



NIH PUBLIC ACCESS

Author Manuscript

Matern Child Health J. Author manuscript; available in PMC 2009 June 8.

Published in final edited form as:

Matern Child Health J. 2008 May ; 12(3): 402–414. doi:10.1007/s10995-007-0248-6.

Understanding Breastfeeding Initiation and Continuation in Rural Communities: A Combined Qualitative/Quantitative Approach

Kori B. Flower,*Charles Drew Community Health Center, Piedmont Health Services, 221 North Graham-Hopedale Road, Burlington, NC, USA***Michael Willoughby,***Frank Porter Graham Child Development Institute, University of North Carolina, Chapel Hill, NC, USA***R. Jean Cadigan,***Center for Developmental Science, University of North Carolina, Chapel Hill, NC, USA***Eliana M. Perrin,***Division of General Pediatrics and Adolescent Medicine, Department of Pediatrics, University of North Carolina, Chapel Hill, NC, USA***Greg Randolph, and***Charles Drew Community Health Center, Piedmont Health Services, 221 North Graham-Hopedale Road, Burlington, NC, USA***The Family Life Project Investigative Team**

Abstract

Objective—To determine factors associated with breastfeeding in rural communities.**Methods**—We combined qualitative and quantitative data from the Family Life Project, consisting of: (1) a longitudinal cohort study ($N = 1292$) of infants born September 2003–2004 and (2) a parallel ethnographic study ($N = 30$ families). Demographic characteristics, maternal and infant health factors, and health services were used to predict breastfeeding initiation and discontinuation using logistic and Cox regression models, respectively. Ethnographic interviews identified additional reasons for not initiating or continuing breastfeeding.**Results**—Fifty-five percent of women initiated breastfeeding and 18% continued for at least 6 months. Maternal employment at 2 months and receiving WIC were associated with decreased breastfeeding initiation and continuation. Ethnographic data suggested that many women had never even considered breastfeeding and often discontinued breastfeeding due to discomfort, embarrassment, and lack of assistance.**Conclusions**—Breastfeeding rates in these rural communities lag behind national averages. Opportunities for increasing breastfeeding in rural communities include enhancing workplace support, maximizing the role of WIC, increasing hospital breastfeeding assistance, and creating a social environment in which breastfeeding is normative.

Keywords

Breastfeeding; Rural; Low-income; Ethnography; WIC; Maternal employment

Introduction

Because breastfeeding confers numerous health advantages for infants, the American Academy of Pediatrics (AAP) endorses exclusive breastfeeding for 6 months and continued breastfeeding for at least a year [1]. Seventy-one percent of United States women initiate any breastfeeding, and only 35% of women breastfeed for 6 months [2], falling short of the Healthy People 2010 goal of 50% [3]. Recognizing the importance of breastfeeding to infant health, the US Department of Health and Human Services has called for research on factors that influence infant feeding, particularly in ethnic minority groups [4].

Previous work suggests that initiation of breastfeeding may be more frequent among urban women (59%) compared with rural women (49%) [5]. More recent studies have not similarly directly compared breastfeeding rates between urban and rural women [2,6], and potential differences in breastfeeding rates in urban and rural areas have been infrequently explored. In rural communities, shared characteristics such as geographic isolation, few economic resources, and limited access to health care [7] might result in distinct influences on women's infant feeding decisions. Despite these differences, breastfeeding in rural communities has rarely been studied.

In urban settings, several longitudinal studies have prospectively examined breastfeeding initiation and discontinuation [8–13]. These studies have suggested that among urban women, breastfeeding initiation and continuation may be influenced by multiple factors, including participation in the WIC program [8], support from the health system [10,12,13], maternal depression [12], and return to work or school [9]. Rural families differ in many important aspects from their urban counterparts: they are more likely to be poor, lack health insurance, and have limited access to hospital-based services [14]. Such differences in demographics and health services might be expected to create a distinct pattern of influences upon breastfeeding in rural communities. Due to the lack of research on breastfeeding among women in rural areas, it is unknown whether the factors that influence breastfeeding initiation and continuation are similar to or distinct from those previously described among urban women.

Contextual information is also needed to fully understand how factors influencing breastfeeding initiation and continuation operate [15] in the lives of women in rural communities. To comprehensively identify key influences on breastfeeding and describe their context, we used a combined quantitative/qualitative approach within the Family Life Project (FLP), a longitudinal study of families in rural North Carolina (NC) and Pennsylvania (PA). Since demographic characteristics [2,16–18], maternal health [12,19,20], infant characteristics [2,21,22], social and health services [8,12,13], and regional characteristics [2,16,18] may be associated with breastfeeding, we examined the relationships of these factors to breastfeeding initiation and continuation in rural communities.

Methods

We used a mixed methods approach consisting of a longitudinal cohort (1,292 families) and an ethnographic study (a separate sample of 30 NC families). The overall Family Life Project was designed to understand how poverty, rurality, and race interact to influence a number of aspects of young children's development. We sought to prospectively investigate infant feeding patterns within the cohort as one part of a larger set of investigations of children's developmental, health, and growth trajectories. We drew on the combination of (1) quantitative data from questionnaires and interviews administered to the FLP cohort, and (2) qualitative data from in-depth interviews conducted in the ethnography.

Longitudinal Cohort Study

Overview—The FLP longitudinal cohort was designed to study families in two major geographical areas of high poverty. A total of 1292 families from three contiguous eastern NC counties and three contiguous central PA counties were selected for a study of the rural South and Appalachia, respectively.

Sampling Strategy and Recruitment—Complex sampling procedures were used to recruit a representative sample of low-income families in both states and an over-sample of African American families in NC. African-American families were not over-sampled in PA as the target communities were >95% Caucasian. In PA, families were recruited in person from three hospitals, which represented a weighted probability sample of all seven hospitals in the target counties. PA hospitals were sampled because the number of babies born in all seven target hospitals far exceeded the number needed for purposes of the design. In NC, in-person recruitment occurred in all three target county hospitals. Additional NC families (approximately 15%) resided in target counties but delivered in non-target hospitals; they were located through systematic searches of nearby county courthouse birth records and recruited by phone.

Recruitment occurred 7 days per week over the 12-month recruitment period between September 15, 2003 and September 14, 2004 using a standardized script and screening protocol. Written informed consent was obtained from all participants and the study was approved by the Institutional Review Board at the University of North Carolina, Chapel Hill.

