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The Contribution of Infant, Maternal, and Family Conditions to Maternal Feeding Competencies

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SYNOPSIS

Objective—Because little is known about the role of family problem-solving processes in the development of mothers' competencies in feeding a very low birth-weight (VLBW) infant, we explored the contribution made by the competence in negotiating displayed by a mother and family member as they jointly problem solve infant-care issues. The infant's neonatal biomedical condition, maternal depressive symptoms, and family poverty status may also contribute to feeding competencies.

Design—A sample of 41 mothers of VLBW infants from 2 longitudinal studies who were observed during feeding at 1 and 8 months infant postterm age, with a family member of their choosing, participated in a dyadic problem-solving exercise. We assessed maternal feeding competencies with the Parent–Child Early Relational Assessment (Clark, 1997) and dyadic negotiating competence using an observational scale from the Iowa Family Interaction Rating Scales (Melby & Conger, 2001). We classified infant condition through medical record audit. Maternal depressive symptoms were assessed with the Center for Epidemiologic Studies–Depression (CES-D) Scale (L. S. Radloff, 1977), and family poverty status was determined through the mother's report of family income.

Results—Mothers' feeding competencies, structured into 2 factors, Parental Positive Affective Involvement, Sensitivity, and Responsiveness (PPAISR) and Parental Negative Affect and Behavior (PNAB, scored in the direction of low negativity) were stable from 1 to 8 months, accounting for the entire set of predictor variables. Neonatal biomedical condition had no effect on either PPAISR or PNAB; depressive symptoms were negatively associated with PNAB at 8 months; poverty status negatively predicted both PPAISR and PNAB at 1 and 8 months; and negotiating competence of the mother–family member dyad was positively associated with PNAB at 1 month.

Conclusions—Evidence that family poverty status and dyadic negotiating competence were both associated with maternal feeding competencies supports inclusion of these family-level variables in a model of feeding competencies. A mother's negotiating competence with another family member who takes a responsible role in infant care may support maternal feeding competencies during a VLBW infant's early weeks when parenting patterns are forming.

INTRODUCTION

From the time of a premature infant's birth, mothers confront cognitive, emotional, social, and medical obstacles in taking on parenting functions, beginning a relationship with the infant, and negotiating roles of family members (B. P. Black, Holditch-Davis, & Miles, 2008; Flacking, Ewald, Nyqvist, & Starrin, 2006; Holditch-Davis & Miles, 1997). The infant's vulnerability related to prematurity may be enhanced by physiological problems associated with immaturity, including apnea and bradycardia, uncoordinated sucking, swallowing, and breathing, and gastrointestinal signs of poorly handling enteral feeding, as well as medical problems such as sepsis or acute lung disease after birth that may become chronic (Ehrenkranz et al., 2006). Along with a sense of powerlessness about the infant's well-being and difficulty in noting or interpreting the infant's cues of need, the infant may be slow to gain weight or progress in neurodevelopment, contributing to a mother's uneasiness, anxiety, or symptoms of depression. The infant's homecoming is a turning point in the transition from being a parent of a fragile premature infant with medical complications or an uncertain prognosis in an unfamiliar and, perhaps, unwelcoming neonatal intensive care environment to assuming the responsibility and control of the infant's care (B. P. Black et al., 2008). However, a mother may yet face obstacles or challenges in caring for the infant and in negotiating support from family members. Episodes of acute illness and rehospitalizations may occur, threatening a mother's confidence and arousing symptoms of depression (Bakewell-Sachs & Gennaro, 2004).

A premature infant's nutrition, beginning with parenteral and tube feedings, does not always progress smoothly in the neonatal intensive care unit, and infants may be discharged home before they are skillful nipple feeders. Although mothers may become more confident of their capacity to feed their premature infants with experience in the early weeks (Reyna, Pickler, & Thompson, 2006), the feeding issues may change with infant development, and feeding a premature infant may challenge mothers throughout the infant's first postterm year (Pridham, Saxe, & Limbo, 2004; Singer et al., 2003; Thoyre, 2000, 2001). This challenge may put a mother at risk for difficulty in competently feeding her premature infant. Feeding competencies are qualities of maternal affect and behavior that are likely to support effective, regulated infant feeding and positive social emotional experience. Maternal feeding competencies have been linked with aspects of infant health, including growth (DeWitt et al., 1997; Pridham, Brown, Sondel, Clark, & Green, 2001; Pridham, Brown, Clark, Sondel, & Green, 2002); cognitive, social, language, and motor development (Bee et al., 1982; Pridham et al., 2002); stress reactivity (Hane, Fox, Polak-Toste, Ghera, & Guner, 2006); and the quality of the mother-infant relationship (Lucarelli, Ambruzzi, Cimino, D'Olimpio, & Finistrella, 2003; Lumeng, Patil, & Blass, 2007).

Despite its theoretical and clinical importance, maternal competencies for feeding very low birth weight (VLBW) infants have received relatively little research attention. To date, these competencies have primarily been studied in association with infant biomedical risk identified in the neonatal period (Holditch-Davis, Cox, Miles, & Belyea, 2003; Jarvis, Myers, & Creasey, 1989; Kelly & Barnard, 2000; Pridham et al., 2002) or maternal psychological distress (Singer et al., 2003). Theoretical discussions (Bronfenbrenner & Morris, 1998; Lerner, Rothbaum, Boulous, & Castellino, 2002) and empirical findings (Feldman, 2007; Feldman, Greenbaum, Mayes, & Erlich, 1997; Raver & Leadbeater, 1999) suggest links among family processes and the quality of a mother's interactive behavior with her infant. Although mothers commonly join with family members in problem solving infant-care issues (Pridham, 1997; Pridham & Zavoral, 1988), the contribution that joint problem-solving processes make to maternal feeding competencies has not been studied. Clinical practice with parents and young children that inclusively aims to consider the roles

and functions of other family members in parent–child interaction could be advanced by knowledge of this contribution.

The purpose of this study was to explore the contribution to maternal feeding competencies made by the competence of mothers and family members in negotiating problems of infant care, taking into account infant, maternal, and family conditions already known to influence maternal interactive behavior. Our specific objective was to examine a preliminary model of maternal feeding competencies with a long-range goal of developing a more fully specified and structured longitudinal model aimed toward interventions tailored to mothers, their VLBW infants, and the family members who engage with mothers in problem solving infant-care issues. We first review the literature on maternal feeding competencies, then review the theory and evidence that supports the contribution of infant neonatal biomedical condition, maternal symptoms of depression, and family conditions.

Maternal Feeding Competencies

Taking the perspective defined by Bronfenbrenner and Morris (1998), Lerner et al. (2002), and Schore (1994) that mother–infant interaction is the primary setting of the infant’s development of cognitive and social-emotional abilities, we propose that maternal feeding competencies provide the conditions for this development. We further propose that the infant’s optimal nutrient intake occurs through affective and behavioral qualities of mother–infant interaction that support the infant’s positive experience, effectiveness, and satisfaction in feeding and regulated feeding interaction (Fox, 1998; Kraemer, Ebert, Schmidt, & McKinney, 1991; Schore, 1994). Maternal feeding competencies thus include provision of a positive presence in both affect and behavior, sensitive responsiveness and involvement with the infant, regulation and inhibition of negative affect, and emotional and cognitive scaffolding of the infant’s feeding and feeding interaction (Fox, 1998; Schore, 1994).

