



Published in final edited form as:

Child Care Health Dev. 2014 September ; 40(5): 740–746. doi:10.1111/cch.12106.

Longitudinal Associations Between Breastfeeding and Observed Mother-Child Interaction Qualities in Early Childhood

Lauren M. Papp

Department of Human Development & Family Studies, University of Wisconsin-Madison

Abstract

Background—Despite extensive literature on the role of breastfeeding in maternal and child health and cognitive development, few studies have systematically tested whether breastfeeding predicts children's socio-emotional outcomes. The present study examined associations between trajectories of breastfeeding and observed parent-child interaction qualities of maternal sensitivity, child positivity, and child negativity from 6 months to 3 years of age.

Methods—Data were drawn from the NICHD Study of Early Child Care and Youth Development ($N = 1,306$ U.S. families). Hierarchical linear modeling accounted for demographic and early characteristics, including home environment, maternal depression, and observed global relationship quality.

Results—Breastfeeding was associated with increases in observed maternal sensitivity over time, even after the effects of demographic and early characteristics were controlled. Accounting for the covariates, breastfeeding was not associated with child behavior (i.e., positivity, negativity) in mother-child interaction across early childhood.

Conclusions—Improved relationship quality, specifically through changes in maternal behavior, may be another advantage experienced by breastfeeding mothers and children.

Breastfeeding is fundamentally a relational process, consisting of mother and child participation, engagement, and dynamics (Dykes & Flacking, 2010). Breastfeeding is relatively common, with U. S. data showing that 74.6% of children born in 2008 were ever breastfed (Center for Disease Control and Prevention, 2011). Despite the pervasiveness of breastfeeding as one of the primary activities occurring between mother and child from birth, almost no research has investigated whether it plays a role in the development of mother-child relationship quality. To address this gap in knowledge, the present study investigates whether breastfeeding is associated with changes in observed mother-child interaction qualities assessed across early childhood.

Well-documented associations have been reported between breastfeeding and a host of improved outcomes for children, including cognitive function, motor skills, immunology, and mortality (e.g., Cunningham, 1995; Duijts et al., 2010; Oddy et al., 2011; Sloan, Stewart, & Dunne, 2010). Moreover, breastmilk provides benefits even to children in

developed countries in obesity, blood pressure, cholesterol, and cancer domains (Hoddinott et al., 2008). Although less commonly examined, breastfeeding also confers emotional and physical advantages to mothers (Godfrey & Lawrence, 2010; Hoddinott et al., 2008; Mezzacappa & Katkin, 2002) and their intimate relationships (Papp, 2012). Scholars considering implications of breastfeeding for both children and mothers have called for additional rigorous research, particularly with respect to observational outcomes and potential selection controls (Labbok, 2001).

In one of the few studies to examine breastfeeding and early relationships, Else-Quest and colleagues (2003) drew from a sample of 570 mother-infant dyads assessed at 4 and 12 months post-birth. Accounting for maternal covariates, breastfeeding mothers (defined as those who reported breastfeeding during the first week post-birth) self-rated higher levels of attachment (marginal) and feelings of reinforcement by infants at 4 months compared with mothers who did not breastfeed; the two groups did not differ on self-reported relationship measures at 12 months. A subset of participants was coded using the Parent-Child Early Relationship Assessment (PCERA; Clark, 1999) during feeding, structured, and play interactions at 4 and 12 months. Although breastfeeding did not distinguish any of the six PCERA scales coded at 4 months, breastfeeding dyads demonstrated lower levels of maternal negative affect, maternal intrusiveness, and infant dysregulation at 12 months (Else-Quest et al., 2003). The findings provided initial empirical support for breastfeeding in the developing mother-infant relationship, yet questions remain concerning the predictive utility of breastfeeding for outcomes over time, as dyads who had previously breastfed were combined with those who continued to breastfeed. In another previous study, mothers who initiated breastfeeding had higher observed sensitivity scores during feeding at 6 months postpartum than those who did not (Britton, Britton, & Gronwaldt, 2006). In sum, early breastfeeding may be associated with the development of maternal-child relationship processes, although direct tests based on repeated measurements of breastfeeding and observational outcomes have been limited.