Recruiters identified 5471 (57% NC, 43% PA) women who gave birth to a child during the recruitment period, 72% of whom were eligible for the study, as defined by residence in target counties with no intent to move within 3 years, and speaking English as their primary language (since the prohibitively high financial cost of training interviewers and preparing and coding all measures in other languages precluded enrollment of non-English speakers). Sixty-eight percent of eligible families agreed to be considered for inclusion in the study. Fifty-eight percent of these women were invited to participate, based on sampling fractions that ensured over-sampling of low-income families in both states, and African-American families in NC. To guide recruitment, families were classified as low-income if they reported household income <200% of the federal poverty line, or used social services indicative of low income (e.g., WIC, food stamps), or if the head of household had less than high school education. Families were classified as “not low-income” for purposes of recruitment if they met none of these criteria. Eighty-two percent of those invited completed the first home visit, resulting in a sample of 1,292 women. The NC sample included African-Americans ($N = 521$), and “other” (predominantly Caucasian) low-income ($N = 168$) and not low-income ($N = 86$) participants. The predominantly Caucasian PA sample included low-income ($N = 344$) and not low-income ($N = 175$) participants. For the present analyses, five infants under the primary care of grandparents were excluded since breastfeeding was not applicable. Thus, our total sample consisted of 1,287 women. Per protocol, only the first infant born to each woman within a 12-month period was included in the study. This resulted in the inclusion of 1,287 infants, all of whom were singleton births.

Data Collection—Home visits were conducted by trained research assistants when the target child was approximately 2 months (mean = 2.6; range = 1.0–9.5) and 6 months (mean = 7.4; range = 5.0–15.4) of age. All families participated in the initial home visit, and the 6-month visit was completed by 93% of participants. Questionnaire and interview data were obtained by research assistants using in-home laptops and computer assisted personal interview (CAPI) technology; questions were either read directly off the laptop by the respondent or read aloud by the interviewer for mothers who read at or below an 8th grade reading level per the K-FAST

literacy screener [23]. Home visits lasted approximately 2½ h and families received \$ 50 at completion of each visit.

Outcome Variables—Respondents were interviewed about breastfeeding during the 2 and 6 month visits. Consistent with national breastfeeding surveillance studies [2], initiation of any breastfeeding was defined by mother’s response to the following question: “Has [target child] ever been fed breast milk?” (yes/no). Duration of breastfeeding was determined by mother’s response to the following question: “How old was [target child] when (he/she) *completely stopped* being fed breast milk?” (days/weeks). This continuous measure of child age at the time of breastfeeding discontinuation was the dependent variable used in Cox regression models. We examined discontinuation at 6 months since the benefits of breastfeeding for this duration are well-documented and supported by recommendations [1,4]. Detailed exploration of the timing and scope of introduction of other liquids and solids is beyond the scope of this analysis; however, recognizing that exclusivity of breastfeeding may relate to breastfeeding commitment, we determined breastfeeding exclusivity at 2 months by examining whether or not women reported having introduced formula, cow’s milk, infant cereal, juice, any sugar-containing liquids, or any solids.

Predictor Variables—At the 2-month visit, we collected data on potential predictors, including the following regional variables: state (NC, PA) and geographic isolation, as indicated by a composite measure consisting of the logged average distance (in meters) from the respondent home to community assets (nearest gas station, physician office, library, fire station, elementary school, high school, public park, supermarket, county seat, and freeway exit ramp).

Demographic variables included poverty level; families were classified as low-income if at recruitment they reported any of the following: (1) family income <200% federal poverty threshold for a given household size, or (2) use of services that require family income <200% federal poverty threshold (food stamps, WIC, TANF, school free lunch program, etc.). More refined measures of poverty, including income-to-needs ratio, were obtained beginning at the 6-month visit. Sensitivity checks of all results reported here indicated that the general indicator of poverty performed in an identical manner to the continuous measure obtained at the 6-month home visit. We used the general indicator of poverty here, since analyses are based on 2- and 6-month home visits. Additional demographic characteristics reported by the mother were: maternal age, race, educational level, current employment (yes/no), relationship status (married, living with partner, non-cohabitating partner, single), number of children in household, birth order of target child, and whether the target child attends a childcare center.

Maternal health factors included the following variables: body mass index (calculated from mother’s report of pre-pregnancy height and weight), self-reported health status as assessed by a general health perception question [24], and maternal smoking during pregnancy. Pregnancy problems were determined by maternal report using a perinatal complications questionnaire [25] and number of pregnancy problems was calculated by summing the following items: heavy bleeding, excess vomiting, pregnancy weight loss over 10 pounds, infection requiring medical care, high blood pressure, water retention, convulsions, serious accidents, and emotional and family problems. Maternal distress was measured using the Brief Symptom Inventory-18 and was defined by symptoms exceeding 90th percentile on T-score (yes/no).

Infant characteristics included the following: gender, gestational age (calculated by subtracting due date reported by mother from birth date), and length of hospital stay as reported by mother. The number of infant health problems was calculated by summing the following problems reported by the mother on a perinatal health questionnaire [25]: having breathing difficulties

at birth, congenital malformations, surgery in the first month, prolonged hospital stay, or admission to neonatal intensive care unit. Infant health status was assessed by a general health perception question which correlates well with chronic conditions in children [26]. Additional infant characteristics included mother's report on a perinatal health questionnaire [25] of infant colic (yes/no), and whether infant was a "difficult baby" (yes/no).

Health and social services included WIC participation, determined by mother's report of whether she or another household member had received WIC since the target child's birth. Breastfeeding assistance was determined by mother's report of receiving services to help with breastfeeding (yes/no).

Analysis—Initiation models involved logistic regression of ever breastfeeding on the predictors described above (regional and demographic variables, maternal health factors, infant characteristics, and social and health services). Continuation models involved Cox proportional hazard models in which duration of breastfeeding (time to termination) was regressed on the same predictors described above; additionally, infant colic, report of a "difficult baby", and breastfeeding assistance were included in the continuation model only.

Since state, race, and poverty were major design characteristics and were associated with breastfeeding in preliminary analyses, we included two and three-way interaction terms including these variables in addition to WIC participation and maternal employment, which we theorized were potentially important breastfeeding influences. We started with a main effects model (no interaction) and re-estimated that model including all possible interactions. We then trimmed the model to include only significant interaction terms. All statistical models were estimated in SUDAAN (version 9) [27] to take into account the complex sampling design. Specifically, robust variance estimation methods, following the methods of Binder [28], were used to obtain correct standard errors.

Ethnographic Study

To inform the cohort study, a separate sample of families was recruited for an ethnography from the same six counties in NC and PA. To minimize burden to the participants, these intensive interviews included families who were not involved in the cohort study. Families were selected to be representative of cohort study participants in terms of poverty status, locality, and race; this was verified after recruitment by comparing ethnography and cohort participants on these characteristics. During February 2003—February 2004 pregnant women were recruited from county health departments, WIC clinics, parenting classes, a home health agency and local maternity clinics and health fairs.

