"MOODY BLUES": Affect Interpretation of Infant Facial Expressions and Negative Affect in Mothers of Preterm and Term Infants

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Abstract

Preterm birth places infants at increased risk for adverse developmental outcomes, with self- and affect regulation problems among the most important impairments. However, few studies have empirically examined maternal interpretation of infant affect in mothers of pre- and term infants. The current study examines how negative affect of mothers of preterm and term infants is associated with their interpretation of infant facial expressions.

One hundred and sixty-eight mothers with their infants (64 term and 104 preterm) participated. Seven days after birth, mothers completed the UWIST Mood Adjective Checklist (UMACL; Matthews, Jones, & Chamberlain, 1990) to assess maternal negative affect. During a home visit, six months after birth, mothers additionally completed a task developed to measure infant affect interpretation (Interpreting Facial Expressions of Emotions through Looking at Pictures task, IFEEL pictures task; Emde, Osofsky, & Butterfield, 1993).

Mothers of preterm infants reported more negative affect than mothers of term infants. However, the relationship between infant birth status (i.e., term *vs.* preterm) and maternal interpretation of infant facial expressions was moderated by the mother's own negative affectivity. Surprisingly, particularly mothers of term infants who also reported high levels of negative affect were found to interpret infant affect significantly more negatively.

Prematurity itself does not seem to be a dominant factor in determining maternal infant affect interpretation, though maternal psychological negative mood does. Both theoretical and practical implications of the results are discussed.

Keywords: maternal negative affect, infant, affect interpretation, preterm

Introduction

In recent years approximately 8% of all newborns in the Netherlands are born preterm, i.e., before 37 weeks of gestational age (Waelput & Kollée, 2008). Due to advances in neonatal care, survival rates among these infants have increased substantially. However, preterm birth still places infants at great risk for adverse developmental outcomes and serious psychological problems (Escobar et al., 2006; Müller-Nix & Ansermet, 2009), and optimal care from parents for vulnerable infants is needed. According to evolutionary theory (Trivers, 1972), parents may be reluctant to provide optimal care, in particular when having limited resources, because of the poor fitness of preterm infants. For example, the crying of preterm infants is experienced as significantly more aversive (Frodi, Lamb, & Wille, 1981; Soltis, 2004) and is more likely to elicit physical abuse and neglect. Cross-cultural research has shown that parental neglect and abuse do occur in infants with poor survival prospects, either due to their ill health or detrimental circumstances (Daly & Wilson, 1984, 1988; Soltis, 2004). Uncertainty about the infant's health status and about their developmental outcome may also delay and disrupt bonding in parents (DeMier et al., 2000).

Besides cognitive and motor delays (Bhutta, Cleves, Casey, Cradock, & Anand, 2002), problems with affect regulation are among the most important problems in preterm infants (Bradley, 2000). Affect regulation refers to the ability to modulate feeling states, mostly in terms of the valence of these states, and the ability to act upon situations appropriately (Larsen & Prizmic, 2004). Difficulties in the ability to regulate affect and affective states are considered risk factors for the development of several psychopathological problems and disorders in later life.

The development of affect regulation in infants in the first year of life is strongly influenced by the quality of mother-infant interaction. The better the quality of daily interaction patterns between mother and child, the better the self-regulation skills that infants develop during the first years of life. Particularly, the way in which mothers interpret their infant's affect has been shown to affect the way infants learn to regulate their own affective states (Fonagy, Gyorgy, & Jurist, 2004; Meurs & Vliegen, 2008). If mothers systematically misinterpret their infant's affective signals and states, their infants will adopt and internalize these inadequate affect interpretations. The infant, on its turn, will fail to develop the capacity to interpret and regulate its own affective states in an effective, efficient and adequate way (Farc, Crouch, Skowronski, & Milner, 2006; Meurs & Vliegen, 2008; Spangler, Maier, Geserick, & Wahler, 2010).