Testing associations between breastfeeding and mother-child relationship quality should address selection bias, or the possibility that mothers who choose to breastfeed may be positively or negatively selected on certain characteristics that also bear on developing interactions with their child. Generally, breastfeeding mothers tend to be married, older, more educated, and have more resourceful homes than their non-breastfeeding counterparts (Gibson-Davis & Brooks-Gunn, 2007; Thulier & Mercer, 2009). Also, some work has shown African American mothers to be less likely to start breastfeeding than either European American or Latina mothers (Thulier & Mercer, 2009). Previous studies indicate that these confounding demographics and socio-economic characteristics may explain some of the benefits of breastfeeding on cognitive development (Holme et al., 2010; Jacobson et al., 1999), and thus should be accounted for in predictive analyses. Further, although linkages between breastfeeding and mothers' well-being remain understudied, maternal depression emerges as a reliable correlate of mother-child interaction qualities (Mistry et al., 2004), and is also included as a covariate.

The current study tested whether breastfeeding in the early years of life was associated with trajectories of observed mother-child relationship qualities. Building on work that has

tended to evaluate relations between breastfeeding and outcomes of mothers (Pearson et al., 2011) and children (Oddy et al., 2011) separately, maternal and child behavior from dyadic interaction was assessed. Given the generally positive outcomes for breastfeeding mothers and children in other domains, the linkage was predicted to be positive in nature, with breastfeeding expected to be positively associated with child positivity and maternal sensitivity and inversely associated with child negativity. Extending covariates included in previous studies, analyses further accounted for demographic characteristics and early home environment, maternal depression, and observed global relationship quality to strengthen conclusions concerning the role of breastfeeding in the development of mother-child relationship qualities.

Method

Participants and Procedures

Participants were a subset of families drawn from Phase I of the National Institute of Child Health and Human Development Study of Early Child Care and Youth Development (NICHD SECCYD), a longitudinal sample of 1,364 children born at 31 hospitals near 10 U.S. research sites during 1991 (NICHD Early Child Care Research Network [ECCRN], 2001). Secondary analysis of the data set was carried out with the approval of the author's Institutional Review Board. The SECCYD collected a wealth of information on child development in contexts. Original families were selected following a conditional random-sampling plan designed to represent the economic, educational, and ethnic diversity of each research site. The present study included 1,306 families (approximately 95% of the original sample), who contributed data on demographic and early characteristics at 1 and 6 months, breastfeeding between 1 month and 36 months, and observed mother-child interaction qualities between 6 and 36 months.

Measures

Demographic and background characteristics—Demographic covariates including maternal race and ethnicity, age, education, and marital or cohabiting status were obtained from the assessment when children were 1 month old. Additional early characteristics (from the 6-month home interview) included as potential confounding variables were the Home Observation of Measurement of the Environment (HOME; Caldwell & Bradley, 1984), maternal depressive symptoms, and an observer rating of the overall impression of the mother-infant relationship. Slightly more than 85% of these observations were rated as “good” or “excellent”. The HOME was based on observations and maternal interviews to evaluate the quality/quantity of stimulation and support available to a child in the home environment. The total HOME score was included ($\alpha = .76$). Maternal depressive symptoms were assessed using the Center for Epidemiological Studies-Depression scale (Radloff, 1977), a 20-item self-report instrument. Respondents indicated how frequently they have been bothered by the listed depressive symptoms (e.g., “I felt that everything I did was an effort”) during the past week, ranging from 0 (*less than one day*) to 3 (*5-7 days*). Cronbach's alpha = .89.

Breastfeeding—Breastfeeding was reported by mothers via a series of questions administered in Phase I. During the 1-month interview, mothers were asked if the child was ever breastfed. Mothers responding no were coded as mother-child dyads who *never breastfed*, and mothers responding yes were asked how old, in weeks, their baby was when breastfeeding had ended. At the 6-month interview, mothers who had indicated breastfeeding at 1 month were asked if they were currently breastfeeding. Those responding no were asked how old, in months, their baby was when breastfeeding had ended. These questions were repeated until the mother reported that breastfeeding had ended, or through 36 months. Breastfeeding predictor variables in subsequent analyses consisted of a dichotomous indicator (1 = *currently breastfeeding*) assessed at 6, 15, 24, and 36 months.