Mothers in each family were interviewed every 6–8 weeks for 2 years on multiple topics related to parenting practices. Follow-up interviews were then conducted every 6 months through June 2007. Interviewers and respondents were matched by race and the same interviewer remained with each respondent throughout the study. Participants were compensated with a gift card to a local large retail store at the conclusion of every interview. All interviews followed set protocols and were digitally recorded and transcribed word for word. Data include not only the transcribed interviews, but also notes written by the interviewers on the context of each interview.

At the NC site, an additional semi-structured interview about infant feeding was inserted as a special topic to be examined in depth. Although the NC and PA sites shared interview protocols on the core topics of interest, they did not administer the same questions on specialized topics due to time constraints. The infant feeding interview was conducted with 30 NC women (17 Caucasian, 13 African-American) when the target children ranged in age from 1 to 2 years. To validate women's recall of infant feeding, data from the interview were compared with earlier

limited infant feeding data collected when the infant was 6 weeks old. Infant feeding interviews lasted approximately 30–60 min, and covered experiences, practices, and attitudes related to infant feeding.

Interview transcriptions and interviewers' notes were entered into QSR N6, a software program that aids in the organization, coding, search and retrieval of textual data. Keyword searches were conducted on all textual data using a variety of terms related to infant feeding such as formula, breastfeed, lactation, and nursing. The software program returned all segments of text where these words occurred. These "hits" were then examined to determine whether the words were used in the context of the participant discussing infant feeding decision making. If information on breastfeeding was not found through word searches, the analyst (JC) then reviewed all textual data collected from that mother to see if the information was available. All data related to each mother's infant feeding beliefs and practices were collated, and then analyzed using matrices to summarize patterns of decision-making about breastfeeding initiation and continuation. An initial matrix of factors influencing breastfeeding initiation and continuation was developed by one of us (JC) independent of the quantitative analysis (performed by MW). We compared cohort study findings with ethnographic findings, then re-examined ethnographic interview transcripts to identify additional themes relevant to the main cohort study findings.

Results

Overall, 628 (55% weighted) (Table 1) women initiated breastfeeding; of these 346 were breastfeeding at 2 months, and 168 (18% weighted) continued at 6 months. Among women who ever breastfed, mean duration of breastfeeding was 3.6 months. Exclusive breastfeeding was infrequent; only 148 (17% weighted) of women reported exclusive breastfeeding at 2 months.

Cohort Study: Characteristics Associated With Breastfeeding Initiation

Overall model fit for initiation of breastfeeding was good ($p = 0.43$ by Hosmer-Lemeshow chi-square test); predictive power was modest (pseudo $R^2 = 0.16$). Results of logistic regression analyses are displayed in Table 2. After adjustment for all covariates, women who resided in PA, were more educated, were married, or who had a first-born child were more likely to initiate breastfeeding. In contrast, women who received WIC or who were employed at 2 months had a decreased likelihood of initiating breastfeeding. However, an interaction was identified between WIC receipt and employment. The women who were most likely to initiate breastfeeding did not receive WIC and were not employed. We did not find statistically significant relationships between breastfeeding initiation and other covariates.

Since substantial variation was unexplained by the initiation model, we turned to our ethnographic data to explore additional potential reasons for not initiating breastfeeding.

Ethnographic Study: Reasons for Not Considering or Initiating Breastfeeding

"I'm Not Open to Breastfeeding"

Of the 30 ethnographic study participants, 18 initiated breastfeeding (six African-American women and 12 Caucasian women). Five ethnographic participants had never considered breastfeeding; when probed, one stated she had not considered it because she did not know anyone who breastfed, and the remaining four were unable to provide specific reasons but had never been open to the idea (Table 3). These women did not perceive their decision not to breastfeed as an active one; rather, they had never really entertained the possibility, as expressed by one participant who said, "It really wasn't a decision. I just pretty much knew I wasn't gonna."

“I Guess I Just Wasn’t Comfortable With It”

The other seven participants who did not breastfeed considered it, but stated that they were not comfortable with breastfeeding for multiple reasons (Table 3). All were concerned about discomfort, believing that the pain thought to be associated with breastfeeding outweighed any compelling advantage. This was conveyed by one woman who had a previously painful breastfeeding experience: “They say it’s healthier, but it was difficult to convince me [to breastfeed] because of the pain.” Women who had not breastfed previously also noted that the anticipated pain was a barrier. As one stated, “A lot of people say it hurts. And then me, after having a baby, I know how mine are—they’re hard as a brick. No, that’s too much pain.” Four women stated that they had chosen not to breastfeed because they planned to return to work or school, and perceived breastfeeding as incompatible with these activities. As one described, “A lot of mothers have to work, so they probably got no choice but to bottle feed.” Breastfeeding was also described by participants as embarrassing and not socially acceptable. Four women indicated that embarrassment had prevented them from breastfeeding, including one who stated, “I don’t like how women do it in public.” Two African-American participants perceived that breastfeeding was not acceptable within their communities. When probed, one indicated that breastfeeding was not part of the “country way,” and the other saw breastfeeding as more acceptable in white than African-American communities. Additional reasons for not breastfeeding were smoking ($n = 1$), and lack of breastfeeding assistance ($n = 1$). Conversely, four women reported that they received extensive assistance from lactation consultants which facilitated initiation and continuation of breastfeeding. One mother said, “She showed me how to do it...It was really a lifesaver.”

In summary, in the cohort study, WIC use and maternal employment were most strongly associated with not initiating breastfeeding. Ethnography participants supplied additional reasons for not breastfeeding, most commonly, concerns about discomfort, returning to work, and embarrassment, or simply never having considered it.

Cohort Study: Characteristics Associated with Breastfeeding Discontinuation at 6 Months

As for breastfeeding initiation, maternal employment at 2 months and receipt of WIC were associated with breastfeeding discontinuation at 6 months. Breastfeeding continuation was more common in PA and among women with a college education (Table 4). In addition, greater gestational age was associated with breastfeeding continuation at 6 months after adjustment for all covariates. We did not detect statistically significant relationships between breastfeeding continuation and other covariates.

Additional Reasons for Breastfeeding Discontinuation from the Ethnographic Study

The most common reason given for discontinuing breastfeeding among women who initiated it was inadequate milk supply ($n = 6$) (Table 3). This interfered with women’s intentions to continue, as expressed by one participant: “I didn’t want to stop. I stopped because my milk wasn’t producing.” Infant health problems resulted in breastfeeding discontinuation for three women. One woman whose infant had lost weight did not receive specific medical advice to discontinue but noted “there’s like a bag that the hospital gives you that has a little bit of formula in it and I was like, well let’s just try it.” A second woman whose infant lost weight indicated that a home health visitor had told her “it probably was best that I stopped breastfeeding because of the weight she had lost.” A third woman stopped breastfeeding after her infant developed thrush, saying, “She got real sick and she wouldn’t drink anything.” Similar to the reasons given for not initiating breastfeeding, women cited discomfort ($n = 3$), employment ($n = 2$), embarrassment ($n = 1$), and smoking ($n = 1$) as reasons for discontinuing breastfeeding.

