothers' parenting over time. Nonetheless, we combined mothers' observed parenting in different tasks (e.g., free play, feeding) to better represent mothers' parenting across different situations that they would typically face on a regular basis. Finally, mothers' accuracy of infants' emotional expressions was based on a laboratory measure. Future research should examine mothers' accuracy at identifying emotional displays in their own infants, which may relate differently to their interaction quality than do photographs of other infants' emotional expressions. Mothers' familiarity with their own infants may make them more accurate, or mothers' history of poorer quality interaction with their own infants—as in the case of postpartum depressed women—may make them less accurate.

In conclusion, this study provides evidence for the importance of examining mothers' emotion accuracy in relation to the quality of their parenting. It also provides one of few findings that reveal no impairment in depressed as compared to nondepressed women as a group, specifically regarding the accuracy with which they identify infants' emotions. The novel information about different patterns of associations in depressed and well women between their emotion accuracy and parenting quality adds an important contribution to the literature and suggests new directions for future research in this area. As more information about potential mechanisms is revealed, more effective interventions with depressed mothers and, ultimately, better preventive intervention efforts with women at risk for depression can be designed, implemented, and tested.

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