Mother-child interaction qualities in early childhood—Semi-structured, 15-minute mother-child interactions were conducted in the home at 6 and 15 months and in the lab at 24 and 36 months. The interaction instructions and codes were adapted across assessments to reflect developmental appropriateness (NICHD ECCRN, 1999). These recorded interactions were coded at a central non-data collection site by trained observers who did not have other information about the families. The current study focuses on qualities that captured maternal and child behaviors hypothesized to be associated with breastfeeding across early childhood. The child outcomes of interest at 6, 15, and 24 months were 4-point ratings of positive mood and negative mood; at 36 months these behaviors were tapped with parallel 7-point ratings of enthusiasm and negativity, respectively. The maternal outcome of interest was the composite score of maternal sensitivity, which at 6, 15, and 24 months, was a sum of 4-point ratings of sensitivity to nondistress, intrusiveness (reverse coded), and positive regard. At 36 months, maternal sensitivity consisted of a sum of 7-point ratings of supportive presence, respect for autonomy, and hostility (reverse coded). Cronbach's alphas for ratings of maternal sensitivity composites ranged from .70 to .78, and intercoder reliability (i.e., intraclass correlation) ranged from .83 to .87 (NICHD ECCRN, 1999). Scores obtained across assessments were transformed to the same scale.

Results

Table 1 reports demographic and early characteristics of the overall sample and by breastfeeding categories: mother-child dyads who never breastfed, mother-child dyads who breastfed for any duration, and mother-child dyads who breastfed 6 months or beyond and thus contributed breastfeeding data to the primary analyses of this study. In general, comparing demographic and early characteristics across the different categories revealed that mother-child dyads who started breastfeeding and who breastfed longer included mothers who were more likely to be **European American**, older, and more educated; live with a spouse/partner; and have lower levels of depressive symptoms relative to dyads who did not breastfeed or who breastfed shorter. Also, mother-child dyads who breastfed and who breastfed longer exhibited relatively higher observed relationship quality and total HOME scores at 6 months compared to those who did not breastfeed or who breastfed **for a shorter duration** (Table 1).

Correlations among mother-child interaction qualities observed at 6, 15, 24, and 36 months were examined. Within constructs, correlations over the four assessments were positive but

small; average $r = .15$, ranging from .06 (child negativity at 6 months and 15 months) to .39 (maternal sensitivity at 6 months and 15 months). Correlations were also small across constructs. For example, cross-construct correlations from observations at the same assessments averaged .02 and ranged from -.08 for child negativity and child positivity at 6 months to -.47 for child negativity and maternal sensitivity at 36 months, supporting consideration of the three interaction qualities as separate outcome variables.

Initial hierarchical linear models examined associations between trajectories of breastfeeding and parent-child interaction qualities from 6 months to 36 months with the following Level 1 model:

$$Y = \beta_0 + \beta_1(\text{wave}) + \beta_2(\text{breastfeeding}) + r, \quad (\text{Eq. 1})$$

where β_0 (**i.e., intercept**) is the average interaction quality outcome of interest at 6 months, β_1 is the rate of linear change in the interaction quality outcome, and β_2 indicates whether current breastfeeding (relative to not breastfeeding) is associated with change in the interaction quality. Models were tested using the HLM program (Raudenbush et al., 2004). Level 1 coefficients with nonsignificant residuals were set to 0 and fixed effects with robust standard errors were interpreted. Results from unconditional models with no Level 2 predictors indicated that current breastfeeding was positively associated with maternal sensitivity (coefficient = 0.527, $t = 6.63$, $p < .001$) and child positivity (coefficient = .077, $t = 2.92$, $p = .022$) over time, but was not reliably associated with changes in child negativity (coefficient = -0.044, $t = -1.32$, $p = .188$).

In light of previous research documenting selection bias and confounds associated with breastfeeding and mother-child interaction, the current study accounted for a broad set of covariates in the central analyses. Accordingly, the following intercept covariates were added to Level 2: study data collection site (1-9), maternal race (1 = *African American*, 0 = *European American or other race*), maternal ethnicity (1 = *Latina*), maternal age, maternal years of education, marital/cohabiting status (1 = married or cohabiting), 6-month total HOME scores, maternal depression, and observed relationship quality levels. Less than 3% of cases had missing Level 2 variables; these were replaced using multiple imputation.

