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Trends and Correlates of Breastfeeding in North Carolina: Results from the North Carolina Pregnancy Risk Assessment Monitoring System (PRAMS) 1997-2001

by

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ABSTRACT

Objectives: Infants who are primarily breastfed have been shown to have fewer episodes of infections such as otitis media, upper respiratory infection, and gastrointestinal disorders. Breastfeeding has been shown to reduce illness, saving health care dollars. This study examines breastfeeding trends over time and identifies demographic, maternal, infant, and environmental factors associated with initiation of breastfeeding and duration over eight weeks.

Methods: Survey data from the Pregnancy Risk Assessment Monitoring System (PRAMS) were used for this study. This consists of a random sample of 7,935 live births for the period 1997-2001.

Results: Overall, 64 percent of women reported initiating breastfeeding; 65 percent of those women continued to breastfeed at eight weeks. This study found that women who have lower income and less education, are unmarried, obese, depressed, or who smoke are less likely to breastfeed. Hispanic women are more likely to breastfeed and to continue to breastfeed at eight weeks, compared to white non-Hispanic women. Women who engage in other healthy behaviors such as taking a multivitamin containing folic acid and not smoking have higher rates of breastfeeding.

Conclusions: While North Carolina has seen a substantial increase in breastfeeding initiation from 1997 (58.8%) to 2001 (67.5%), this is still below the National Healthy People 2010 goal of 75 percent. By eight weeks only about 40 percent of women were still breastfeeding at all, lower than the Healthy People 2010 goal of having 50 percent still breastfeeding at six months. Health care providers should educate women of childbearing age on the health benefits of breastfeeding, and should specifically target at-risk groups of women such as those who are overweight, unmarried, depressed after giving birth, or have a high school degree or less.

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Introduction

Human milk is widely accepted as the best food for human infants.¹ Infants who are fed primarily with formula, as compared to those who are breastfed, have: a greater susceptibility to infections (such as diarrhea, respiratory tract infections, otitis media, pneumonia, urinary infection, necrotizing enterocolitis, and invasive bacterial infection); a depressed immune system response; an increased risk for chronic disease (including type 1 and 2 diabetes); a higher incidence of allergic disease/asthma and childhood obesity;¹⁻³ and diminished cognitive development.^{1,4} There are health benefits for the women who breastfeed as well, including reduced risk for premenopausal breast cancer and some types of ovarian cancer.^{5,6}

How long are most women breastfeeding?

The Healthy People 2010 objectives on breastfeeding are for 75 percent of women to initiate breastfeeding, 50 percent to be breastfeeding at six months, and 25 percent to still be breastfeeding at 12 months.¹ The good news is that breastfeeding initiation has increased over the last two decades. Unfortunately, however, most who initiate do not breastfeed for six or even four months, and very few who start breastfeeding do so exclusively (meaning they do not give the baby anything other than breast milk, including formula, juice, or more than a little water). Data from the National Health and Nutrition Examination Survey (NHANES) (Phase II, 1991-1994) show that 53.6 percent of infants were ever breastfed and only 22.4 percent were breastfed at six months.⁷ More recent national data (third quarter, 2001) from the National Immunization Survey show somewhat more encouraging findings: 65.1 percent of children were ever breastfed and the six- and twelve-month rates for any breastfeeding were 27 percent and 12 percent respectively.⁸ Exclusive breastfeeding at six months was only 7.9 percent.

Who is breastfeeding?

There are notable differences in breastfeeding duration by geography, socioeconomic status, and ethnicity. In terms of geography, a lower proportion

of Southern women initiate and are continuing to breastfeed at six months than women in other regions of the country. NHANES⁷ data indicate that women in the South had an initiation rate of 44.1 percent and a six-month rate of 16.0 percent (any breastfeeding). This was lower than those for women in the Northeast (47.6%, 18.2%), the Midwest (56.2%, 24.8%), and the West (69.8%, 32.7%). This pattern holds for exclusive breastfeeding as well: at six months only 4.4 percent of Southern women were exclusively breastfeeding as compared to 15.5 percent in the West, 11.7 percent in the Northeast, and 9.4 percent in the Midwest.