In the cohort study, receipt of WIC was strongly associated with discontinuing breastfeeding. Of the 28 women in the ethnography who received WIC, none *spontaneously* said that

participation in WIC made any difference in her decision regarding whether to initiate breastfeeding. When these women were queried about WIC, one found breastfeeding painful and said that the fact that WIC gives away formula made her decision to stop breastfeeding easier. Conversely, one woman said that taking parenting classes associated with WIC helped influence her to initiate breastfeeding, which she continued for 4 months. Of the 11 women who used WIC and decided not to breastfeed, four stated that WIC staff did not show a preference between breastfeeding and formula, while six stated that WIC staff recommended breastfeeding and discussed its benefits.

Discussion

Despite national attempts to publicize the advantages of breastfeeding, in the rural communities described here, only 55% of women initiated any breastfeeding, and only 18% breastfed for 6 months. Breastfeeding in this rural cohort lags behind national rates for breastfeeding initiation (71%) and continuation at 6 months (35%) [2]. Our combined quantitative/qualitative approach suggests that there are some important ways that the factors influencing breastfeeding initiation and duration among rural women mirror those previously identified among urban women.

We found that similar to the general population and urban samples [2,29,30] WIC use was associated with decreased breastfeeding initiation and continuation in our rural cohort, even after adjustment for low-income status. Using a prospective design, we were able to determine that WIC participation preceded breastfeeding discontinuation, strengthening evidence that WIC participation may compromise breastfeeding. Combining contextual information from the ethnography with these findings, however, illustrates the complexity of women's experiences. There is some evidence from the ethnography and from previous studies that WIC participation could have a beneficial effect on breastfeeding initiation [8,31]. In sum, the cohort study identifies WIC use as a marker for discontinuing breastfeeding, while the ethnography revealed little overall evidence of strong influence one way or another.

Identifying WIC as an influence on breastfeeding among rural women, as has previously been done for urban women, highlights the potential importance of this program and its policies. Established as a permanent program in 1974, WIC serves approximately 76,000 women, infants, and children a month, and has been demonstrated to result in numerous improved maternal and child health outcomes [32]. Yet, criticisms of WIC's potential impact on breastfeeding include the provision of free formula, which could discourage breastfeeding [33], and the greater monetary value of food packages given to formula-feeding compared with breastfeeding women [34]. We were not able to examine how and why WIC participation may interfere with breastfeeding, but this topic is deserving of further study, particularly since WIC programs that implement breastfeeding promotion strategies have documented success in improving breastfeeding rates [35].

Return to employment is another factor that appears to strongly influence breastfeeding duration in this rural cohort. Interestingly, return to employment has also been identified as a strongly negative influence on breastfeeding in the general U.S. population and urban samples [36–40]. We hypothesize that women in these rural communities whose economic circumstances require early postpartum employment may have jobs where there is little support for breastfeeding. A recent sample of urban low-income women similarly found that return to work negatively affected breastfeeding duration, especially for women in administrative and manual positions [41]. While we did not examine women's specific employment characteristics, breastfeeding support in different jobs could also be important to breastfeeding continuation in rural communities and is in need of further exploration.

Assistance with breastfeeding is another potentially modifiable influence on breastfeeding for rural women. Though we did not observe a statistically significant relationship between assistance and breastfeeding duration in the cohort study, and we lacked data on the timing, quality, and quantity of assistance received, the ethnographic data suggest that women in these rural communities sometimes lack access to breastfeeding assistance. In previous qualitative studies, women have similarly reported that insufficient breastfeeding assistance limited breastfeeding duration [42,43]. Women in our ethnography also expressed concerns about infant weight loss and the compatibility of breastfeeding with smoking. These perceptions suggest opportunities for health care providers in rural communities to provide additional education about breastfeeding and encouragement where no true contraindications exist.

We observed greater breastfeeding initiation and continuation among PA compared with NC women, even after adjusting for race, education, poverty, and other covariates. This could reflect greater acceptance of breastfeeding as a normative behavior in the PA communities studied. Although ethnographic data on breastfeeding were not available in PA, the NC ethnographic data suggested that internalized social norms and experiences may shape women's intentions regarding breastfeeding. For example, several African-American participants never considered breastfeeding and indicated that they did not know anyone who breastfed. If women lack role models for breastfeeding or believe it is something more associated with a different ethnic or income group, they may not enter pregnancy perceiving breastfeeding as normal and socially acceptable [15]. Further exploration of internalized norms could be helpful in understanding how breastfeeding can best be promoted in different rural communities.

Limitations include our examination of *any* breastfeeding, rather than exclusive breastfeeding, as the outcome. Given the infrequency of any breastfeeding in our sample, we felt it was important to understand the factors that influence it, though exclusive breastfeeding is the preferred goal. Another limitation is that constraints within the cohort study did not permit collection of information on women's prior breastfeeding experience or exposure, which could be important influences. Finally, while the cohort is characteristic of rural communities in the Southeast and Appalachia, it did not include the Spanish-speaking population in these areas. The ethnographic sample was selected to be typical of cohort study participants, but there may be subtle differences between these two groups since recruitment for the cohort study was hospital-based, and recruitment for the ethnography occurred at multiple sites including parenting classes and health fairs, which may have attracted participants who are more educated about infant health. Despite this potential bias, a similar percentage of participants in both the cohort study and ethnography breastfed their infants, and the infrequency of breastfeeding in both samples suggests that the location of recruitment likely had little effect on infant feeding behavior. Since time constraints resulted in only the NC women being interviewed about breastfeeding, the ethnographic study results may be less generalizable to the entire cohort. Finally, there are additional possible influences on breastfeeding, such as maternal HIV status, that we were not able to address through either the cohort study or ethnography.

It is encouraging that in both the cohort and ethnographic study women having their first child were most likely to breastfeed. This suggests that there may be future opportunities to promote successful breastfeeding experiences, which could then increase the likelihood of breastfeeding subsequent children [39]. Our combined quantitative and qualitative approach demonstrates that much work remains to be done to support low-income rural women in perceiving breastfeeding as "normal, desirable, and achievable" [4]. Women in rural communities may benefit from support services, such as peer counseling programs, which have previously been evaluated with promising results [44]. As previously suggested for urban women, our results suggest that for rural women, workplace environments and WIC offices may be points of potential leverage for further increasing breastfeeding initiation and continuation.