Table 2 shows results from hierarchical linear models with the three observed mother-child interaction qualities as outcome variables (see Equation 1). Results indicated that current breastfeeding was associated with increases in maternal sensitivity over time, accounting for the linear change in maternal sensitivity; demographic controls; and early characteristics of total HOME score, maternal depression, and observed mother-child relationship quality. Hierarchical linear models also indicated that, once the demographic controls and early characteristics were accounted for, breastfeeding was not reliably associated with trajectories of observed child behavior (*i.e.*, negativity, positivity) during mother-child interaction across early childhood (see Table 2).

Discussion

This study is among the first to investigate breastfeeding across early childhood in the literature on socio-emotional development. Hierarchical linear models tested associations between the course of breastfeeding and trajectories of mother-child interaction qualities observed between 6 months and 3 years of age, taking into account a broader set of demographic and early characteristics than considered in previous breastfeeding studies. Results indicated that breastfeeding, relative to never breastfeeding, predicted positive changes in mothers' sensitivity levels beyond the developmental course of mother behavior during interaction with child, even after accounting for the set of covariates, which included early mother-child global relationship quality. Breastfeeding was not associated with observed child behavior (i.e., negativity, positivity) during mother-child dyadic interaction across early childhood. The current study showed breastfeeding patterns to differentially relate to differences in demographic variables and early home and maternal characteristics. It was important to include covariates in the trajectory models, which helped to minimize a potential bias in the observed association between breastfeeding and mother-child relationship outcomes and strengthen the conclusion that the increases in maternal sensitivity over time were attributable to breastfeeding rather than other behaviors or characteristics.

Examining mother-child interaction qualities across early childhood was ideal because it paralleled the study's measurement of breastfeeding. Nevertheless, it is possible that focusing on dyadic interaction qualities that were initially measured when the child was 6 months failed to capture associations between breastfeeding and changes in child behavior in mother-child interaction. For example, mothers of 2-3 month old infants reported less frequent problematic crying among breastfed babies than formula- or mixed-fed babies (van der Wal et al., 1998). It is possible that direct effects of breastfeeding on children's emotionality in dyadic interaction may diminish over time as other influences (e.g., relationships within the family; Eiden et al., 1995) increase. Alternatively, effects of breastfeeding on multiple domains of child adaptation may be observed indirectly later in development, potentially through the positive changes in maternal behavior observed here. The current findings lend support to the predictive utility of breastfeeding on certain outcomes, at least between 6 months and 3 years of age, and encourage consideration of breastfeeding and feeding practices in process-oriented models (including tests of mediation and moderation) of child social-emotional development.

This study also contributes to understanding the long-term implications of mother-child relationship quality in broader family contexts. Drawing from a large, 15-year prospective study in Australia, Strathearn and colleagues (2009) reported an inverse association between breastfeeding and the likelihood of maternal maltreatment, with nonbreastfed children experiencing a nearly fourfold increase in the odds of neglect compared with children breastfed for 4 or more months, even after adjusting for confounds. By promoting physiological bonding or behavioral changes associated with secure caregiving relationships, breastfeeding may serve as a protective factor in long-term, and potentially high-risk, family relationships (Strathearn et al., 2009).