In the South, and nationally, women with lower income and less education are less likely to initiate breastfeeding and they breastfeed a shorter time than women with more income and education. Nationally, Li and colleagues⁷ report that 14.3 percent of the women in the lowest income group (< 100% of the poverty level) were still breastfeeding (at all) at six months compared to 30.7 percent of the women in the highest income group (>350% of the poverty level). Partly because of their lower income, women who are participants in the Women, Infants, and Children's (WIC) supplementary food program are less likely to breastfeed. Analysis by the Centers for Disease Control and Prevention (CDC) of 1993-1998 data from the Pregnancy Risk Assessment Monitoring System (PRAMS) from 10 states found that 48.7 percent of the women on WIC who initiated breastfeeding were still predominantly breastfeeding at greater than ten weeks, compared to 63.6 percent of those not on WIC.⁹ In terms of education, national data indicate that the six-month rate of any breastfeeding for women with less than high school education was 10.0 percent, compared to 44.6 percent for women with a high school education.

Most studies also indicate that initiation and duration rates are lower for African American women than white or Latina women.^{7,8,10} CDC's analysis of the PRAMS data from ten states found that although initiation rose between 1993 and 1998 for most groups, predominant breastfeeding at

greater than ten weeks *decreased* over this time period for most groups, including African American women, women less than 20 years of age, those with high school education or less, unmarried women, and those on WIC and on Medicaid.⁹ These patterns also hold for the rates of exclusive breastfeeding at six months. Nationally, exclusive breastfeeding at six months is also positively associated with income and education, and non-Hispanic white and Mexican-American women are significantly more likely than non-Hispanic African American women to still be exclusively breastfeeding at six months (26.6%, 22.5%, 8.3% respectively).⁷

Does it matter how long women breastfeed?

Many studies suggest that in order for women and infants to realize the full benefits of breastfeeding, infants need to breastfeed for many months. For example, Oddy and colleagues³ concluded that breastfeeding reduced the risk of childhood asthma *only* if exclusive breastfeeding continued for at least four months post-partum. Similarly, Kramer and colleagues¹¹ found that reduced gastrointestinal infection was associated with exclusive breastfeeding for six months. Gillman, et al.,² found that infants who were breastfed had a lower risk of being overweight during older childhood and adolescence than those who were fed formula, *and* that those who were breastfed six months had a lower risk than those who were breastfed only three months. Similar results are reported for the association between breastfeeding duration and higher intelligence.⁴ This relationship also holds for women's health benefits of breastfeeding. The Collaborative Group on Hormonal Factors in Breast Cancer,⁵ for example, concluded from their review of the literature that the more women breastfeed the more they are protected against breast cancer, and that reduced ovarian cancer in breastfeeding mothers is associated with duration.⁶ In general, studies suggest the benefits of breastfeeding for mothers and babies are linked to both breastfeeding duration and to breastfeeding exclusivity.

Purpose of this study

The purpose of the present study is to identify demographic, maternal, infant, and environmental factors associated with breastfeeding initiation and duration at eight weeks in North Carolina. We also examine breastfeeding initiation and duration trends over time. We use North Carolina PRAMS data for 1997-2001. Most of the variables in the PRAMS survey focus on demographic and maternal factors. Our analysis helps identify groups at high risk for low initiation and short duration and also points to factors associated with lower breastfeeding that are potentially modifiable through breastfeeding promotion programs.

Methods

The sample

The sample used in this report was obtained from the North Carolina Pregnancy Risk Assessment Monitoring System (PRAMS). PRAMS was implemented by the Centers for Disease Control in 1987 to assist state health departments in establishing and maintaining a public health surveillance system of selected maternal behaviors and experiences to supplement data from vital records. PRAMS is a random, stratified, monthly mail/telephone survey of North Carolina women who recently delivered a live-born infant. Each month, a sample of approximately 200 women with recent live-born deliveries is drawn from the Provisional Birth File. North Carolina stratifies the sample on birth weight, with oversampling occurring among low birth weight babies (1,500-2,499 grams) and very low birth weight babies (less than 1,500 grams).