Acknowledgements

The authors gratefully acknowledge the Family Life Project field sites and research assistants in North Carolina and Pennsylvania, and thank families for their participation. The study was funded by grant PO1HD039667 from the National Institute of Child Health and Human Development. The authors report no conflict of interest. Support for R. Jean Cadigan was provided by the National Institute of Child Health and Human Development (grant 5-T32-HD007376: Human Development: Interdisciplinary Research Training) to the Center for Developmental Science, University of North Carolina, Chapel Hill. Support for Eliana M. Perrin was provided by the National Institute of Child Health and Human Development (grant #HD01441). We thank Debra Skinner and Margaret Bentley for manuscript review.

Appendix

The Family Life Project Ethnographic Study Infant Feeding Interview Guide

- Did you ever breastfeed your baby? If yes, proceed to Section A. If no, proceed to Section B.

Section A

[FOR WOMEN WHO *EVER* BREASTFED, ask]:

- Did you also use formula to feed your baby? What kind of formula did you use?
 - If yes, when did you use it?
 - [Probes: (when breastfeeding was inconvenient, wasn't able to pump, etc.)]
 - If no, did you ever consider formula feeding? What made you decide not to use formula?
- How long did you breastfeed? How many days/weeks/months?
- What factors influenced your decision to stop?

Probes:

 - child characteristics (e.g., gestational age, health, temperament)
 - maternal characteristics (e.g., previous experience, mood, fatigue, unsupportive family, work schedule, nature of childcare)
 - social climate (e.g., embarrassment)
 - difficulty with breastfeeding
 - not enough support/instruction/information
- Do/did work constraints ever get in the way of your breastfeeding? If yes, how so?
- Does/did anything else sometimes prevent you from breastfeeding? If so, what?

[Proceed to Section C]

Section B

[FOR WOMEN WHO *NEVER* BREASTFED, ask]:

- What kind of formula did you feed your baby?
- Did you ever consider breastfeeding? Why or why not?

[Proceed to Section C]

Section C

- When did you decide whether or not to breastfeed? (i.e., Before getting pregnant? During pregnancy? How far into pregnancy? After birth?)
 - Did you change your mind at some point? If so, when and why?
- What would you say most influenced your decisions about breastfeeding or formula feeding?
 - [probes: relatives, friends, health clinic professional, doctors, previous experience, work schedule, childcare situation, media/advertisements, mood—fatigue]
 - Did you use WIC resources during your pregnancy? If so, did you feel the WIC office had any particular view on breastfeeding or formula feeding?
 - Was there anything about your pregnancy, labor, and/or delivery that influenced your decisions about breastfeeding or formula feeding? (i.e., low birth weight of infant, early surgery, etc.)
- What are your husband's/partner's views on breastfeeding?
- How much of a factor was your husband/partner in your decision regarding breastfeeding? (or to stop breastfeeding?)
- Of your family and friends who have had children, how many of them have breastfed?
- What are your family and friends' views on breastfeeding?
- Did anyone at the health clinic/doctor's office ever talk to you about breastfeeding?
 - If yes, who spoke to you and what did they say?
 - Were you ever offered any breastfeeding classes or assistance (i.e., lactation consultant advice)?
 - If yes, what did you think of this program/assistance?
 - Did it change what you were doing?
- Have you heard how long doctors typically recommend that women breastfeed babies? What have you heard?
- What other liquids did you feed to your baby in the first 3 months? (ie. soda, tea, chicken broth, juice, YooHoo, etc)
- What about when the baby was 4–6 months? What other liquids did you feed your baby during this period? (i.e., soda, tea, chicken broth, juice, YooHoo, etc.)
- When did you begin feeding your child cereal? What influenced your decision to do this?
- For any children you have in the future, do you think you'll breastfeed or formula feed them? Why?
- What do you see as the benefits to breastfeeding? What are the drawbacks?
- What do you see as the benefits to formula feeding? What are the drawbacks?
- Are there places where it is inappropriate to breastfeed? Why or why not?
- Do you think most women in your community breastfeed or formula feed?
- How do you think people in your community view breastfeeding?

- What do you think influences women in this country to breastfeed or formula feed? (i.e., media advertisements, friends/relatives, work schedule, childcare situation, woman's concern about leaking/breasts sagging, etc.) Do you think that most women in this country breastfeed or formula feed?
- How do you think people in this country view breastfeeding?
- Is there anything else you would like to share about breastfeeding or formula feeding?

Abbreviations

NC, North Carolina; PA, Pennsylvania; WIC, Women, infants and children supplemental nutrition program; OR, Odds ratio; CI, Confidence interval; AAP, American Academy of Pediatrics; FLP, Family Life Project; TANF, Temporary assistance for needy families.

References

1. American Academy of Pediatrics Section on Breastfeeding. Breastfeeding and the use of human milk. *Pediatrics* 2005;115:496–506. [PubMed: 15687461]
2. Li R, Darling N, Maurice E, Barker L, Grummer-Strawn LM. Breastfeeding rates in the United States by characteristics of the child, mother, or family: The 2002 National Immunization Survey. *Pediatrics* 2005;115:e31–e37. [PubMed: 15579667]
3. US Department of Health, Human Services. *Healthy People 2010: Understanding and improving health*. 2nd ed Washington, DC: US Government Printing Office; 2000.
4. US Department of Health, Human Services. *HHS Blueprint for action on breastfeeding*. Washington, D.C.: US Government Printing Office; 2000.
5. Li R, Ogden C, Ballew C, Gillespie C, Grummer-Strawn L. Prevalence of exclusive breastfeeding among US infants: The Third National Health and Nutrition Examination Survey (Phase II, 1991–1994). *American Journal of Public Health* 2002;92:1107–1110. [PubMed: 12084691]
6. Chandra A, Martinez GM, Mosher WD, Abma JC, Jones J. Fertility, family planning, and reproductive health of U.S. women: data from the 2002 National Survey of Family Growth. *National Center for Health Statistics. Vital Health Stat Series* 2005;23(25):1–160.
7. Gaston MH. access and 0 health disparities: changing the health paradigm for rural women in the 21st century. *Women's Health Issues* 2001;11:7–16.
8. Chatterji P, Brooks-Gunn J. WIC participation, breastfeeding practices, and well-child care among unmarried, low-income mothers. *American Journal of Public Health* 2004;94:1324–1327. [PubMed: 15284035]
9. Kurinij N, Shiono PH, Ezrine SF, Rhoads GG. Does maternal employment affect breast-feeding? *American Journal of Public Health* 1989;79:1247–1250. [PubMed: 2764202]
10. Kuan LW, Britto M, Decolongon J, Schoettker PJ, Atherton HD, Kotagal UR. Health system factors contributing to breastfeeding success. *Pediatrics* 1999;104:e28. [PubMed: 10469811]
11. Ertem IO, Votto N, Leventhal JM. The timing and predictors of the early termination of breastfeeding. *Pediatrics* 2001;107:543–548. [PubMed: 11230597]
12. Taveras EM, Capra AM, Braveman PA, Jensvold NG, Escobar GJ, Lieu TA. Clinician support and psychosocial risk factors associated with breastfeeding discontinuation. *Pediatrics* 2003;112:108–115. [PubMed: 12837875]
13. Taveras EM, Li R, Grummer-Strawn L, et al. Opinions and practices of clinicians associated with continuation of exclusive breastfeeding. *Pediatrics* 2004;113:e283–e290. [PubMed: 15060254]
14. Clark SJ, Savitz LA, Randolph RK. Rural children's health. *Western Journal of Medicine* 2001;178:142–147. [PubMed: 11156932]
15. Bentley ME, Dee DL, Jensen JL. Breastfeeding among low income, African-American women: Power, beliefs and decision making. *Journal of Nutrition* 2003;133:305S–309. [PubMed: 12514315]
16. Phares, TM.; Morrow, B.; Lansky, A.; Barfield, WD.; Prince, CB.; Marchi, KS.; Braveman, PA.; Williams, LM.; Kinneburgh, B. Surveillance for disparities in maternal health-related behaviors-