Maternal competencies likely to support an infant’s positive (i.e., satisfying, pleasurable, and regulated) feeding experience are expressed affectively and behaviorally in visual and verbal contact, positive affect, enjoyment, social initiative, connectedness, and mirroring of infant behavior as well as sensitivity and responsiveness to her infant’s cues (Clark, Hyde, Essex, & Klein, 1997; Schermann-Eizirik, Hagekull, Bohlin, Persson, & Sedin, 1997). Maternal competencies that may support an infant’s attentiveness to feeding and prevent or reduce dysregulatory affect and behavior are expressed through responses attuned to an infant’s cues of need or satiation; adaptive structuring of a feeding and mediating the feeding environment for an infant’s participation and satisfying intake; physical handling that maintains an infant’s physiologic stability; and, particularly for VLBW infants, the safe, uncompromised transfer of food. Engaging the infant in feeding through positive, warm affect, social initiations, responsiveness, and low levels of anxiety and negative reactivity (Clark et al.; Thoyre, 2003) may contribute to the infant’s regulatory capacities and interest in feeding. Thus, low levels or lack of maternal negative affect and behavior may be treated as a feeding competency.

Infant Neonatal Biomedical Condition

A VLBW infant’s biomedical condition, defined in the neonatal period, may put the infant at risk for feeding difficulties and challenge maternal feeding competencies (Thoyre, 2001; Thoyre, Shaker, & Pridham, 2005). Researchers have found lower responsiveness and involvement during feeding at both 4 and 8 months postterm age for prematurely born infants compared with term infants (Barnard, Bee, & Hammond 1984). For VLBW infants, the risk is increased by neonatal morbidity, including respiratory distress syndrome (RDS) or neuromotor deficits (Korner & Constantinou, 2001; Taylor, Klein, Drotar, Schluchter, & Hack, 2006). Jarvis et al. (1989) studied the contribution of infant neonatal biomedical

condition to mother–infant teaching interaction at 4 and 8 months postterm age for mothers, all at least 17 years old. Their sample consisted of 18 VLBW premature infants recovered from RDS, 16 premature infants with the chronic form of RDS (i.e., bronchopulmonary dysplasia [BPD]), and 13 healthy infants born at term. Mothers of infants with BPD, in addition to showing less sensitivity to their infants' cues and less responsiveness to the infant's distress than the mothers of the infants in the RDS group, had lower scores on these behaviors at 8 months than at 4 months. The investigators concluded that the effects of severe illness on mother–infant interaction last well beyond the neonatal period.

Singer et al. (1996) studied the difference infant neonatal biomedical condition made for discrete maternal feeding behaviors. Mothers were in their late 20s on average and had a mean education of at least 13 years. The investigators found that, at 1-month postterm age, the 55 VLBW infants with BPD took in less formula during a feeding than did the 34 VLBW infants without BPD. Mothers of the VLBW infants in both groups gave their infants more verbal and physical prompts to continue eating than did mothers of the 52 healthy term infants. The investigators concluded that mothers responded to the difficulty VLBW infants had in feeding with a directive strategy that was different from the feeding strategy used by mothers of the term infants.

In a later study, Singer et al. (2003) assessed feeding interaction longitudinally with the Nursing Child Assessment Satellite Training (NCAST) Parent–Child Feeding Interaction Scale (Barnard, Eyres, Lobo, & Snyder, 1979; Kelly & Barnard, 2000) at 1, 8, and 12 months. The sample included a group of 52 healthy term infants in addition to the group of 103 VLBW infants with BPD and the 68 VLBW infants without BPD. Mothers were of similar age, education, and social class to that of the mothers in the Singer et al. (1996) study. Approximately half of the mothers in each of the three groups were members of a minority race VLBW infants with and without BPD, compared with healthy term infants, showed less responsiveness and less clarity of cues. Differences between VLBW and healthy term infants increased with time. Although mothers of VLBW infants with BPD showed more cognitive and social-emotional growth-fostering behaviors than did mothers of healthy term infants at 1 month, they did not increase in these behaviors between 1 and 8 months or between 1 and 12 months as did mothers of healthy term infants. The investigators concluded that the lack of differences between the VLBW infants with and without BPD in either maternal or infant interactive feeding behaviors may have resulted from mothers having a similar view of their VLBW, prematurely born infants regardless of risk status.

Holditch-Davis et al. (2003) provided a perspective of the contribution of infant biomedical condition, defined in terms of maturity status at birth and chronic illness, to maternal and infant interactive behavior through use of naturalistic observation and microanalytic observational categories. Holditch-Davis et al. studied three groups of VLBW, prematurely born infants: 41 premature infants with a chronic condition, 20 term infants with a chronic illness, and 28 infants who were prematurely born and without chronic illness. Fewer than half of the mothers of the premature infants were members of a minority race, and education averaged about 14 years. Mothers of chronically ill infants, whether preterm or term, were more responsive and provided more social stimulation than did mothers of the healthy premature infants during a 1-hr in-home observation. The investigators conjectured that mothers of the chronically ill infants may have been compensating for their lower functional maturity.

Taken together, the results concerning the difference made for maternal interactive behavior by infant neonatal biomedical condition for the studies reviewed were mixed, perhaps because of variability of infants within the biomedical category, the type of interaction

assessed (i.e., teaching or feeding), or the differences in methods used to assess interaction (i.e., count of frequency of occurrence within specified observational intervals or designation of occurrence or lack of occurrence on an item coded). Another issue to consider in interpreting the results of these studies is the variability in interaction that could have been accounted for by maternal or family-level conditions.

Mothers' Symptoms of Depression

Affecting 10–12% of postpartum women in general (Burt & Stein, 2002) and an estimated 25% of low-income mothers of young children (Lanzi, Pascoe, Keltner, & Ramey, 1999), maternal depressive symptoms at both clinical and subclinical levels have been found to negatively affect mother–infant interactions (Feldman, 2007; Murray & Cooper, 1997; Murray, Fiori-Cowley, Hooper, & Cooper, 1996; Weinberg & Tronick, 1998). After accounting for infant race, social class, and multiple birth status, Singer et al. (1996) learned that maternal psychological distress—examined in terms of depression and anxiety—significantly increased verbal prompting of the infant to feed. The contribution of psychological distress to this intrusive maternal feeding behavior was in addition to the contribution made by the infant's VLBW status. Verbal prompting to feed may be a sign of a mother's concern about the infant's nutrient intake. In a later study, Singer et al. (2003), after accounting for both infant biomedical risk defined by status as a neonate and by age, found that maternal distress was significantly associated with cognitive growth-fostering during feeding but not with sensitivity to infant cues or responsiveness to distress. The NCAST Parent–Child Feeding Interaction Scale (Barnard et al., 1979) that Singer et al. used did not permit assessment of the qualitative aspects of either the verbal prompting or the cognitive growth-fostering behavior of mothers, making in-depth study of feeding interaction in the context of maternal depressive symptoms important.

To date, the contribution of maternal depressive symptoms to maternal competencies in feeding has not been examined relative to the contribution made by infant neonatal biomedical condition. Parsing the relative contribution of depressive symptoms in the context of infant condition is important to the identification of the type of support mothers need in developing and performing feeding competencies. How the contribution of depressive symptoms to feeding competencies changes as the infant grows older is important to examine. The effects of maternal depression on mother–infant interaction quality may be especially strong during the time of transition to parenthood when patterns of parenting behavior with the new infant are forming (Feldman, 2007; Matthey, Barnett, Ungerer, & Waters, 2000).