Although to date little is known about specific factors affecting maternal affect interpretation, two factors, in particular, seem to play a crucial role in mothers'

interpretation of the infants' affect, i.e., preterm birth and mother's own psychological state. First, for mothers of preterm infants it is often difficult to interpret their infant's affect adequately. Preterm infants are less expressive and less attentive. The opportunities for making eye contact are limited and the infants are less oriented towards their mother's face (Beek, Hopkins, & Hoeksma, 1994; Bozette, 2008). Mothers of preterm infants are therefore confronted with greater challenges in terms of reading their infants' signals appropriately (Bradley, 2000). Affective states of preterm infants are therefore much more difficult to interpret. In addition, as a result of the unexpected and often traumatic birth of a preterm infant, these mothers are at increased risk of developing psychological distress (Fegran, Helseth, & Fagermoen, 2008; Vigod, Villegas, Dennis, & Ross, 2010).

Moreover, in the first period after birth, mothers more generally experience a period of postpartum blues or negative affect, with a wide variety of symptoms that generally involve mood lability, tearfulness, and more or less mild forms of anxiety and depressive symptoms. The ability to interpret their infant's affect and facial expressions adequately may then be hampered by heightened levels of maternal psychological distress in the postpartum period. Distressed mothers are not always open to experience negative emotions and tend to interpret emotions in a less constructive way (Meurs & Vliegen, 2008). High levels of maternal distress generally imply also increased levels of depressive symptoms (Davis, Edwards, Mohay, & Wollin, 2003). Women experiencing depressive symptoms, in particular, judge neutral facial expressions as significantly more negative than healthy women (Frewen & Dozois, 2005) and also interpret infant facial expressions more negatively (Emde, Osofsky, & Butterfield, 1993; Meurs & Vliegen, 2008; Stein et al., 2010). The own negative affect of depressive mothers thus produces a negative bias when interpreting their infants' affect. It is found that the higher the levels of negative affect these depressive mothers experience, the more likely they are to notice and identify negative emotions expressed by their children (Robbins-Broth, Goodman, Hall, & Raynor, 2004). Infants of mothers who experience negative affect may subsequently, on their turn, internalize this negatively biased way of interpreting affect (Meurs & Vliegen, 2008). As a result, those infants will more often experience negative affect themselves than infants of mothers who are not experiencing negative affect. The negatively biased interpretation of their affect by their mothers will thus lead to a negatively biased interpretation of their own affect and may put the infant at an increased risk for developing internalizing psychopathology in childhood and adolescence (Bradley, 2000; Emde et al., 1993; Larsen & Prizmic, 2004). Furthermore, it is known that interventions aimed at influencing parental psychological states and mood are highly effective in preventing infants from developing psychopathology (Keren, Feldman, Eidelman, Sirota, & Lester, 2003; Korja et al., 2008). An early intervention program to reduce

negative affect and mood in mothers may thus additionally decrease the risk for developing psychopathology in preterm infants.

Up until now few studies have been conducted to examine the relationship between maternal mood or negative affect and the interpretation of infant affect in mothers of term infants (Arteche et al., 2011; Stein et al., 2010). The current study is among the first to examine whether maternal negative affect or mood is associated with a biased interpretation of the infant's facial expressions of affect and whether the status of the infant (term or preterm) also has an effect on this process. It is expected that mothers who experience more negative affect also interpret infant facial expressions more negatively than mothers who experience less negative affect themselves. Since interpretation of infant affect through facial expressions is more difficult in preterm infants, because of a lack in expressive signals, especially in mothers of preterm infants the effect of maternal negative affect on affect interpretation is expected to be salient.

Methods

Participants

This study is part of a longitudinal project in which parents of term and preterm infants are followed during the first six months after childbirth. Of the term infants 52% were firstborns and 78% of the preterm infants were firstborn. Parents were enrolled in the study between September 2009 and November 2011 (see Tooten et al., 2012). Mothers with term infants (37-42 weeks gestational age, *n*=64) were recruited from maternity wards of eight general hospitals in the southern part of the Netherlands. Mothers with preterm infants (25-36 weeks gestational age, *n*=104) were recruited from maternity wards of eight general hospitals as well as from the neonatal intensive care unit (NICU) of two specialized hospitals. The recruitment was conducted by nurses. Parents were asked to participate within 24 hours after given birth. The families who met the inclusion criteria and were interested to participate in the study were informed about the implications of the study and the intervention in general (i.e., the amount of time and the home visits) by the nurses. Mothers had to speak and read Dutch fluently and sufficiently. The study was approved by the Dutch Medical Ethical Testing Committee (METC).

Measures

Background measures. Background measures (such as birth weight, maternal educational level, ethnicity, marital status) were provided through questionnaires filled in by the mothers one week after birth.