The findings provide evidence for the notion that breastfeeding promotes an enduring positive relationship between mother and child, which has been consistently assumed, but not rigorously tested, in the literature (Jansen et al., 2008). However, several qualifications should be noted. First, breastfeeding was related to only one of three observed interaction outcomes over time; support for a modest relation aligns with the “good enough” caregiving hypothesis that holds that breastfeeding is neither necessary nor sufficient for the development of positive mother-child relationship quality (Else-Quest et al., 2003). Rather, breastfeeding is posited to be one of many factors associated with child socio-emotional development trajectories. Second, the study did not assess biological or bioactive properties of human milk that may account for the observed associations, for example, via effects on central nervous system, brain development, and other organ systems (McNamara & Carlson, 2006; Schack-Nielsen & Michaelsen, 2007). Future research should incorporate both biological and psychosocial factors in relation to breastfeeding and child development over time. Third, given that approximately one-quarter of the sample breastfed for 6 months or longer, the current design did not support investigation of duration of breastfeeding as a potential moderating factor. Designs with more intensive measurements of breastfeeding timing and the outcomes of interest across early childhood would be better suited to capture effects of duration. As well, age at which milk other than breast milk was introduced should be included in future studies to comprehensively measure exclusive breastfeeding. Fourth, SECCYD results are not representative of all U.S. families, and thus do not extend to the development of parent-child relationships in many contemporary household and family structures. Finally, although not anticipated, breastfeeding related only to changes in observed maternal (not child) behavior. It is important to bear in mind the difficulties in isolating breastfeeding from related maternal behaviors and confounding factors, including the decision to breastfeed (see Wolf, 2011). Clearly, designs with more focused attention on breastfeeding and associated behaviors and cognitions are needed to inform causal conclusions.

As current public health efforts encourage more women to breastfeed their children and to breastfeed through the first year of life (e.g., U. S. Department of Health and Human Services, 2011), it remains important to clarify how breastfeeding affects mothers and those close to them. These findings may offer additional benefits associated with breastfeeding for consideration by mothers and those who support them (e.g., partners, family members, health care providers) and play a critical role in establishing and maintaining breastfeeding (Dykes & Flacking, 2010).

Acknowledgments

This research was supported in part by Grant R03 HD057346.

References

- Britton JR, Britton HL, Gronwaldt V. Breastfeeding, sensitivity, and attachment. *Pediatrics*. 2006; 118:e1436–e1443.10.1542/peds.2005-2916 [PubMed: 17079544]
- Caldwell, B.; Bradley, B. *Home Observation for Measurement of the Environment*. Little Rock, AR: University of Arkansas at Little Rock; 1984.