Family Conditions

Family conditions may affect maternal feeding competencies at two levels: distal and proximal (Bornstein, Hahn, Suwalsky, & Haynes, 2003). Poverty, a distal condition and an index of economic deprivation, may be estimated from the comparison of household income with a poverty threshold of income that varies with family size and inflation (Duncan & Magnuson, 2003). Poverty is known to diminish parents' capacity for positive parenting (McLoyd, 1998). No matter what its origins and duration, poverty limits a family's tangible and social assets, increases the challenge and risks of day-to-day living, and disadvantages a family's internal and external transactions, including a mother's interaction with her infant (K. J. Conger, Reuter, & Conger, 2000; R. D. Conger et al., 2002). For low-income women, Raver and Leadbeater (1999) reported that diminished capacity to respond sensitively to a child was associated with a high number of external challenges. Singer et al. (2003) examined, in bivariate correlational analysis, the effect of socioeconomic status (SES) on maternal competencies in feeding premature infants, assessed with the NCAST Parent–Child Feeding Interaction Scale, and found that mothers of higher SES did more social-emotional

and cognitive growth-fostering during the first postterm year than did mothers of lower SES. Mothers of higher SES, however, did not have higher scores on either maternal sensitivity to cues or response to the infant's distress. The contribution of poverty status to maternal feeding competencies has not been specifically studied.

Evidence that the relationship that parents have with each other is associated with the parent-child relationship (Engfer, 1988; Erel & Burman, 1995; Feldman, 2000, 2007) supports exploration of maternal feeding competencies from a proximal family-level perspective. Family problem solving, a proximal family-level variable, is integral to dealing with challenges within a family (Beavers & Hampson, 2003; Melby & Conger, 1991; Miller, Ryan, Keitner, Bishop, & Epstein, 2000; Olson, 2000). Family problem solving is defined by processes of problem identification and specification, selection and application of solutions, and/or assessment of identification accuracy or solution effectiveness that are engaged in by the whole family together or by a subset of family members (Cox & Davis, 1999). Problem solving of infant-care issues by mothers and family members, including the infant's father or another person who joins the mother in infant care, may be particularly important for a mother's feeding competencies in the early months of a VLBW infant's life when care needs are novel, intense, and often urgent or complex (Kenner & Bagwell, 1998). Research has shown that negotiating—dealing with an issue through discussing, being open to other viewpoints, and compromising (Melby et al., 1998)—is central to identification and specification of problems and to development of solutions by family members (Beavers & Hampson, 2003; Olson, 2000; Reuter & Conger, 1995).

Research findings relevant to mother-family member competence in negotiating infant-care issues are sparse, and research objectives and methods concerning this subject on the whole must be drawn from the literature on dyadic relationships within the family in general. Specifically, mother-infant feeding interaction is a behavioral component of a parenting or caregiving subsystem of the family system (Stevenson-Hinde, 1990) and, as such, articulates directly or indirectly with the problem solving that mothers and family members do as dyads to manage infant-care issues (Hill, Fonagy, Safier, & Sargent, 2003). The negotiating competencies exhibited during this dyadic problem solving may provide a climate and model for mothers' adaptive affect and behavior during feeding. Skilled negotiating requires a sensitivity to the other's perspective and a willingness to make compromises (i.e., to be responsive to the other's wishes, needs, or agenda) so as to manage the task or accomplish the goal. Mothers may experience empathy and learn sensitive and responsive interactive problem-solving behavior through constructive negotiating with family members who participate with them in infant care or in dealing with infant-care issues (Engfer, 1988; Feldman, 2007). Thus, the joining together of mother and family member in constructive negotiating while problem solving infant-care issues may allow for a parallel process in mother-infant feeding interaction. The ability of a mother to express understanding and empathy to her infant may be supported by her own experience of receiving understanding and empathy from others (Lieberman, Silverman, & Pawl, 2000).

Competence in negotiating issues of infant care and the contribution it makes to feeding competencies may change as the mother-family member dyad gains experience in problem solving together, as needs, relationships, and circumstances within the family change, and as the caregiving functions of mothers evolve through the infant's first postterm year (George & Solomon, 1999; Heinicke, 2002). Bell et al. (2007) used grounded theory to identify features of early family relationships of 18 first-time European American parents of healthy term infants living in French-speaking Canada. These investigators learned that family relationships (parental and parent-infant), from the perspective of the parents, changed from undifferentiated and disorganized at 1 week to differentiated at 6 weeks to integrated at 16 weeks, with acknowledgement of differences in father-infant and mother-infant

relationships. An important feature of the Bell et al. study is the exploration of change in the first 4 postpartum months of both the family relationship and the parent–child relationship with the intention of discerning the difference the characteristics of the family relationship made for the parent–child relationship. Whether the contribution made to maternal feeding competencies by the competence of mothers and family members in negotiating infant-care issues changes as the infant grows older has not yet been studied.

Stability or Change in Maternal Feeding Competencies

In theoretical models, the predictiveness of conditions theorized to have an effect across time on maternal feeding competencies will be affected by the extent to which the model accounts for shared variance. Examination of the shared variance in feeding competencies at 1 and 8 months infant postterm age would extend knowledge of maternal competence development in the context of infant, maternal, and family-level conditions (Bronfenbrenner, 1996).

To date, study of stability or change in maternal feeding competence has been limited to comparison of mean scores across occasions for mothers of infants in specific neonatal biomedical risk categories. Barnard et al. (1984) learned that, at 8 months, mothers of premature infants remained almost unchanged from 4 months in the positive and sensitive qualities of their feeding interaction despite increased infant responsiveness and involvement. Singer et al. (2003), using the NCAST Parent–Child Feeding Interaction Scale, found that mothers of VLBW, prematurely born infants of high and low biomedical risk increased in cognitive growth-fostering behavior as the infant grew older but not in sensitivity to distress, responsiveness to cues, or social-emotional growth-fostering. The cognitive growth-fostering subscale includes an item for the parent’s encouragement or allowance of the child’s exploration of breast, bottle, food, cup, or bowl, and is more likely observed as the infant grows older and becomes developmentally capable of acquiring self-feeding skills. Although these studies have generated questions for further research, the change or stability in maternal feeding competencies may have been inadequately described because of measurement issues and limited attention to infant, maternal, and family-level conditions.

Hypotheses

In light of the theoretical and clinical importance of examining maternal feeding competencies in the context of infant neonatal biomedical risk, maternal depressive symptoms, family poverty level, and mother–family member negotiating competence, we made three predictions. The first was that the theoretical model of conditions predictive of maternal feeding competencies would remain stable between 1 and 8 months. Our second prediction was that, accounting for all of the other variables in the theoretical model, higher infant neonatal biomedical risk and depressive symptoms and family poverty status would be associated with lower maternal feeding competencies. Third, we predicted that, accounting for all other variables in the theoretical model, mothers who were more competent in negotiating infant-care issues with a family member would reveal greater social-emotional and task-related competencies in feeding their infants. We expected the relationship of negotiating competence and maternal feeding competencies to be stronger at 1 month, when the transition to parenting the VLBW infant was likely to still be underway, than at 8 months when caregiving roles, practices, and behavior are likely to be better established and regulated among mothers and family members participating in care (Bell et al., 2007; Heinicke, 2002) and mothers are less likely to be deprived of sleep.

METHODS

Participants

Data for this exploratory longitudinal study came from two longitudinal intervention studies (Study 1 occurred from 1995 to 1997, $n = 41$; Study 2 occurred from 1999 to 2000, $n = 29$) with families recruited through four Level III special care nurseries in a U.S. Midwestern city. Both studies involved the same research team and used identical data collection procedures and intervention protocols. The postterm ages of 1 and 8 months were selected for study based on shifts at these ages in infant biobehavioral characteristics (Emde, 1989) prompting change in caregiving practice. In the present study, we used data from observation of a structured family dyad (mother–family member) problem-solving session, observation of maternal feeding behavior, the infant's medical record of biomedical condition in the neonatal period, and the mother's report of income category for determination of family poverty status.