Negative affect. Negative affect was measured using the UWIST Mood Adjective Checklist (UMACL; Matthews, Jones, & Chamberlain, 1990). The UMACL consists of 52 positive (e.g., calm, comfortable, satisfied) and negative (e.g., sad, depressed, fearful) mood states. Responses range from 0 *(not at all)* to 3 *(very much).* Mothers are asked to indicate how often they experienced the described mood states in the past week. In the current study, we were particularly interested in negative affect and the possible lack of positive affect experienced by the new mothers. Therefore, we created a composite measure of positive and negative affect. Positive moods were reversely coded and a total scale score was computed by adding up all of the scores. Higher score represented more negative affect. The total score could range from 0 to 156. In the current study the scores were *M*=54, *SD*=22 and Range 5-112, with a Cronbach alpha of .94. The predictive and discriminant validity of the UMACL are satisfactory (Matthews et al., 1990).

Affect interpretation. Affect interpretation of infant facial expressions by mothers was assessed using the Infant Expressions of Emotions from Looking at Pictures task (IFEEL pictures task; Emde et al., 1993), which is a projective test to evaluate individual differences in attributions of emotions seen in infants. The test is designed to identify parents who systematically interpret their infant's affective signals as negative affect (Meurs & Vliegen, 2008). The IFEEL pictures task consists of 30 pictures showing ambiguous facial expressions in infants. The mothers were asked to describe in one word the strongest and clearest emotion that the displayed infant on the photograph expresses. Their description of the emotional expression was allocated to one of twelve basic categories of affect; five positive affect categories and seven negative affect categories. There was also a category for non-decodable descriptions of emotional expression and a category for missing answers. The number of descriptions of emotions that were allocated to the different categories was counted and it was assessed if mothers had a negative or a positive bias in their affect interpretation. In the present study we assessed how often mothers responded with a negative emotion to the 30 pictures. The mean of negative emotions is *M*=10.6 (*SD*=3.4; Range 4-23). The IFEEL pictures task shows good psychometric properties. The IFEEL pictures test also showed good inter-observer reliability of more than .80.

Procedures

When mothers showed interest in participating in the study, a nurse informed them in detail about the aim of the study. When the mothers agreed to participate, they signed an informed consent form. One week after birth, mothers were asked to fill in the questionnaires regarding background information (e.g., educational level, marital status, and medical history). The UMACL to assess maternal negative affect was completed one week after birth and the IFEEL pictures task was administered six months after birth during a home visit.

Statistical Analyses

Background measures. Mothers of preterm infants and mothers of full term infants were compared on all background characteristics. The background characteristics were analyzed using Chi-square and *t*-tests.

Pre- vs. term. Pearson product-moment correlation coefficients were calculated to examine the relationships between infant status (i.e., preterm vs. term), maternal negative affect, and mothers' affect interpretation of infant facial expressions.

Maternal negative affect. To assess the differences in negative affect between mothers of preterm and term infants, an independent samples *t*-test was conducted with infant status (term vs. preterm) as independent variable and total number of negative emotions as dependent variable.

Affect interpretation. To evaluate the differences in interpretation of infant facial expressions/affect between mothers of preterm and term infants, total scores were computed for the number of negative emotions that mothers adjusted to infant facial expressions. A sum score was obtained for affect interpretation of negative interpretations. An independent samples *t*-test was conducted with infant status (term vs. preterm) as independent variable and the number of negative affect interpretations as dependent variable.

The relationship between maternal negative affect, preterm birth and affect interpretation of infant facial expressions. To examine if maternal negative affect moderates the relationship between preterm birth and maternal affect interpretation, first total scores were computed for the amount of negative affect experienced by mothers. To analyse the (moderating) relationships among maternal negative affect, maternal negative affect interpretation of infant facial expressions and preterm

birth, a hierarchical regression analysis was conducted with maternal negative affect interpretation as dependent variable and maternal negative affect, infant status and the interaction term as independent variables. In the first step, for gestational age a dummy variable (i.e., infant status) was created with 0 representing infants born full term ($\geq$37 weeks of gestational age) and 1 representing infants born preterm (<37 weeks of gestational age). In the second step, an interaction term was created to represent the interaction effect between maternal negative affect and infant status. Subsequently, post hoc analyses were performed to interpret significant interaction terms. Finally, an additional hierarchical regression analysis with gestational age as a continuous predictor variable (instead of preterm vs. term as dummy variable) was conducted.