- Selected states, Pregnancy Risk Assessment Monitoring System (PRAMS), 2000-2001; Surveillance Summaries. Jul 2. 2004 p. 1-13.2004, MMWR
17. Ponza M, Devaney B, Ziegler P, Reidy K, Squatrito C. Nutrient intakes and food choices of infants and toddlers participating in WIC. *Journal of American Diet Association* 2004;104:S71-S79.
 18. Ryan AS. The resurgence of breastfeeding in the United States. *Pediatrics* 1997;99:e12. [PubMed: 9099787]
 19. Hilson J, Rasmussen K, Kjolhede C. Maternal obesity and breast-feeding success in a rural population of white women. *American Journal of Nutrition* 1997;66:1371-1378.
 20. Hall RT, Mercer AM, Teasley SL, et al. A breast-feeding assessment score to evaluate the risk for cessation of breast-feeding by 7 to 10 days of age. *The Journal of Pediatrics* 2002;141:659-664. [PubMed: 12410194]
 21. Killersreiter B, Grimmer I, Buhner C, Dudenhausen JW, Obladen M. Early cessation of breast milk feeding in very low birthweight infants. *Early Human Development* 2001;60:193-205. [PubMed: 11146238]
 22. Merewood A, Brooks D, Bauchner H, MacAuley L, Mehta SD. Maternal birthplace and breastfeeding initiation among term and preterm infants: A statewide assessment for Massachusetts. *Pediatrics* 2006;118:e1048-1054. [PubMed: 17015498]
 23. Kaufman, AS.; Kaufman, NL. Kaufman Functional Academic Skills Test (K-FAST). American Guidance Service; Circle Pines, Minnesota: 1994.
 24. Krause N, Jay G. What do global health items measure? *Medical Care* 1994;9:930-942. [PubMed: 8090045]
 25. Reich W, Todd R, Joyner CA, Neuman RJ, Heath AC. Reliability and stability of mothers' reports about their pregnancies with twins. *Twin Research* 2003;6:85-88. [PubMed: 12723994]
 26. Runyan, DK. Monitoring child health and well-being in large population surveys. In: Thornton, A., editor. *Well-being of children and families: Research and data needs*. University of Michigan Press; Ann Arbor, Michigan: 2001.
 27. Research Triangle Institute. SUDAAN language manual. Vol. Release 9.0 ed. Research Triangle Institute; Research Triangle Park, NC: 2004.
 28. Binder DA. On the variances of asymptotically normal estimators from complex surveys. *International Statistical Review* 1983;51:279-292.
 29. Ahluwalia IB, Morrow B, Hsia J. Why do women stop breastfeeding? Findings from the Pregnancy Risk Assessment and Monitoring System. *Pediatrics* 2005;116:1408-1412. [PubMed: 16322165]
 30. Ryan AS, Zhou W. Lower breastfeeding rates persist among the Special Supplemental Nutrition Program for Women, Infants, and Children participants, 1978-2003. *Pediatrics* 2006;117:1136-1146. [PubMed: 16585308]
 31. Schwartz JB, Popkin BM, Tognetti J, Zohoori N. Does WIC participation improve breast-feeding practices? *American Journal Public Health* 1995;85:729-731.
 32. US Department of Agriculture Food, Nutrition Service. *The National WIC evaluation: An evaluation of the special supplemental food program for women, infants and children*. Alexandria, Virginia: US Department of Agriculture; 1987.
 33. Tuttle CR. An open letter to the WIC program: The time has come to commit to breastfeeding. *Journal of Human Lactation* 2000;16:99-103. [PubMed: 11153350]
 34. Committee to Review the WIC Food Package. *WIC food packages: Time for a change*. Institute of Medicine; Washington, DC: 2005.
 35. Ahluwalia IB, Tessaro I, Grummer-Strawn LM, MacGowan C, Benton-Davis S. Georgia's breastfeeding promotion program for low-income women. *Pediatrics* 2000;105:e85. [PubMed: 10835098]
 36. Hanson MB, Hellerstedt WL, Desvarieux M, Duval SJ. Correlates of breast-feeding in a rural population. *American Journal of Health Behavior* 2003;27:432-444. [PubMed: 12882437]
 37. Visness C, Kennedy K. Maternal employment and breast-feeding: findings from the 1988 National Maternal and Infant Health Survey. *American Journal of Public Health* 1997;87:945-950. [PubMed: 9224174]

38. Gross SM, Caulfield LE, Bentley ME, et al. Counseling and motivational videotapes increase duration of breast-feeding in African-American WIC participants who initiate breast-feeding. *Journal of American Diet Association* 1998;98:143–148.
39. Ryan A, Martinez G. Breast-feeding and the working mother: a profile. *Pediatrics* 1989;83:524–531. [PubMed: 2927992]
40. Gielen A, Faden R, O'Campo P, Brown C, Paige D. Maternal employment during the early postpartum period: effects on initiation and continuation of breast-feeding. *Pediatrics* 1991;87:298–305. [PubMed: 2000269]
41. Kimbro RT. On-the-job moms: work and breastfeeding initiation and duration for a sample of low-income women. *Maternal and Child Health Journal* 2006;10:19–26. [PubMed: 16521055]
42. Mozingo JN, Davis MW, Droppleman PG, Merideth A. “It wasn't working”: Women's experiences with short-term breastfeeding”. *American Journal of Maternal Child Nursing* 2000;25:120–126. [PubMed: 10810844]
43. Raisler J. Against the odds: breastfeeding experiences of low income mothers. *Journal of Midwifery & Women's Health* 2000;45:253–263.
44. Shaw E, Kaczorowski J. The effect of a peer counseling program on breastfeeding initiation and longevity in a lowincome rural population. *Journal of Human Lactation* 1999;15:19–25. [PubMed: 10578771]