We found no significant differences between the intervention and comparison groups of either of the two studies on any of the variables we examined in the analyses of the hypotheses. To determine whether the data from the two studies could be treated as one sample, we performed equivalence tests (Chow & Liu, 1992) on the 1 and 8 month assessments of the maternal feeding competence variables. The two one-sided tests of the nonequivalence hypothesis used the average standard deviation of the comparison group for the margin of equivalence. This margin was approximately .80 (i.e., the mean difference plus or minus .80 was used to examine equivalence). Because the data were equivalent at an alpha level of .05, they were combined into one sample for the present analyses.

The final sample, derived from the original sample of 70 families, included the 41 families who had the opportunity and were able to provide a problem-solving assessment, either at 1 month ($n = 39$) or at 8 months ($n = 35$), and an observation of feeding interaction, either at 1 month ($n = 38$) or at 8 months ($n = 35$). The primary reason that families did not participate in the problem-solving assessment was inability of scheduling it at a time when mother, family member, and nurse data collector could be present. Only 2 mothers could not identify a family member who problem solved infant-care issues with them. Parents often staggered work shifts through the 24-hr day for the purpose of childcare so that one family member worked nights whereas the other worked days. Of the 41 families, 6 (14.6%) who agreed to participate in the family problem-solving component of the study dropped out before it was completed. The primary reason for this attrition was inability of the research nurse to contact the family.

Mothers who provided both a problem-solving assessment and a feeding interaction observation were significantly higher in years of education than mothers who did not ($M = 14.03$, $SD = 2.86$; $M = 12.15$, $SD = 2.23$, respectively), ($t = 2.86$, $df = 64$, $p = .006$), but did not differ significantly in age, marital status, and ethnicity. Infants of the participating mothers did not differ in birth weight or in length of hospitalization.

VLBW infants eligible for the study were appropriately sized for gestational age (Ballard et al., 1991; Lubchenco, Hansman, Dressler, & Boyd, 1963) and free of congenital or medical conditions that could interfere with oral intake (e.g., a defect of the heart or gastrointestinal system requiring surgery and nothing by mouth for a number of days). Potentially exclusionary conditions were discussed with the neonatologist on the research team before making a decision about recruitment. Both breast-milk feeding and formula feeding infants were included. Eligible mothers were able to speak and read English, were at least 17 years old at the time of the infant's birth, and were planning to be responsible for the infant's care.

Each mother asked a family member she expected to engage with her in infant care to participate in the two dyadic problem-solving assessments.

At the time of recruitment, the 41 mothers who contributed data to this study were, on average, 27.4 years of age ($SD = 5.4$ years; range = 19–37 years). Their mean age of education was 14.0 years ($SD = 2.8$ years; range = 9–21 years). At 1 month, 23 of the mothers were employed ($M = 17.88$ hours per week, $SD = 17.75$ hours per week; range = 8–42 hours per week). At 8 months, 27 of the mothers were employed ($M = 23.21$ hours per week, $SD = 18.37$ hours per week; range = 6–55 hours per week). The majority of mothers ($n = 32$, 78%) were married or partnered. Of the mothers, 17 (41.5%) were primipara. For multipara, number of children ranged from 2 to 5. The majority of mothers were ethnic minorities; 22 (53.6%) were African American; 15 (36.6%) mothers were European American; and 4 (9.7%) were Latin American or Asian American. Of the participating family members, 34 were spouses or partners of mothers, 5 were maternal grandmothers of the infant, 1 was a maternal aunt, and 1 was an infant's 16-year-old sister who had considerable caregiving responsibility for her infant sibling when she was not in school.

Of the infants, 20 (48.8%) were male. The gestational age of infants at birth averaged 26.92 weeks ($SD = 2.34$ weeks; range = 23.29–32 weeks). The birth weight of infants, on average, was 953.15 g ($SD = 279.21$ g; range = 540–1676 g). Except for 1 infant, all infants weighed less than 1,500 g at birth and, therefore, could be classed as VLBW. Of the infants, 19 (46.3%) had a diagnosis of BPD. Only 6 (14.6%) of the infants had not been diagnosed with acute respiratory disease in the neonatal period. None of the infants had a diagnosed intraventricular hemorrhage of Grade 3 or 4. Of the infants, 17 (41.5%) had a record of a Grade 1 or 2 intraventricular hemorrhage, 5 had a history of necrotizing enterocolitis, and 22 had a record of sepsis.

Procedures

A research nurse recruited families before the infant's hospital discharge; the nurse had obtained informed written consent from both parents unless the father was unavailable. Participating family members gave written consent at the time that the mother was recruited, if available, or before the first problem-solving assessment. After recruitment, mothers completed a demographic data form and described plans for infant feeding. The same research nurse completed home visits for data collection at 1 and 8 months. These visits were scheduled to include the mother's infant feeding in her usual manner and at a time during the visit she determined was appropriate. The problem-solving assessments were scheduled for the same visit or for a later, separate visit, sometimes in the evening or on the weekend, for the convenience of the mother and the family member participant. Both the feeding interaction and the problem-solving assessment were videotaped for later rating in a laboratory setting. The research nurse assessed the infant's respiratory, cardiovascular, and neuromotor systems during the home visit, and weighed the infant before a meal on a portable electronic scale weighing within 10 g of accuracy.

Measures

Maternal feeding competencies—We used the Parent–Child Early Relational Assessment (PCERA; Clark, 1985) to measure maternal feeding competencies. The PCERA is an observational instrument for assessment of qualities of affect and behavior that the parent and child bring to the interaction. The qualities of affect and behavior are rated from videotaped feeding interaction on 5-point scales concerning the extent and intensity of occurrence. A higher score on each quality represents more adaptive affect and behavior. Anchors are specific to each quality rated. For example, for warm, kind tone of voice, the score of “1” is labeled “no warmth; cold or distant tone of voice is characteristic.” A score

of “5” is “very warm, kind and loving voice is characteristic.” Scores of 2, 3, and 4 are each with a descriptor.

In the present study, we used two factors theoretically and empirically derived in a large sample study of maternal–infant interaction during feeding (Clark, 1985). One factor, labeled *Parental Positive Affective Involvement, Sensitivity and Responsiveness* (PPAISR), comprises 16 items to describe qualities of maternal affect and behavior including the warmth and kindness in the mother’s tone of voice; expression of positive affect and enjoyment of her infant; lack of depression and a withdrawn mood; quality of visual contact; amount and quality of verbalizations; social initiative; contingent response to infant positive behavior; connectedness with the infant; mirroring of the infant’s affect; creativity; and sensitivity and responsiveness to her infant. A second factor, labeled *Parental Negative Affect and Behavior* (PNAB), comprises 13 items to describe maternal competence from the perspective of structuring the feeding and mediating the environment to support nutrient intake and development of feeding skill; sensitivity and responsiveness to the infant; and lack of the following: expression of an angry tone of voice, negative attitude towards the baby, intrusive behavior, response to negatively nuanced infant behavior, rough or abrupt handling of the infant, or inflexible or rigid behavior. Alpha coefficients obtained in this study for the PPAISR factor were .95 for 1 month and .88 for 8 months. Alpha coefficients for the PNAB factor were .71 at 1 month and .87 at 8 months.

Following Clark’s (1985) coding protocol, we rated the PCERA items from the second 5 min of videotaped feeding interaction. Clark and other investigators have demonstrated the validity of the PCERA (Clark, 1999; Clark et al., 1997; M. M. Black, Hutcheson, Dubowitz, Starr, & Berenson-Howard, 1996). PCERA raters were trained to code with exact agreement of at least 80% with PCERA coding trainer. Each videotaped feeding interaction was independently coded by one of three equivalently trained coders. Of the feeding interactions, 11% were coded by a second person to estimate reliability of coding. For the PPAISR factor items, inter-rater exact agreement averaged 77.6%. The two-way mixed effects intraclass correlation coefficient (Choukalas, Melby, & Lorenz, 2000) for the PPAISR factor items was .96 (95% confidence interval, .89–.98). For the PNAB factor items, inter-rater agreement averaged 81.5%; the intraclass correlation coefficient was .85 (95% confidence interval, .62–.94).