- Center for Disease Control and Prevention. Breastfeeding report card report card–United States, 2011. 2011. Retrieved from <http://www.cdc.gov/breastfeeding/data/reportcard.htm>
- Clark R. The parent-child early relational assessment: A factorial validity study. *Educational and Psychological Measurement*. 1999; 59:821–846.10.1177/00131649921970161
- Cunningham, AS. Breastfeeding: Adaptive behavior for child health and longevity. In: Stuart-Macadam, P.; Dettwyler, KA., editors. *Breastfeeding: Biocultural perspectives*. Aldine de Gruyter; New York: 1995. p. 243-264.
- Duijts L, Jaddoe VW, Hofman A, Moll HA. Prolonged and exclusive breastfeeding reduces the risk of infectious diseases in infancy. *Pediatrics*. 2010; 126:e18–e25.10.1542/peds.2008-3256 [PubMed: 20566605]
- Dykes F, Flacking R. Encouraging breastfeeding: A relational perspective. *Early Human Development*. 2010; 86:733–736.10.1016/j.earlhumdev.2010.08.004 [PubMed: 20826072]
- Eiden RD, Teti DM, Corns KM. Maternal working models of attachment, marital adjustment, and the parent-child relationship. *Child Development*. 1995; 66:1504–1518.10.1111/j.1467-8624.1995.tb00948.x [PubMed: 7555226]
- Else-Quest NM, Hyde JS, Clark R. Breastfeeding, bonding, and the mother-infant relationship. *Merrill-Palmer Quarterly*. 2003; 49:495–517.10.1353/mpq.2003.0020
- Gibson-Davis CM, Brooks-Gunn J. The association of couples' relationship status and quality with breastfeeding initiation. *Journal of Marriage and Family*. 2007; 69:1107–1117.10.1111/j.1741-3737.2007.00435.x
- Godfrey JR, Lawrence RA. Toward optimal health: The maternal benefits of breastfeeding. *Journal of Women's Health*. 2010; 19:1597–1602.10.1089/jwh.2010.2290
- Hoddinott P, Tappin D, Wright C. Breast feeding. *BMJ*. 2008; 336:881–887.10.1136/bmj.39521.566296.BE [PubMed: 18420694]
- Holme A, MacArthur C, Lancashire R. The effects of breastfeeding on cognitive and neurological development of children at 9 years. *Child: Care, Health Development*. 2010; 36:53–590.10.1111/j.1365-2214.2009.01068.x
- Jacobson SW, Chiodo LM, Jacobson JL. Breastfeeding effects on intelligence quotient in 4- and 11-year-old children. *Pediatrics*. 1999; 103(5) Retrieved from <http://www.pediatrics.org/cgi/content/full/103/5/e71>.
- Jansen J, de Weerth C, Riksen-Walraven JM. Breastfeeding and the mother-infant relationship—A review. *Developmental Review*. 2008; 28:503–521.10.1016/j.dr.2008.07.001
- Labbok MH. Effects of breastfeeding on the mother. *Pediatric Clinics of North America*. 2001; 48:143–158.10.1016/S0031-3955%2805%2970290-X [PubMed: 11236722]
- McNamara RK, Carlson SE. Role of omega-3 fatty acids in brain development and function: Potential implications for the pathogenesis and prevention of psychopathology. *Prostaglandins, Leukotrienes and Essential Fatty Acids*. 2006; 75:329–349.10.1016/j.plefa.2006.07.010
- Mezzacappa ES, Katkin ES. Breast-feeding is associated with reduced perceived stress and negative mood in mothers. *Health Psychology*. 2002; 21:187–193.10.1037//0278-6133.21.2.187 [PubMed: 11950109]
- Mistry RS, Biesanz JC, Taylor LC, Burchinal M, Cox MJ. Family income and its relation to preschool children's adjustment for families in the NICHD Study of Early Child Care. *Developmental Psychology*. 2004; 40:727–745.10.1037/0012-1649.40.5.727 [PubMed: 15355162]
- NICHD ECCRN. Child care and mother-child interaction in the first 3 years of life. *Developmental Psychology*. 1999; 35:1399–1413.10.1037/0012-1649.35.6.1399 [PubMed: 10563730]
- NICHD ECCRN. Nonmaternal care and family factors in early development: An overview of the NICHD Study of Early Child Care. *Journal of Applied Developmental Psychology*. 2001; 22:457–492.10.1016/S0193-3973(01)00092-2
- Oddy WH, Robinson M, Kendall GE, Li J, Zubrick SR, Stanley FJ. Breastfeeding and early child development: A prospective cohort study. *Acta Paediatrica*. 2011; 100:992–999.10.1111/j.1651-2227.2011.02199.x [PubMed: 21299610]
- Papp LM. The longitudinal role of breastfeeding in mothers' and fathers' relationship quality trajectories. *Breastfeeding Medicine*. 2012; 7:241–247.10.1089/bfm.2011.0074 [PubMed: 22148926]

- Pearson RM, Lightman SL, Evans J. The impact of breastfeeding on mothers' attentional sensitivity towards infant distress. *Infant Behavior & Development*. 2011; 34:200–205.10.1016/j.infbeh.2010.12.009 [PubMed: 21185606]
- Radloff LS. The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*. 1977; 1:385–401.10.1177/014662167700100306
- Raudenbush, SW.; Bryk, AS.; Congdon, R. HLM 6 for Windows. Skokie, IL: Scientific Software International, Inc; 2004. Computer software
- Schack-Nielsen L, Michaelsen KF. Advances in our understanding of the biology of human milk and its effects on the offspring. *The Journal of Nutrition*. 2007; 137:503S–510S. [PubMed: 17237337]
- Sloan S, Stewart M, Dunne L. The effect of breastfeeding and stimulation in the home on cognitive development in one-year-old infants. *Child Care in Practice*. 2010; 16:101–110.10.1080/13575270903529136
- Strathearn L, Mamun AA, Najman JM, O'Callaghan MJ. Does breastfeeding protect against substantiated child abuse and neglect? A 15-year cohort study. *Pediatrics*. 2009; 123:483–493.10.1542/peds.2007-3546 [PubMed: 19171613]
- Thulier D, Mercer J. Variables associated with breastfeeding duration. *Journal of Obstetric, Gynecologic, & Neonatal Nursing*. 2009; 38:259–268.10.1111/j.1552-6909.2009.01021.x
- U. S. Department of Health and Human Services. The surgeon general's call to action to support breastfeeding. Washington, DC: U. S. Department of Health and Human Services, Office of the Surgeon General; 2011.
- van der Wal MF, van den Boom DC, Pauw-Plomp H, de Jonge GA. Mothers' reports of infant crying and soothing in a multicultural population. *Archives of Disease in Childhood*. 1998; 79:312–317.10.1136/adc.79.4.3.12 [PubMed: 9875040]
- Wolf, JB. *Is breast best? Taking on the breastfeeding experts and the new high stakes of motherhood*. New York University Press; New York: 2011.