Up to three self-administered surveys are mailed to mothers in the sample, with nonrespondents followed up with a telephone interview. The first survey is mailed approximately 3-4 months after delivery. Self-reported survey data are then linked to selected birth certificate data and weighted for sample design, nonresponse, and noncoverage to create the annual PRAMS analysis data sets. These

weights make the data representative of all North Carolina women with a live-born delivery.

We combined data for the years 1997 through 2001. North Carolina began data collection July 1, 1997, providing us with six months of data for 1997. During this time period, there were a total of 519,095 live births in North Carolina. Included in the PRAMS samples were 10,812 women, and from these we have 7,935 completed surveys (a 73% response rate).

Measures

Breastfeeding initiation was defined as any breastfeeding after delivery. *Breastfeeding duration for at least eight weeks* was defined as breastfeeding for at least eight weeks after delivery, whether or not the infant was exclusively breastfed during this period. An eight-week cut-off was used because the first questionnaire could have been mailed as early as twelve weeks after delivery, and so it would have been difficult to assess breastfeeding at a later time. To control for the correlates of initiation, we looked at the eight-week breastfeeding rates only among the subset of the women who initiated breastfeeding.

Demographic factors used in the analysis were maternal race/ethnicity, age, education, and marital status. Race/ethnicity was categorized as white non-Hispanic, African American non-Hispanic, other non-Hispanic, and Hispanic. Maternal age was categorized as less than 20 years, 20-24 years, 25-34 years, and 35 years and older. Maternal education was categorized as less than high school, high school, or more than high school. Marital status was categorized as married or unmarried. **Maternal factors** included parity, participation in WIC/Medicaid, pre-pregnancy weight, post-partum depression, use of multivitamin with folic acid, smoking (continuous smoking before, during, and after pregnancy), use of postpartum birth control, and pregnancy intendedness. Parity was categorized as whether or not the mother had a previous live birth. Pre-pregnancy weight was categorized as obese (BMI ≥ 30) and not obese (BMI <30). A mother was defined as receiving Medicaid benefits if she had her prenatal care or delivery paid by

Medicaid. Participation in WIC was defined as participation by the mother in the WIC program during her pregnancy. These two variables were combined to create a WIC/Medicaid status variable consisting of mothers who received WIC benefits *and* were enrolled in Medicaid; mothers who received WIC benefits and were not enrolled in Medicaid; Medicaid-enrolled mothers who did not receive WIC services; and mothers who did not receive *either* WIC or Medicaid benefits. The single **infant factor** was the number of nights the infant spent in the hospital (3 or more versus less than 3). The single **environmental factor** was whether or not a health care provider discussed breastfeeding with the mother.

Analysis

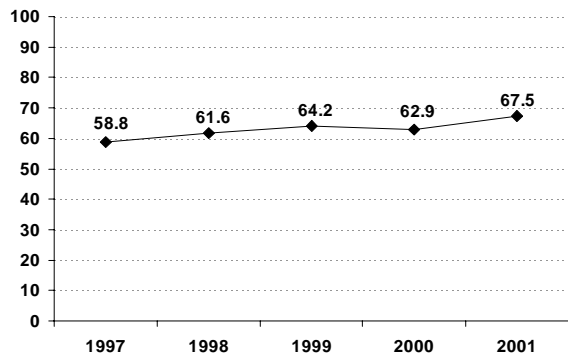
To take the complex survey sampling methods into account, the data were analyzed using the SUDAAN¹² software. All analyses in this report were produced using weighted PRAMS data, designed to reflect the entire population of North Carolina women having a live birth during 1997-2001. Surveys with missing data for some variables are excluded from the analyses involving those variables. As an approximation, differences in percentages between the categories of a variable are considered statistically significant at the $p < .05$ level if the confidence intervals do not overlap. Multivariate logistic regression was used to identify independent correlates of breastfeeding initiation and duration (at eight weeks after delivery). Odds ratios from the multivariate analysis are statistically significant if the confidence interval does not include 1.0.