Negotiating competence during family (dyadic) problem solving—Negotiating processes include eliciting input from others; resolving differences; accepting direction; integrating interests; sharing meaning, expectations, or goals; and considering new possibilities (Melby & Conger, 2001). We assessed these processes by applying the Iowa Family Interaction Rating Scales (IFIRS; Melby & Conger, 2001; Melby et al., 1998) to a videotaped interaction task. The task began with the mother and family member independently ranking the three baby-care topics (i.e., problems) most in mind or needing discussion from a set of seven topics provided the dyad. These topics included the following: (1) the baby’s crying, (2) feeding the baby, (3) the baby’s sleeping, (4) having daycare for the baby, (5) bringing the baby up right, (6) taking care of the baby’s health, and (7) some other topic specified by the mother or family member. After the mother and family member had discussed, for practice, the topic of celebrating an upcoming holiday, birthday, or special occasion, the dyad was given three cards— each naming a selected topic—to discuss to their satisfaction. These cards were ordered as follows: (1) the mother’s highest ranked topic, (2) the family member’s highest ranked topic, and (3) the mother’s second highest ranked topic. The dyad was instructed to discuss each of these topics in turn within a 15-min period in terms of three questions: (1) “What is on our minds about this?” (2) “What is going on between the two of us about this?” and (3) “What can we do to take care of this?” The dyad was asked to try to agree on at least one action to take to address this issue.

The research assistant left the room after checking the videorecorder during the practice task and returned after the dyad signaled completion of the set of tasks or 15 min had elapsed, whichever came first. After the session was completed, mother and family member independently rated the effectiveness of the interactive problem solving on a 9-item family rating form.

The IFIRS problem-solving scales were applied to the videotaped, dyadic problem-solving interaction by three individuals trained to criterion reliability (at least 80% agreement) with 24 hr of instruction in the manual definitions for each ordinal scale point (Melby et al., 1998), independent rating of videotapes, and discussion of ratings of videotapes provided by the Iowa State University's Institute for Social and Behavioral Research (ISBR) trainers. To make training specific to the study, these trainers provided criterion scores on six tapes from our sample. The ISBR procedure was used by project staff to train a fourth rater who participated in the rating of 13% of the videotapes. Except for one individual who participated in the problem-solving assessment for three families, raters had no contact with families.

Following independent rating of each problem-solving interaction by at least two raters from the pool of four trained raters, discrepant ratings on each scale were discussed with review of the videotape for all assessments. A consensus score was obtained and used as the final rating for each problem-solving assessment. Melby and Conger (2001) documented acceptable inter-rater reliability and content, concurrent, and predictive validity of the scales with diverse populations of families.

The Negotiating/Compromising Scale of the IFIRS describes the competence of both mother and family member (i.e., focals) regarding willingness to resolve differences and come to shared meanings or mutual agreements through flexibility, openness, and engagement in a give-and-take process. Keeping in mind that all 9 scale points are used in rating, the descriptors for the odd-numbered points on negotiating are as follows: 1 (*not at all characteristic, the focal shows no willingness to negotiate and compromise with the other person*), 3 (*minimally characteristic, the focal rarely displays willingness to negotiate and compromise with the other person*), 5 (*somewhat characteristic, the focal occasionally shows some willingness to negotiate and compromise, although these behaviors are absent more than present*), 7 (*moderately characteristic, the focal fairly often displays willingness to negotiate and compromise*), and 9 (*mainly characteristic, the focal frequently shows willingness to negotiate and compromise*; Melby et al., 1998). Separate mean scores were obtained for mother and for family member on the Negotiating/Compromising Scale for the set of up to three problems addressed by the dyad. Use of the mean reduces distortion in competence scores resulting from characteristics of a specific topic of discussion (Vuchinich, Angelelli, & Gatherum, 1996).

To obtain a valid family (dyadic)-level measure of negotiating, we used the concordance correlation coefficient (Lin, 1989, 2000) to assess agreement between raters' scores for mothers and scores for family members on the Negotiating/Compromising Scale. We examined this coefficient to justify the combining of scores for mothers and family members in a family-level measure of negotiating. For the 1-month observation, the coefficient was .74 (95% confidence interval = .60–.88). For the 8-month observation, the coefficient was .63 (95% confidence interval = .43–.84). Because both 1- and 8-month negotiating coefficients fell in the range of scores designated as having moderate agreement (.61–.80), we summed and averaged the negotiating score for mothers and for family members to obtain a score for dyadic negotiating at 1 and 8 months.

Symptoms of depression—The 20-item Center for Epidemiologic Studies-Depression (CES-D) Scale (Radloff, 1977), used to measure mothers' depressive symptoms, is a well-validated self-report instrument (Radloff & Locke, 1986; Roberts, Vernon, & Rhoades, 1989). Mothers rate the duration or frequency of symptoms in the past week on a 4-point scale ranging from 0 (*rarely/none of the time*) to 3 (*most or all of the time*). A total score (range = 0–60) is obtained by reversing the ratings for the 4 items describing positive experience and then summing the 20 item scores. The higher the item score, the more intense the depressive symptoms experienced. The CES-D Scale alpha coefficients were .68 and .74 for the 1- and 8-month assessments, respectively, of the present study.

Infant neonatal biomedical condition—We used the Neonatal Medical Index (NMI, Korner & Constantinou, 2001) to assess infant biomedical condition as revealed during the neonatal hospitalization. The NMI ranges from 1 (*freedom from medical complications*) to 5 (*occurrence of the most serious medical problems*). The NMI includes birth weight criteria referenced to 1000 g as well as the presence and character of medical complications (i.e., respiratory distress, days on oxygen or assisted ventilation, apnea or bradycardia and type of treatment required, patent ductus arteriosus requiring medical or surgical treatment, periventricular leukomalacia, intraventricular hemorrhage and its grade, hyperbilirubinemia requiring exchange transfusion, meningitis, or seizures). Validity of the NMI has been supported by the finding that the rating predicted cognitive and motor development, assessed for 512 low birth weight premature infants with the Bayley Scales, at 12 and 24 months (Korner et al., 1993). For the present study, NMI ratings were obtained from a research nurse's audit of the infant's medical record for the initial hospitalization. Scores ranged across the entire scale and averaged 3.93 ($SD = 1.08$).

The infant's history of acute illness, chronic health conditions, emergency room visits, and hospitalization was obtained for descriptive purposes from the primary care clinic record and from maternal report made for the period of time that had elapsed between data collection visits.

Poverty—As an index of family economic condition, poverty status is defined by money income thresholds for families of a specific size and composition (U.S. Census Bureau, 2006). In the present study, mothers reported family size, number of related children, and income category on a demographic data form. The income categories were as follows: (1) less than \$10,000; (2) \$10,000–\$14,999; (3) \$15,000–\$19,999; (4) \$20,000–\$24,999; (5) \$25,000–\$34,999; (6) \$35,000–\$44,999; (7) \$45,000–\$54,999; and (8) \$55,000 or greater. Incomes in the present sample ranged from less than \$10,000 (12 families; 29.3%) to \$35,000–\$44,999 (1 family; 2.4%). Each family's income category was examined against the poverty threshold level for a family of that composition to identify each family's status on the poverty variable. If the upper level of the income category fell at or below the poverty threshold for a family of the same composition, poverty status was categorically designated as 1; status higher than the poverty threshold was designated with 0.