Table 1
 Characteristics of women and infants in the Family Life Project longitudinal cohort (N = 1287)

Variable	Weighted percent or mean (Range) ^d
Regional variables	59%
State (PA)	8.4 (6.7, 10.2)
Geographic isolation ^b	26.6 (14.5, 44.6)
Demographic Variables	22%
Maternal age (years)	83%
African-American	20%
Mother has high school degree/GED	41%
Mother has college degree (4 years)	56%
Mother employed	19%
Mother married	1.6 (1, 4)
Mother single, residing with partner	66%
Number of children <5 years in household	41%
Low-income ^c	23%
Infant is firstborn	26.0 (15.2, 62.0)
Infant attends childcare center	1.7 (0, 9)
Body mass index (kg/m ²)	26%
Maternal health factors	4%
Number of pregnancy problems ^d	2.0 (1, 5)
Smoked during pregnancy	39.1 (25.9, 46.4)
Maternal distress ^e	52%
Health rating ^f	1.2 (0, 5)
Gestational age (weeks)	3.3 (0.3, 4.0)
Male	1.2 (1, 5)
Infant characteristics	15%
Number of infant health problems ^g	18%
Days hospitalized prior to discharge	55%
Health rating ^f	18%
"Difficult baby"	61%
Had colic	33%
Initiated breastfeeding	
Breastfed \geq 6 months	
WIC	
Lactation assistance	
Health and social services	

Variable	Weighted percent or mean (Range) ^d
^a Percents and means are weighted to reflect sampling strategy and permit comparison to source populations	
^b Composite measure consisting of logged average distance (in meters) from the respondent home to community assets located in the six target counties from which families were sampled	
^c Defined as “low-income” if: (1) family income <200% federal poverty threshold for a given household size, or (2) family uses social services that require family income <200% federal poverty threshold (food stamps, WIC, TANF, elementary school free lunch program, etc.)	
^d Sum of pregnancy problems as reported by mother: bleeding, excess nausea/vomiting, weight loss, infection, high blood pressure, water retention, convulsions, accidents, emotional and family problems	
^e Defined by symptoms exceeding 90th percentile on global symptom (internalizing) index T score from the Brief Symptom Inventory-18	
^f Health rating reported by mother: 1 = “Excellent”, 2 = “Very Good”, 3 = “Good”, 4 = “Fair”, 5 = “Poor”	
^g Sum of following infant health problems as reported by mother: not breathing on own at birth, having breathing difficulties that required immediate treatment, congenital malformations or birth defects, surgery in the first month, prolonged hospital stay beyond mother’s discharge, or admission to neonatal intensive care unit	

Table 2
 Predictors of initiation of breastfeeding among women in the Family Life Project cohort ($N = 1,287$)

Variable	Separate OR (95% CI)	All + Interaction ^d OR (95% CI)
Regional variables		
State (PA)	1.89 (1.49–2.40)	1.44 (1.02–2.04)
Geographic isolation ^b	1.12 (0.94–1.32)	1.03 (0.84–1.25)
Demographic variables		
Maternal age (years)	1.02 (0.98–1.07)	1.02 (0.97–1.07)
African-American	0.68 (0.51–0.90)	0.86 (0.58–1.27)
Mother has high school education	1.81 (1.25–2.61)	1.65 (1.11–2.44)
Mother has college education	2.89 (1.77–4.70)	2.44 (1.44–4.15)
Mother employed	0.58 (0.44–0.78)	0.36 (0.20–0.66)
Mother married	1.72 (1.18–2.52)	1.63 (1.09–2.44)
Mother unmarried, residing with partner	1.06 (0.72–1.57)	1.11 (0.74–1.66)
Number of children <5 years in household	1.20 (0.96–1.51)	1.15 (0.89–1.47)
Low-income ^c	0.91 (0.61 – 1.38)	1.25 (0.66 – 2.38)
Maternal health factors		
Infant birth order (first)	1.73 (1.10 – 2.73)	1.77 (1.08 – 2.90)
Infant attends childcare center	0.90 (0.68–1.19)	0.91 (0.68–1.22)
Body mass index (kg/m ²)	1.01 (0.99–1.02)	1.01 (0.99–1.03)
Number of pregnancy problems ^d	0.95 (0.87–1.04)	0.98 (0.89–1.07)
Smoked during pregnancy	0.64 (0.48–0.86)	0.83 (0.59–1.17)
Maternal distress ^e	1.02 (0.54–1.91)	1.32 (0.70–2.49)
Health rating ^f	0.80 (0.69–0.94)	0.92 (0.77–1.09)
Gestational age (weeks)	1.04 (0.96–1.13)	1.04 (0.94–1.14)
Male	0.89 (0.69–1.14)	0.83 (0.63–1.10)
Number of infant health problems ^c	1.08 (0.85–1.37)	1.02 (0.80–1.30)
Days hospitalized prior to discharge	1.26 (0.68–2.35)	1.34 (0.68–2.63)
Health rating ^f	0.84 (0.63–1.13)	1.01 (0.74–1.38)
Health and social services	0.31 (0.23–0.41)	0.39 (0.20–0.74)
Interaction terms		
WIC		
WIC × Employed		2.08 (1.07–4.08)

^a ORs are adjusted for all variables listed in table

^b Composite measure consisting of the logged average distance (in meters) from the respondent home to community assets located in the six target counties from which families were sampled

- ^c Defined as “low-income” if: (1) family income <200% federal poverty threshold for a given household size, or (2) family uses social services that require family income <200% federal poverty threshold (food stamps, WIC, TANF, elementary school free lunch program, etc.)
- ^d Pregnancy problems as reported by mother, including bleeding, excess nausea/vomiting, weight loss, infection, high blood pressure, water retention, convulsions, accidents, emotional and family problems
- ^e Defined by symptoms exceeding 90th percentile on global symptom (internalizing) index *T* score from the Brief Symptom Inventory-18
- ^f Health rating reported by mother: 1 = “Excellent”, 2 = “Very Good”, 3 = “Good”, 4 = “Fair”, 5 = “Poor”
- ^g Sum of following infant health problems as reported by mother: not breathing on own at birth, having breathing difficulties that required immediate treatment, congenital malformations or birth defects, surgery in the first month, prolonged hospital stay beyond mother’s discharge, or admission to neonatal intensive care unit