Results

Sample characteristics are presented in Table 1. Term and preterm infants significantly differed on neonatal background variables associated with prematurity. Obviously, the preterm infants had significant lower gestational age [$t(2, 164)=17.82$, $p<.001$] and lower birth weight [$t(2, 164)=15.10$, $p<.001$]. In the preterm group more infants were firstborns than in the term group (78% vs. 52%). In addition, a significant difference was found between preterm and term infants on maternal age at birth [$t(2, 166)=2.99$, $p<01$]. The mean age of mothers in the term group was higher than in the preterm group. Also a significant difference between groups was found in maternal educational level [$\chi^2(2, 166)=16.08$, $p<.01$]. There were significantly more mothers with a medium educational level in the preterm group compared to the full-term group. In the full-term group significantly more mothers had a high educational level than in the preterm group. Maternal age at birth ($r=.05$, p=ns), and maternal educational level [$F(2, 165)=1.78$, p=ns], however, were not found significantly related to the study variable.

Table 1. *Descriptive Statistics and Differences Between Full- and Preterm Infants*

	Full- term ≥37 weeks GA (*n*=64)		Preterm <37 weeks GA (*n*=104)		*F*
	M	*SD*	*M*	*SD*	
Gestational age (weeks)	39.54	1.40	32.31	3.01	17.92[***]
Birth weight (gram)	3433.70	503.71	1869.66	721.02	15.10[***]
Maternal age at birth (years)	33.38	4.21	31.07	5.06	2.99[**]
	n	%	*n*	%	χ2
Maternal educational level					16.08[**]
Low	6	9.4%	20	19.2%[*]	
Medium	13	20.3%	44	42.3%[*]	
High	45	70.3%	40	38.5%[*]	
Marital status					.81
Single/divorced	1	1.6%	4	3.8%	
Cohabiting	25	39.1%	42	40.4%	
Married/Registered artners	38	59.4%	58	55.8%	
Birth order					27.66[***]
Firstborns	33	52.0%	80	78.0%	
Laterborns	31	48.0%	23	22.0%	

Note. GA = Gestational age.
[*]*p*=<.05, [**]*p*=<.01, [***]*p*=<.001.

Univariate Correlations

Pearson product-moment correlation coefficients were calculated to examine the relationships between infant status (i.e., preterm *vs.* term), maternal negative affect, and mothers' affect interpretation of infant facial expressions. There was a weak positive, but significant correlation between negative affect as experienced and reported by mothers and their negative affect interpretation of infant facial expressions (r=.18, p<.05) and between maternal negative affect and infant status (r=.25, p=.001). The lower the gestational age, the higher the negative affect as experienced by mothers. No significant association was found between mothers' negative affect interpretation and infant status (r=.04, p=ns).

Differences between Mothers of Preterm and Term Infants

An independent samples *t*-test showed a significant difference between mothers of full term infants and mothers of preterm infants on maternal negative

affect $t(166)=-3.38$, $p=.01$, with mothers of preterm infants scoring significantly higher on negative affect than mothers of full term infants (Table 2). In contrast, no significant difference was found for the mean scores for negative affect interpretation between mothers of full-term and preterm infants $t(166)=-.56$, $p=.58$.

Table 2. *Mean Scores for Maternal Negative Affect and Maternal Negative Affect Interpretation, Sorted by Gestational Age*

	Preterm		Term		t
	M	SD	M	SD	
Negative affect	58.35	22.85	46.70	19.55	3.38[*]
Affect interpretation	10.66	3.46	10.36	3.37	-.56

[*]$p=<.05$, [**]$p=<.01$.

Interaction Effects

To analyse the possible (moderating) relationships among maternal negative affect, maternal negative affect interpretation of infant facial expressions and preterm birth a hierarchical regression analysis was conducted with maternal interpretation of infants facial expressions as dependent variable.

Table 3. *Hierarchical Regression Statistics for Maternal Negative Affect Interpretation Regressed on Infant Status and Negative Affect*

	Maternal Negative Affect Interpretation				
	β	R^2	ΔR^2	F	df
Step 1		.03[*]	.03[*]	2.61	2,165
Infant status (preterm vs. term)	.00				
Negative affect	.18[*]				
Step 2		.05[*]	.02[*]	3.17	3,164
Infant status	.38				
Negative affect	.42[**]				
Negative affect x infant status	-.52[*]				

[*]$p=<.05$, [**]$p=<.01$.