Results

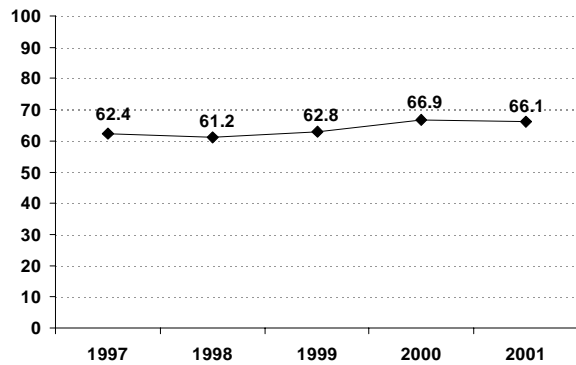
Trends in breastfeeding rates

The percentages of women who initiated breastfeeding and, among those who initiated, the percentage who were breastfeeding at eight weeks after delivery are shown in Figures 1 and 2. For the entire period 1997-2001, 64 percent of women reported initiating breastfeeding while 65 percent of women who initiated breastfeeding reported breastfeeding at eight weeks, both well below Healthy People 2010 objectives. While North

**Figure 1. Self-Reported Breastfeeding Initiation by Year
NC PRAMS, 1997-2001**



**Figure 2. Self Reported Breastfeeding Initiation at
Eight Weeks (Among Those Who Initiated) by Year
NC PRAMS, 1997-2001**



Carolina has seen a substantial increase in breastfeeding initiation from 1997 to 2001, there was only a small increase from 1997 to 2001 in the percentage of mothers initiating breastfeeding who continued to breastfeed at eight weeks.

Factors associated with breastfeeding initiation

Table 1 shows the percentages of women who initiated breastfeeding (mothers who ever breastfed their baby, regardless of how long or exclusivity) by demographic, maternal, infant, and environmental characteristics. Also shown, through logistic regression, are the adjusted odds of

breastfeeding initiation. Overall, 63.5 percent of mothers reported initiating breastfeeding. Those who reported the highest levels of initiation were Hispanic women (87.2%) and women who had more than a high school education (78.4%). Levels of initiation were also significantly higher than the overall initiation rate for white non-Hispanic women, women over the age of 24, women not enrolled in WIC or receiving Medicaid benefits, married women, women who took a multivitamin containing folic acid every day before they became pregnant, women who did not smoke, and women whose pregnancy was intended. Levels of initiation were lowest among African American non-Hispanic women (43.9%), unmarried women (43.3%), women who smoked (43.7%), women under the age of 20 (44.8%), women who did not have a high school degree (48.6%), women who reported being very depressed after giving birth (48.8%), and women who were enrolled in the WIC program *and* had either their delivery or prenatal care paid for by Medicaid (50.0%) (Table 1, Column 2).

Results from the logistic regression analysis, adjusting for all factors simultaneously, are shown in Table 1, Column 3. Compared to white non-Hispanic women, Hispanic women were significantly more likely to initiate breastfeeding (OR = 6.3, 95% CI = 4.2,9.5), while African American non-Hispanic women were significantly less likely to initiate breastfeeding (OR = 0.7, 95% CI = 0.5,0.8). Women who were not married were less likely to initiate breastfeeding than married women (OR = 0.5, 95% CI = 0.4,0.6). Logistic regression analysis revealed that women who had the following characteristics were also less likely to initiate breastfeeding than their counterparts: high school or less education, obese, depressed after giving birth, had a previous live birth, not taking a multivitamin every day before pregnancy, smoking (before, during, and after pregnancy), and using some form of postpartum birth control.