Key Messages

1. Differential breastfeeding patterns were observed across demographic and early maternal and home characteristics, encouraging continued inclusion of covariates in statistical tests of breastfeeding effects. 2. Breastfeeding was associated with positive changes in observed maternal sensitivity across early childhood. 3. Future research should examine maternal caregiving changes as a mediator of the documented relations between breastfeeding and later maternal and child outcomes.

Table 1
Sample Characteristics and Descriptive Statistics

	Breastfeeding Categories			Sample <i>N</i> = 1,306
	Never breastfed <i>n</i> = 361	Ever breastfed <i>n</i> = 945	Breastfed at 6 mos. <i>n</i> = 358	
Demographics				
% mother is Latina ^a	1.9	5.1	4.5	4.2
% mother is European American ^{a b}	66.2	89.5	93.9	83.1
% mother is African American ^{a b}	30.7	5.4	2.2	12.4
% mother is another race	3.0	5.1	3.9	4.5
Mother's age ^{a b}	25.51 (5.61)	29.27 (5.30)	30.90 (4.93)	28.23 (5.64)
Mother's years of education ^{a b}	12.78 (2.16)	14.85 (2.39)	15.49 (2.31)	14.28 (2.50)
% mother is married/cohabiting ^{a b}	73.7	90.6	95.8	85.9
Early characteristics				
Total HOME score ^{a b}	33.79 (5.53)	37.50 (3.81)	38.29 (3.41)	36.47(4.67)
Maternal depression ^{a b}	10.78 (8.95)	8.36 (7.99)	7.66 (7.26)	9.03(8.34)
Observed relationship quality ^{a b}	3.97 (0.71)	4.31 (0.64)	4.43 (0.57)	4.22 (0.68)

Note. Means and standard deviations are presented for continuous variables; percentages are presented for dichotomous variables. Higher HOME scores reflect higher levels of observed home environment. Higher depression scores reflect higher levels of self-reported depression symptoms. Higher relationship quality scores reflect higher levels of observed mother-infant relationship.

^aComparing mother-child dyads who never breastfed and those who did revealed a significant difference ($p < .05$).

^bComparing mother-child dyads who breastfed for less than 6 months and those who breastfed for 6 months or more revealed a significant difference ($p < .05$).

Table 2
Results of Hierarchical Linear Models Predicting Mother-Child Interaction Qualities from Breastfeeding Accounting for Demographics and Early Characteristics

Y = Mother-Child Interaction Qualities	Outcome variables					
	Child Positivity		Child negativity		Maternal sensitivity	
	Coeff	t	Coeff	t	Coeff	t
Constant						
Intercept	2.458	62.41**	1.472	31.07**	9.168	81.33**
Mother is African American	-0.152	-4.29**	0.092	2.20*	-0.784	-7.01**
Mother is Latina	-0.092	-0.56	-0.047	-0.87	-0.104	-0.82
Mother's age	-0.001	-0.36	-0.001	-0.60	0.016	2.73**
Mother's years of education	0.020	3.88**	-0.010	-2.00*	0.137	10.12**
Mother is married/cohabiting	0.044	1.28	-0.045	-1.07	0.170	1.62
Total HOME score	0.005	1.48	0.003	1.07	0.054	6.73**
Maternal depression	-0.001	-0.82	0.003	1.91 [†]	-0.009	-2.37*
Observed relationship quality	0.020	1.08	-0.079	-3.87**	0.295	6.04**
Wave slope						
Intercept	0.126	15.20**	-0.118	-13.50**	0.182	9.64**
Breastfeeding slope						
Intercept	0.022	0.65	0.002	0.05	0.157	2.03*

Note. Study site was also included as a covariate in the models (results not shown).

[†] $p < .06$.

* $p < .05$.

** $p < .01$.