Data Analysis

We used fixed occasions repeated measures regression to examine all three hypotheses. This analytic strategy is a hierarchical, marginal distributional model designed for longitudinal studies (Diggle, Liang, & Zeger, 1994; Goldstein, 1986; Yang, Heath, & Goldstein, 2000). The strategy uses all of the data available at any one occasion, models data for specific occasions and for dependency across occasions, and permits assessment of differences in the dependent variable between occasions. The analyses included estimates for both the random parameter (intercept) and fixed parameters (predictor variables) together with their standard errors (Goldstein, 2003). Effect size for specific model parameters was estimated by

calculating the difference between the full model proportion of variance explained and the proportion of variance when the specific variable of interest was removed. We used a version of Cohen's (1998) effect size for proportion of variance to estimate the effect:

$$f_i^2 = \frac{R_{Y,K}^2 - R_{Y,K-i}^2}{1 - R_{Y,K}^2}$$

where $R_{Y,K}^2$ is the proportion of variance explained by the full model (all predictors), and $R_{Y,K-i}^2$ is the proportion of variance explained less the variable of interest. We used contrasts to examine difference in the contribution made by predictor variables to PPAISR and to PNAB as well as in the variance of the predictor variables between 1 and 8 months.

RESULTS

Maternal Experience and Infant Health and Growth at 1 and 8 Months

At Neonatal Intensive Care Unit (NICU) discharge, infants had been hospitalized approximately 82 days ($SD = 25$ days, range = 35–140 days). At the time of the first data collection visit in the home, mothers had been responsible for their infants' care for an average of 39 days ($SD = 22$ days, range 6–113 days). By the second data collection visit, mothers had been responsible for their infants' care an average of 262 days ($SD = 30$ days, range = 211–340 days). Of the infants, 8 were on supplemental oxygen through the first visit; 4 of these continued on supplemental oxygen through the second visit at approximately 8 months. Fifteen (36.6%) of the infants were hospitalized during the study period, several more than once, primarily for acute respiratory illness ($M = 5$ days of hospitalization, $SD = 14$ days, range = 0–83 days). One infant had a tracheostomy after a severe respiratory infection and prolonged hospitalization before the second visit. Of the infants, 24 (58.5%) were seen in the emergency department for as many as 3 times during the 8 months of the study. Infants had many visits to the primary care or urgent care clinic for acute illness problems during the 8 months.

Signs of breathing difficulties, often associated with nasal congestion or wheezing, were observed by the nurse collecting data in the home for 12 infants at 1 month and for 9 infants at 8 months. At 1 month, 5 of the infants had weight less than the 5th percentile for gestation-adjusted age on the Center for Disease Control's gender-specific growth chart (National Center for Health Statistics, 2000). At 8 months, 11 of the infants had weight less than the 5th percentile, signifying growth deficiency for approximately 20% of the 41 infants.

Only 2 of the mothers were breastfeeding their infants at the time of the first, 1-month visit, although many mothers had supplied breast milk for their infants during the NICU stay. None of the mothers was breast feeding at 8 months. Of the mothers, 24 (58.5%) were employed at 1 month; 13 were working at least 40 hours per week. At 8 months, 30 mothers (73.2%) were employed, 18 of them working at least 40 hours per week.

Descriptive Data on Outcome and Predictor Variables

Maternal feeding competencies—Table 1 shows the mean scores and standard deviations for both outcome variables, PPAISR and PNAB, assessed at 1 and 8 months. On a scale from 1 to 5 ranging from 1 (*none of the quality or an extremely negative quality*) to 5 (*characteristically competent*), PPAISR scores, on average, were closer to 3 than 4; PNAB scores, on average, were closer to 4 than 3. PPAISR scores had a wider range and a larger

standard deviation than did PNAB scores, which were, on average, in the direction of very little or absent negative affect and behavior.

Infant neonatal biomedical condition—For all but 2 infants, the Neonatal Medical Index/NMI score was at least 3, indicating birth weight of less than 1000 g and one or more medical problems during the neonatal period (e.g., continued assisted ventilation, apnea or bradycardia requiring medical treatment, hyperbilirubinemia, or a patent ductus arteriosus needing treatment). The NMI score for 56% of the infants was 4 or 5. A score of 4 indicated the need for assisted ventilation or oxygen for 15–28 days, resuscitation for apnea or bradycardia, and/or major surgery. A score of 5 indicated assisted ventilation or oxygen for longer than 29 days.

Mothers' depressive symptoms—On average, mothers' depressive symptoms were below 16, the CES-D cut score found by Radloff (1977) to be correlated with clinical depression. Scores were widely varying, however, from almost no symptoms at all to scores well above 16. Approximately 27% of the mothers had a CES-D score of 16 or above at 1 month; 29% of the mothers had a score of 16 or above at 8 months.

Family condition: Poverty—Somewhat less than half of the families ($n = 17$; 41.5%) had an estimated annual income below the federal poverty threshold for family size at the time of recruitment to the study.

Family condition: Dyadic negotiation competence—Dyadic competence in negotiating issues of infant care, for all but four families at 1 month and one family at 8 months, was assessed for three problems at each observation. At both 1 and 8 months, these problems most frequently concerned taking care of the baby's health, 26.2% and 31.1%, respectively. At 1 month, feeding the baby was the topic of discussion as often as was the topic of the baby's health. At 8 months, feeding was second in frequency of discussion (i.e., 26.2% of the problems). Bringing the baby up was the third most frequently discussed topic; 15.1% of the dyads identified it as an issue at 1 month and 17.5% at 8 months.

On average, the ratings that mothers and family members gave the dyadic problem-solving process following each of the two assessments indicated that they understood the problems they were trying to solve, found it easy to work on the difficulty and thought it important to solve it, felt comfortable in the exercise process, and were sure both of them would do what each had said they would do to solve the difficulty.

At both 1 and 8 months, the negotiating competence scores for mothers and for family members fell between the scale points of 4 and 5 on the 9-point scale, indicating that both were somewhat characteristically open, flexible, and willing to give and take (see Table 1). Negotiating competence scores were wide ranging, and, at 1 month, included all but the highest score. At 8 months, scores did not include both the lowest and highest ends of the scale.

Predictor variables within 1- and 8-month assessments, shown in Table 2, were not significantly correlated. The intra-correlation of CES-D scores and family negotiating competence scores, which were measured at both 1- and 8-months, were significant and positive, $r = .56, p < .001$, $r = .37, p = .03$, respectively. Intra-correlation coefficients for both PPAISR and PNAB were large and positive, $r = .61, p < .001$; $r = .67, p < .001$.

For all predictor variables, the contrasts in contribution to maternal feeding competencies, PPAISR and PNAB, and in the variance of the contribution to these feeding competencies of the set of predictor variables, were nonsignificant. The covariance between intercepts at 1

and 8 months for both PPAISR and PNAB, shown in Table 3, was significant and the correlation coefficient was large, indicating substantial shared variance between occasions in the two feeding competency factors when all variables in the model were taken into account. In sum, the 1- and 8-month models of predictors for PPAISR and PNAB were similar.

Exploration of the Model of Infant, Maternal, and Poverty Predictors of Feeding Competencies

Analysis of bivariate coefficients showed no significant relationships ($p < .05$) among predictor variables for either the 1- or the 8-month models. Examination of the Variance Inflation Factor (VIF) and Tolerance showed no evidence of multicollinearity of the predictor variables, infant neonatal medical condition, mother's depressive symptoms, poverty, and dyadic negotiating competence (O'Brien, 2007). VIF was approximately 1 for all independent variables, and Tolerance ranged from .93 to .99. Therefore, all four variables were included in the model of predictors of the two feeding competency variables, PPAISR and PNAB.