**Table 1. Percentages of Women Initiating Breastfeeding and Adjusted Odds Ratios (from Logistic Regression), with 95% Confidence Intervals
NC PRAMS 1997-2001**

Variables	Number Initiating	Percent Initiating (95% CI)	Adjusted Odds Ratio (95% CI)
All Women	4,520	63.5 (62.1,64.9)	
DEMOGRAPHIC FACTORS			
Race/Ethnicity			
Hispanic	422	87.2 (83.6,90.8)	6.3 (4.2,9.5)
African American non-Hispanic	931	43.9 (40.8,47.0)	0.7 (0.5,0.8)
Other non-Hispanic	143	60.5 (52.7,68.3)	0.8 (0.5,1.1)
White non-Hispanic	3,024	67.7 (66.0,69.4)	1.0 (Referent)
Education			
< High School	713	48.6 (45.3,51.9)	0.3 (0.3,0.4)
High School	1,215	52.4 (49.8,55.0)	0.5 (0.4,0.6)
> High School	2,586	78.4 (76.7,80.1)	1.0 (Referent)
Age			
<20	471	44.8 (40.7,48.9)	0.7 (0.5,1.0)
20-24	1,066	55.7 (52.8,58.6)	0.7 (0.6,1.0)
25-34	2,406	71.2 (69.3,73.1)	0.8 (0.6,1.0)
35+	577	74.0 (70.1,77.9)	1.0 (Referent)
Marital Status			
Not Married	1,073	43.3 (40.6,46.0)	0.5 (0.4,0.6)
Married	3,447	73.3 (71.7,74.9)	1.0 (Referent)
MATERNAL FACTORS			
Medicaid/WIC Status			
On WIC/On Medicaid	1,405	50.0 (47.6,52.4)	0.9 (0.7,1.1)
Not on WIC/On Medicaid	346	56.1 (50.7,61.5)	0.9 (0.7,1.3)
On WIC/Not on Medicaid	293	62.1 (56.5,67.7)	0.9 (0.7,1.2)
Not on WIC/Not on Medicaid	2,434	76.7 (74.8,78.6)	1.0 (Referent)
Pre-Pregnancy Weight			
Obese (BMI >=30)	687	56.9 (53.2,60.6)	0.8 (0.6,0.9)
Not Obese	3,819	64.8 (63.2,66.4)	1.0 (Referent)
Postpartum Depression			
Very Depressed	352	48.8 (43.3,54.3)	0.7 (0.6,0.9)
Not/Moderately Depressed	4,131	64.6 (63.1,66.1)	1.0 (Referent)
Previous Live Birth			
Yes	2,196	61.2 (59.2,63.2)	0.7 (0.6,0.8)
No	2,290	66.8 (64.7,68.9)	1.0 (Referent)
Multivitamin Use			
Not Every Day/ Not At All	3,090	59.1 (57.4,60.8)	0.7 (0.6,0.9)
Took Every Day	1,415	76.4 (73.9,78.9)	1.0 (Referent)
Smoking			
Yes	470	43.7 (39.5,47.9)	0.6 (0.5,0.8)
No	3,994	66.7 (65.2,68.2)	1.0 (Referent)
Postpartum Birth Control			
Yes	3,818	62.5 (61.0,64.0)	0.7 (0.5,0.8)
No	672	70.5 (66.7,74.3)	1.0 (Referent)
Intendedness			
Unintended	1,600	53.7 (51.4,56.0)	1.0 (0.9,1.2)
Intended	2,758	71.7 (69.9,73.5)	1.0 (Referent)
INFANT AND ENVIRONMENTAL FACTORS			
Infant Nights in Hospital			
3 or More	2,324	62.0 (59.6,64.4)	1.0 (0.9,1.2)
Less Than 3	2,175	64.3 (62.5,66.1)	1.0 (Referent)
Health Care Worker Discussed Breastfeeding			
Yes	3,861	63.1 (61.6,64.6)	1.1 (0.9,1.4)
No	586	68.2 (64.2,72.2)	1.0 (Referent)

All estimates are weighted; number initiating is the unweighted number. The sample excludes women with data missing on breastfeeding initiation. Total sample size for 1997-2001 is 7,935. CI = confidence interval. Statistically significant odds ratios are shown in bold print.