The analysis (Table 3) revealed a significant main effect of maternal negative affect on maternal negative affect interpretation in the first step ($\beta=.18$, $p<.05$). Higher scores of maternal negative affect were associated with higher scores on negative affect interpretation of facial expressions on photographs of infants. Infant status (i.e., term vs. preterm) was not found significantly related to maternal

negative affect interpretation, in the first step (β=.001, p=ns). The main effect of maternal negative affect (β=.42, p<.05) remained significant in the second step and also the interaction term of maternal negative affect and infant status was found to be significantly related to maternal negative affect interpretation of infant facial expressions (β=-.52, p<.05) with a significant R^2 change of .02 [$F(1, 164)$=4.01, p<.05]. Subsequent post hoc tests (Figure 1) reveal that mothers of term infants interpret infant facial expressions more negatively than mothers of preterms if they themselves experience more negative affect [Term infants $M_{\text{low negative affect}}$=9.63, SD=3.14; $M_{\text{high negative affect}}$=12.22, SD=3.28; Preterm infants $M_{\text{low negative affect}}$=10.49, SD=3.47; $M_{\text{high negative affect}}$=10.78, SD=3.48; $F(1, 164)$=3.98, p<.05]. An additional hierarchical regression analysis with gestational age as a continuous predictor variable (instead of preterm vs. term) showed similar results [$F(3, 163)$=3.02, R^2=.05, ΔR^2=.02, p<.05].

Figure 1. *Affect Interpretation of Facial Expressions in Relation to Maternal Negative Affect, Separately for Mothers of Preterm and Term Infants*
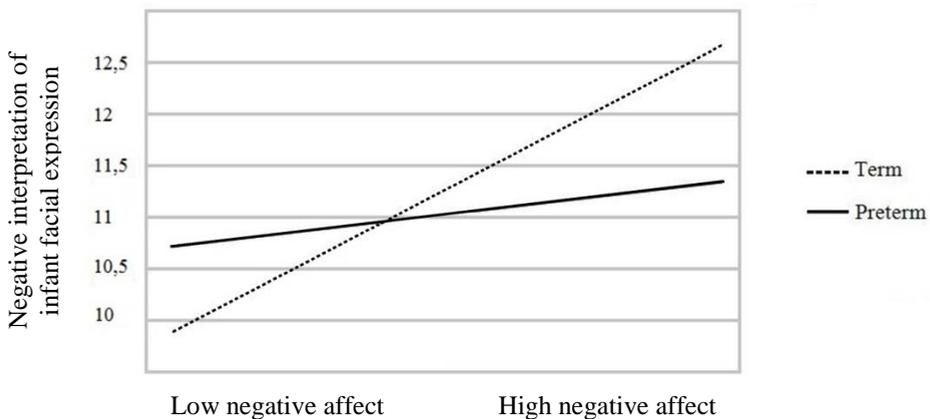
Discussion

This study is among the first to examine the relationship among preterm birth, maternal mood and mothers interpretation of infant affect. As expected and in line with previous studies, one month after birth mothers of preterm infants reported more negative affect than mothers of term infants. The risk of developing a negative mood and negative affect after birth and having a 'moody blues' period thus increases when an infant is born prematurely (Fegran et al., 2008; Vigod et al., 2010). We further predicted that higher levels of negative affect would

subsequently cause a negative bias in interpreting affect expressed by infants (Robbins-Broth et al., 2004). This expectation was partly supported by the results of the present study. Remarkably, in contrast to our hypothesis, only in *term* infants, higher levels of maternal negative affect were significantly related to higher levels of negative infant affect interpretation.

To put it differently, the most salient factor that causes a negative bias in interpretation of infant affect or facial expressions is thus not having experienced a preterm delivery/birth per se. After having a preterm delivery almost all parents experience more negative feelings for a substantial period of time. This is inherent to the stressful situation of preterm birth in which anxieties and worries prevail. The high levels of negative mood in parents of preterm infants may therefore be different from high levels of negative mood and affect reported by parents of term infants. In this latter group high levels of negative mood are not directly related to the stressful situation of a preterm delivery but may be rather connected with underlying personality traits or context variables.