The total proportion of variance explained by the model of predictor variables was 26% and 25% at 1 and 8 months, respectively, for PPAISR and 35% and 31% at 1 and 8 months, respectively, for PNAB (see Table 3). The chi-square tests used to test the difference between 1- and 8-month intercepts for both PPAISR and PNAB were not significant, indicating that, on both occasions, when all of the predictor variables in the model were accounted for, the means of the two maternal feeding competence factors were similar.

Accounting for all the other variables in the model, the infant's neonatal biomedical condition, indexed by NMI, did not make a significant contribution to either PPAISR or PNAB (see Table 3). Depressive symptoms were significantly and negatively associated as predicted with PNAB at 8 months. The effect size of poverty in relation with both PPAISR and PNAB at 1 and 8 months is relatively large, whereas the effect sizes for both NMI and depressive symptoms in relation with both PPAISR and PNAB is very small.

Effect of Dyadic Negotiating Competence on Maternal Feeding Competencies

Although dyadic negotiating competence did not contribute significantly at either 1 or 8 months to PPAISR, accounting for all variables in the model, it emerged as a significant predictor of PNAB at 1 month (see Table 3). Although the effect size for dyadic negotiating in relation to PNAB was small at both 1 and 8 months (.129 and .121, respectively), it was, nevertheless, larger than the effect size for NMI and for depressive symptoms.

DISCUSSION

This study was a preliminary exploration of a theoretical model of maternal competencies in feeding VLBW infants. The model was specified comprehensively, taking the developmental science perspective that infant, mother, and family-level conditions provide a context in which mother–infant interaction can be understood as it evolves across time (Bronfenbrenner & Morris, 1998; Lerner et al., 2002). We explored the model within occasion at both 1 and 8 months, infant postterm age, and longitudinally across occasions for maternal feeding competencies specified by two factors of observed qualities of affect and behavior, PPAISR and PNAB. Because we could not find any published research that explores the model of relations outlined here, we chose to do the study with the small sample of VLBW infants that we had studied over a 6-year period despite realizing that the study was likely underpowered. The sample included infants, all appropriately sized for gestational age, who had a diagnosis of respiratory distress syndrome, an acute lung disease, or BPD, a chronic lung disease. The history of acute or chronic lung disease potentially

augmented the contribution of the infant's neonatal biomedical condition as well as biologic status at birth to maternal feeding competencies.

Compared with published estimates of approximately 10% incidence of postpartum depression in new mothers (Chaudron, Kitzman, Szilagyi, Sidora-Arcoleo, & Anson, 2006), a higher percentage of women in our sample had CES-D scores at a level suggestive of clinical depression (27% at 1-month postterm assessment and 29% at 8-months post-term assessment). This incidence is comparable to that described by Chaudron et al. for a sample of 49 urban women who completed a postpartum depression screener at two or more well childcare visits before 3 months and between 3 and 11 months postpartum. Approximately 17% of the mothers in our sample who were high in depressive symptoms at 1 month were also high in symptoms at 8 months. Approximately 15% of the mothers whose symptom level was lower than the CES-D cutoff score of 16 at 1 month had scores at 16 or higher at 8 months. Mothers of VLBW infants may be at relatively high risk for either a chronically high level of depressive symptoms or exacerbation of symptoms later in the infant's first year. The development of a high level of depressive symptoms later in the first postterm year of a prematurely born, VLBW baby prompts exploration of infant, maternal, and family conditions associated with this symptom trajectory.

The model was explored early in the first postterm year when mothers and family members may still be transitioning to the care of their VLBW infants and adapting to disrupted patterns of sleep and daily living. The model was also explored later in the year when, although caregiving and other roles may be better defined among mothers and family members and daily life and sleep may be less disrupted by the needs of the VLBW infant, infant development of self-feeding skills may challenge mothers' feeding competencies.

Tests of the hypotheses provided some support for the theoretical model regarding maternal feeding competencies, examined in terms of PPAISR and PNAB. The test of the first hypothesis concerning the stability of the theoretical model of conditions predictive of maternal feeding competencies between 1 and 8 months showed substantial covariance in 1- and 8-month intercepts of both PPAISR and PNAB when all the predictor variables were controlled for. This finding indicates sameness from 1 to 8 months of the relative position of mothers' scores for feeding competencies, expressed as qualities of affect and behavior included in the PPAISR and PNAB factors, accounting for all of the predictor variables in the model. The lack of significant difference between 1- and 8-month intercepts for both PPAISR and PNAB is consistent with the stability of maternal feeding competencies across periods of the first year of VLBW infants found in earlier studies (Barnard et al., 1984; Singer et al., 2003). Examination of shared variance in PPAISR and in PNAB, accounting for all model predictors, is an approach to the study of consistency across occasions that brings the context, provided by the predictor variables, into the analysis. The fact that not all of the variance in PPAISR and in PNAB was shared between occasions points to the need for further theoretical and empirical identification of explanatory variables.

Tests of the second and third hypotheses revealed need for further model specification and refinement of variables and measures. The small sample size meant that we had inadequate power to detect what might have been significant effects of each of the predictor (i.e., explanatory variables) on PPAISR and on PNAB. Despite lack of power, however, the study provided information about the specific effect on PPAISR and on PNAB at 1 and 8 months of each of the explanatory variables (i.e., infant neonatal biomedical condition, maternal depressive symptoms, and the family-level conditions, poverty, and dyadic negotiating competence), taking into account all other variables.

Although differences were found in the contribution of specific explanatory variables to PPAISR and PNAB, the analyses for the second hypothesis showed the regression equation for PNAB to have some similarities to the regression equation for PPAISR. Family poverty status, which we used as a distal indicator of resources and access to them, had a substantially greater effect on both PPAISR and PNAB than either infant neonatal biomedical condition or maternal depressive symptoms. Family poverty status is an easily accessible index of scarcity or deprivation of resources. Our use of the categorical variable, poverty status, was, however, a very imprecise estimate of resources, and was assessed only once during the infant's first postterm year. Aspects of family poverty status and variation among families in them need to be determined. Although low education and minority status may be associated with poverty, these variables may not be central to the effect of poverty on maternal feeding competencies. Access to family support, work obligations and family responsibilities, and day-to-day stressors, potentially variables associated with poverty, may have a greater direct or indirect effect on a mother's feeding practice, interaction, and competencies than education.

As predicted by the third hypothesis, the contribution to PNAB of the proximal family-level condition, dyadic negotiating competence in problem solving infant care issues, at 1 month was beyond the contribution made by either infant neonatal biomedical condition, maternal depressive symptoms, and poverty. This finding supports the idea, derived from Hill et al. (2003), that the competence with which family members problem solve together may influence a mother's feeding competence. The finding that PNAB, which includes items concerned with absence of anxiety and negative reactivity to the infant as well as structuring and mediating the feeding and the feeding environment, was associated with dyadic negotiating competence at 1 month suggests that openness to the thought and affect of the problem-solving partner, a central feature of negotiating competence, may be learned in the experience and carry over to a mother's response to the affect and behavior of her infant during feeding. In contrast, maternal positive affective involvement with her infant during feeding, which is central to PPAISR, may have less to do with openness to another's thoughts and feelings. If the relation between dyadic negotiating competence and PNAB is replicable with a larger, more representative sample, examination of mechanisms of the effect of the quality of dyadic negotiating competence on feeding competencies is warranted through prospective, longitudinal study. How dyadic negotiating competence moderates or mediates the effect of direct intervention for development of feeding competencies is an important question for a randomized clinical trial.