Why women did not consider, initiate and continue breastfeeding: ethnographic data from rural communities in North Carolina

Table 3

Reasons for not considering breastfeeding	Illustrative quotes
Never open to breastfeeding	"From the minute I knew about having babies I said I'm not going to do that."
Did not know anyone who has ever breastfed	"I never really thought about it 'cause nobody in my family never breastfed so it just wasn't something that I ever thought about.... I don't know nobody that breastfed."
<i>Reasons for not initiating breastfeeding</i>	
Pain	"The pain. I do have to go back to the pain. And the peeling of your nipples and the bleeding and the hurt and the don't wanna be touched."
Planned employment/school	"Cause I knew she'd have to go to daycare eventually.... I didn't want to have to pump it. I just wanted to make it and go."
Embarrassment	"I guess I just wasn't comfortable with it. It just wasn't—I just couldn't see myself. And then I was like, that's gonna make 'em sore. And I'm very uncomfortable about how women are so open to do that in public. I'm just like, no, that's not me. I couldn't do that. So it never came up for me. Other people told me I should—the bond, healthier, less expensive. But I didn't care. I didn't want to do it."
Lack of social acceptability	"I think it's more accepted in Caucasian communities than it is in African-American communities.... 'Cause I think kids in the Caucasian community are very attached to their mummies. I mean, most of them are spoiled.... I think they really feed into that 'it's the bond you have with the child.' I'm just going to be real here. Caucasian women are the types who take their children to Gymboree. They get them in these music classes and dance classes when they're one years old and two. They're really into the 'Leave it to Beaver' mother-type stereo type. I think they do breastfeed more."
Smoking	"I smoke cigarettes too and I'm not gonna let my baby breastfeed off of me if I smoke cigarettes, no way."
Lack assistance	"There's no help for women in this town who want to breastfeed. No support."
<i>Reasons for discontinuing breastfeeding</i>	
Inadequate milk supply	"I'd pump and pump and I even took pills to make it come in more and it didn't work.... I had to give him formula. I was doing half and half.... I done that until I dried up."
Pain	"I didn't do it long because he hurt me too bad."
Employment	"We did a crash course in weaning in a week."
Infant health problems	"He lost a pound in the hospital... and I just got really frustrated."
Embarrassment	"Even though she's my baby, I didn't want her seeing that part of my body. That may sound crazy. I didn't want her seeing under my clothes. It didn't make me feel comfortable. I felt weird."
Leaking	"My boobs were leaking like someone was pouring water out of a spigot.... I said I can't deal with that."
Smoking/other substances	"I was about to have a nicotine fit... I was like no, it [breastfeeding] didn't work for me."

Table 4
 Predictors of continuation of breastfeeding at 6 months among women in the Family Life Project cohort ($N = 1,287$)

Variable	Separate Hazard ratio (95% CI)	All ^a Hazard ratio (95% CI)
Regional variables		
State (PA)	0.61 (0.50–0.75)	0.67 (0.51–0.88)
Geographic isolation ^b	1.13 (0.96–1.32)	1.06 (0.90–1.25)
Demographic variables		
Maternal age (years)	0.98 (0.95–1.02)	0.97 (0.93–1.00)
African-American	1.17 (0.90–1.52)	0.92 (0.66–1.27)
Mother has high school education	0.82 (0.56–1.19)	0.83 (0.57–1.20)
Mother has college education	0.47 (0.34–0.64)	0.47 (0.33–0.67)
Mother employed	1.42 (1.12–1.80)	1.36 (1.07–1.75)
Mother married	0.94 (0.68–1.30)	0.90 (0.65–1.25)
Mother unmarried, residing with partner	1.09 (0.75–1.58)	1.07 (0.74–1.56)
Number of children <5 years in household	0.86 (0.70–1.05)	0.83 (0.68–1.03)
Low-income ^c	1.09 (0.80–1.50)	0.66 (0.43–1.02)
Birth order (first)	1.15 (0.80–1.66)	1.00 (0.68–1.47)
Infant attends childcare center	1.16 (0.92–1.46)	1.12 (0.88–1.43)
Maternal health factors		
Body mass index (kg/m ²)	1.01 (1.00–1.03)	1.01 (1.00–1.03)
Number of pregnancy problems ^d	1.07 (0.99–1.15)	1.01 (0.93–1.09)
Smoked in pregnancy	1.72 (1.33–2.21)	1.07 (0.81–1.42)
Maternal distress ^e	0.93 (0.49–1.75)	0.80 (0.40–1.60)
Health rating ^f	1.11 (0.96–1.28)	1.05 (0.91–1.22)
Infant characteristics		
Gestational age (weeks)	0.96 (0.89–1.04)	0.92 (0.86–0.99)
Male	1.03 (0.83–1.27)	1.10 (0.89–1.36)
Number of infant health problems ^g	0.96 (0.81–1.14)	0.91 (0.74–1.11)
Days hospitalized prior to discharge	1.26 (0.90–1.77)	1.00 (0.69–1.46)
“Difficult baby”	1.11 (0.75–1.66)	1.00 (0.67–1.49)
Colic	1.02 (0.70–1.49)	1.36 (0.94–1.97)
Health rating ^f	0.91 (0.70–1.18)	0.74 (0.56–1.00)
Health Services		
WIC	2.47 (1.98–3.08)	1.99 (1.32–2.99)
Lactation assistance	1.23 (0.99–1.53)	1.02 (0.81–1.28)

^a Hazard ratios are adjusted for all variables listed in table

- ^b Composite measure consisting of the logged average distance (in meters) from the respondent home to community assets located in the six target counties from which families were sampled
- ^c Defined as “low-income” if: (1) family income < 200% federal poverty threshold for a given household size, or (2) family uses social services that require family income < 200% federal poverty threshold (food stamps, WIC, TANF, elementary school free lunch program, etc.).
- ^d Pregnancy problems as reported by mother, including bleeding, excess nausea/vomiting, weight loss, infection, high blood pressure, water retention, convulsions, accidents, emotional and family problems
- ^e Defined by symptoms exceeding 90th percentile on global symptom index *T* score from the Brief Symptom Inventory-18
- ^f Health rating reported by mother: 1 = “Excellent”, 2 = “Very Good”, 3 = “Good”, 4 = “Fair”, 5 = “Poor”
- ^g Sum of following infant health problems as reported by mother: not breathing on own at birth, having breathing difficulties that required immediate treatment, congenital malformations or birth defects, surgery in the first month, prolonged hospital stay beyond mother’s discharge, or admission to neonatal intensive care unit