Another possible explanation for the finding that prematurity is not related to negative affect interpretation by the mother may be offered by the theory of compensatory care (Beckwith & Cohen, 1978; Hoffenkamp et al., 2012). To attenuate the effects of hazardous events – like preterm birth – parents may increase care giving behavior to their vulnerable infant. Some studies indeed reported that a preterm birth actually may stimulate more parental care and investment instead of disinterest and non-attachment (Wright & Zucker, 1980).

The interaction effect, i.e., that especially in mothers of term infants, negative affect has an effect on interpretation of facial expressions, finally may be explained by the sophisticated care and support for preterm infants in the Dutch health care system. In the current sample, infants born preterm generally stayed in the hospital after birth for at least eight days. In the hospital mother and infant receive individualized care by highly qualified professionals, such as nurses and medical doctors. It has been demonstrated that infants and their families benefit significantly from the individualized care they receive during hospitalization of a preterm infant (Als et al., 2003). Adjusting to infant signals and cues as well as growth promoting communication patterns are the main focus of developmental care in neonatal settings. All parents of preterm infants are supported by nurses to focus and respond to the most subtle signals of the infant. As a consequence, although these mothers may experience high levels of negative affect in the first week after birth, this may not affect the interpretation of their infants' signals as more negative.

In the present study, the group of preterm infants consists of both very preterm infants (born before 31 weeks gestational age) and moderately preterm infants (born between 32-37 weeks gestational age). In particular the very preterm infants

and their parents (i.e., mothers) were submitted to a Neonatal Intensive Care Unit (NICU) and received specialized care tailored at the difficulties mothers of preterm infants may encounter (Als et al., 2003; Raju, Higgins, Stark, & Leveno, 2006). As such, these mothers may have been successfully guided in anticipating upon the signals their infants express. One of the main aspects that are focused upon by nurses concerns the difficulties in interpreting the infants' affect through facial expressions (Beek et al., 1994; Bozette, 2008; Bradley, 2000).

The training by the nursing staff further aims at making mothers more sensitive to the subtle expressive signals of their preterm infant and reacting to these signals properly. To interpret infant affect adequately, however, mothers' own psychological state is considered to be an important factor. Whereas mothers of preterm infants may not differ as much from mothers of term infants in terms of the ability to pick up their infants' expressive signals due to specialized training during hospitalization, they nevertheless do experience more negative affect. Since negative affect during the postpartum period may hamper the development of optimal bonding between mother and child, acknowledgement of maternal negative mood is nevertheless needed.

Some limitations of the current study must be stressed. First, only 6% of the variance of negative affect interpretation is explained and we only assessed maternal negative affect in relation to the interpretation of infant facial expressions. However, factors like personality traits and other parental characteristics could also be expected to affect interpretation of infant faces. Future studies are needed to further assess the role of these factors. Next, the UMACL and the IFEEL pictures task have norms based on a population of mothers of term infants (Matthews et al., 1990; Meurs & Vliegen, 2008). Both instruments are not validated in populations of preterm infants. Furthermore, because of the time elapsed between the administration of the UMACL one week after birth and administering the IFEEL pictures task six months after birth, it is difficult to determine how negative mood at one week after birth has influenced the difficulty in affect interpretation six months after birth.

Finally, the group of preterm infants consisted of moderately preterm infants as well as very preterm infants. These two groups may differ in specific ways. For example, especially very preterm infants have received intense and specialized care during the first weeks and months after birth. The differences between moderately preterm and very preterm infants may be substantial in a number of cases; as such the group may be less homogenous and it can be more difficult to derange conclusions from the results. Additional analyses, however, did not show gestational age to be a significant predictor in the analyses.

In general and in line with previous research, we found that preterm birth was related to experiencing more negative affect in mothers. However, the current study adds to previous research that not mothers of vulnerable preterm infants but mothers of term infants may be more at risk to interpret their infants' signals more negatively. In the term group, mothers' negative affectivity seems to have a stronger impact on their affect interpretation of infant facial expressions than in the preterm group. Prematurity in itself does not seem to be a dominant factor in determining maternal infant affect interpretation, though maternal psychological negative mood does. Since the negative bias in the interpretation of infant affect due to maternal negative affect leads to an increased risk for the development of internalizing disorders in infants, such as depression and anxiety, future research should focus on preventive interventions and support for mothers experiencing high levels of negative affect.

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