The lack of a significant contribution of maternal symptoms of depression to either PPAISR or PNAB at 1 month in the context of the other predictor variables may have several explanations. Mothers, at 1 month, may have compensated for depressive symptoms in their feeding interactions with their infants, perhaps prompted by information concerning their infant's nutrient intake and developmental needs and guidance from special care nursery staff. The significant negative association of depressive symptoms with PNAB at 8 months but not with PPAISR may have been a function of the smaller standard error for depressive symptoms in association with PNAB than with PPAISR. A larger, more heterogeneous sample may produce different effects for depressive symptoms.

The small sample precluded examining the interactive effect of poverty on the association of depressive symptoms with feeding competencies. Poverty is known to be associated with a higher incidence of depression in mothers of young children (Hall, Williams, & Greenberg, 1985; Lanzi et al., 1999). Support from the father or other caregiver may mediate the effects of a mother's depressive symptoms on her competence in feeding her infant.

The lack of significant association of the NMI with either PPAISR or PNAB may be solid evidence of the relation of infant neonatal biomedical condition and maternal feeding competencies. The finding, however, in light of published studies (DeWitt et al., 1997; Singer et al., 2003) showing an effect on maternal competence of infant prematurity and neonatal morbidity suggests that, despite being constructed as an ordinal variable, the NMI may not adequately qualify the infant's biomedical condition in terms that are meaningful for a mother's feeding interaction behavior at 1 and 8 months. The scores on the NMI for the most part fell in the upper two points of the scale, perhaps constraining the relation with maternal feeding competencies.

With a larger sample, we could have included infant feeding competencies as well as other conditions in the model of predictors of maternal feeding competencies. Feldman (2007) studied infant regulation of negative emotionality during play interaction and found a link to maternal sensitivity. The adequacy of the infant's growth, as perceived by the mother or communicated by clinicians, may also make a difference in maternal feeding competencies through the pathway of maternal perception of competence (Bithoney, Van Sciver, Foster, Corso, & Tentindo, 1995).

Although the findings of this exploratory, small sample study cannot be generalized to mothers of VLBW infants during their first postterm year, and the theoretical model needs development and examination with a sample adequately large to test hypotheses, the model provides a point of departure for study of maternal feeding competencies. In particular, exploration of conditions theoretically linked to feeding competencies, such as those expressed in the factors PPAISR and PNAB, supports the use of these two factors for study of the effects of maternal feeding competencies on infant health outcomes. The proportion of variance accounted for in PPAISR and in PNAB by the model at both 1 and 8 months, and the variance shared between assessments at 1 and 8 months for both PPAISR and PNAB, are evidence of the model's usefulness. Taken together, the results support replication of the study with a larger and more diverse sample of mothers and VLBW infants.

Several directions for future research are suggested by study findings as well as by theoretical literature. The link of the dyadic problem-solving competence, negotiating, to mother-infant feeding interaction needs exploration in terms of the family member who participates with the mother, whether it is the infant's father or some other family member; and the quality of the relationship of mothers and participating family members. Examination of the expectations and intentions of family members and mothers concerning their interpersonal relationship and joint participation in infant feeding may further understanding of the link between dyadic negotiating competence and maternal feeding competencies.

This study supports the idea that the quality of negotiating engaged in by a mother and family member during problem solving of infant-care issues may be associated with maternal feeding competencies. Along with intervention targeted directly at feeding competencies, support of competence in negotiating among mothers and family members who participate in infant caregiving is a significant area of clinical practice to be developed for health care, early intervention, and home visiting settings. Identification and testing of effective approaches to support negotiating competence in contexts of prevention and intervention are directions for further research.

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TABLE 1
Descriptive Statistics for Time-Varying Measures in the Analytical Model at 1 and 8 Months

	1 Month				8 Months			
	<i>n</i>	<i>M</i>	<i>SD</i>	Range	<i>n</i>	<i>M</i>	<i>SD</i>	Range
Parent-Child Early Relational Assessment								
Parental Positive Affective Involvement, Sensitivity, and Responsiveness ^a	38	3.16	.86	1.62–5.00	35	3.19	.86	1.37–4.47
Parental Negative Affect and Behavior ^a	38	4.11	.43	3.07–4.93	35	3.78	.59	2.36–4.93
Center for Epidemiological Studies-Depression Scale								
Depressive symptoms ^b	37	12.81	8.25	2–40	40	13.18	7.85	1–35
Negotiating/Compromising Scale of the Iowa Family Interaction Rating System								
Negotiating, mother ^c	39	4.13	1.96	1–8	35	4.72	1.39	2–7
Negotiating, family member ^c	39	4.16	1.91	1–8	35	4.72	1.49	2–8
Dyadic negotiating ^c	39	4.14	1.81	1.00–7.67	35	4.72	1.30	1.67–7.25

Note. *n* is the number of families with data for the assessment.

^a Scale ranges from 1 to 5; a higher score indicates greater competence.

^b May range from 0 to 60; a higher score represents a greater number of symptoms of depression.

^c Scale ranges from 1 to 9; a higher score represents greater negotiating competence.

TABLE 2
Bivariate Correlations Among the Model Predictor Variable at 1 and 8 Months

	1 Month		8 Months	
	Neonatal Medical Index ^a	CES-D Score ^b	Neonatal Medical Index	CES-D Score
CESD Scales	-.001		-.18	
Poverty ^c	.06	.20	.06	.09
Family negotiating competence ^d	-.14	.03	-.10	.05
Poverty				-.05

Note. *n* is the number of families with data for the assessment, ranging from 35 to 41 at 1 month and 35 to 40 at 8 months. All correlations are Pearson's *r* except for poverty, for which correlation is point biserial. CES-D = Center for Epidemiological Studies-Depression.

^a Neonatal Medical Index was measured once, before hospital discharge.

^b Symptoms of depression, measured at 1 and 8 months.

^c Poverty status = 1, non-poverty status = 0, assessed after recruitment.

^d Family negotiating competence, measured at 1 and 8 months.

TABLE 3

Parameter Estimates and Effect Sizes for Hierarchical Fixed Occasions Repeated Measures Regression Analyses of Maternal Feeding Competencies

Maternal Competence/Predictor Variables	1 Month	Effect Size	8 Months	Effect Size
Parental Positive Affective Involvement, Sensitivity, and Responsiveness				
Intercept	1.045 (.795)		2.013 (.839)	
Neonatal Medical Index	.069 (.124)	.008	.067 (.118)	.032
Depressive symptoms	.005 (.015)	.038	-.022 (.014)	.004
Poverty ^a	.893 (.272)**	.290	.893 (.272)*	.284
Dyadic negotiating	.083 (.062)	.014	.044 (.082)	.045
Total model <i>R</i> ²	.2627		.2496	
Variance	.573 (.140)***		.514 (.129)***	
Covariance	.325 (.112)**			
Correlation of intercepts	.599			
Parental Negative Affect and Behavior				
Intercept	3.182 (.379)***		3.085 (.569)***	
Neonatal Medical Index	-.021 (.059)	.006	-.019 (.082)	.001
Depressive symptoms	.003 (.007)	.045	-.019 (.009)*	.030
Poverty ^a	.446 (.130)***	.335	.515 (.180)**	.354
Dyadic negotiating	.061 (.028)*	.129	.049 (.054)	.121
Total model <i>R</i> ²	.3505		.3121	
Variance	.134 (.033)***		.249 (.062)***	
Covariance	.122 (.038)**			
Correlation of intercepts	.671			

Note. *N* = 38. The standard error is shown in parentheses.

^aPoverty was coded as "1" for estimated family income of less than the federal poverty threshold and "0" for estimated family income greater than the federal poverty threshold.

*
p < .05;

**
p < .01;

p < .001.