Factors associated with breastfeeding at eight weeks after delivery

Table 2 shows the percentages of women who were breastfeeding at eight weeks after delivery *among those who initiated breastfeeding* (regardless of exclusivity) by demographic, maternal, infant, and environmental characteristics. The adjusted odds of breastfeeding at eight weeks are also shown from logistic regression. Overall, among the subset of women who initiated breastfeeding, 64.2 percent of women reported breastfeeding at eight weeks after delivery. Levels of breastfeeding at eight weeks were highest for women who were of Hispanic ethnicity (74.0%), women who had more than a high school education (71.0%), women over the age of 35 (74.9%), women ages 25-34 (70.0%), women who were not using any postpartum birth control (73.9%), and women who took a multivitamin containing folic acid every day before pregnancy (72.1%). Other groups of women who had a significantly higher percentage of breastfeeding at eight weeks compared to the overall rate were women who received neither WIC nor Medicaid benefits, married women, women who did not smoke, and women who reported their pregnancy to be intended. Levels of breastfeeding at eight weeks were lowest among African American non-Hispanic women (56.4%), unmarried women (50.7%), women who smoked (45.8%), women under the age of 20 (45.4%), women ages 20-24 (53.4%), women who did not have a high school degree (58.4%), women who had only a high school degree (52.8%), women who reported being very depressed after giving birth (53.0%), obese women (54.8%), women who were enrolled in the WIC program *and* had either their delivery or prenatal care paid for by Medicaid (55.6%), and women who were enrolled in the WIC program but did not have their delivery or prenatal care paid by Medicaid (55.0%) (Table 2, Column 2).

The logistic regression analysis, adjusting for all factors simultaneously, revealed that, compared to white non-Hispanic women, Hispanic women were more likely to continue breastfeeding at eight weeks after delivery (OR = 1.8, 95% CI = 1.3,2.7). Education and age were also significant predictors of breastfeeding continuation at eight weeks after delivery. Compared to women who had more than a high school degree, women who had less than a high school degree (OR = 0.7, 95% CI = 0.5,0.9) and women who had a high school degree (OR = 0.6, 95% CI = 0.5,0.8) were less likely to breastfeed at eight weeks. Women under the age of 20 (OR = 0.5, 95% CI = 0.3,0.7) and those ages 20-24 (OR = 0.5, 95% CI = 0.3,0.7) were less likely to continue to breastfeed at eight weeks after delivery, compared to women age 35 and older. Women who were not married were also less likely to breastfeed at eight weeks after delivery (OR = 0.6, 95% CI = 0.4,0.8) compared to married women. Women who had a previous live birth were *more* likely to continue to breastfeed at eight weeks (OR = 1.2, 95% CI = 1.1,1.5), compared to women who did not have a previous live birth. Interestingly, compared to women who received neither WIC nor Medicaid benefits, women who were not enrolled in the WIC program but did have either their prenatal care or delivery paid by Medicaid were more likely to breastfeed at eight weeks (OR = 1.7, 95% CI = 1.1,2.5). Groups who were less likely to breastfeed at eight weeks after delivery were obese women; women who reported being very depressed after giving birth; women who did not take a multivitamin every day before pregnancy; women who smoked before, during, and after pregnancy; and women who used some form of postpartum birth control (Table 2, Column 3).

**Table 2. Percentages of Women Breastfeeding at Eight Weeks (*among Women Initiating*) and Adjusted Odds Ratios (from Logistic Regression), with 95% Confidence Intervals
NC PRAMS 1997-2001**

Variables	Number Breastfeeding at Eight Weeks	Percent Breastfeeding at 8 Weeks (95% CI)	Adjusted Odds Ratio (95% CI)
All Women	2,811	64.2 (62.4,66.0)	
DEMOGRAPHIC FACTORS			
Race/Ethnicity			
Hispanic	305	74.0 (68.9,79.1)	1.8 (1.3,2.7)
African American non-Hispanic	513	56.4 (51.8,61.0)	1.0 (0.8,1.3)
Other non-Hispanic	88	65.8 (56.2,75.4)	1.0 (0.6,1.8)
White non-Hispanic	1,905	64.2 (62.1,66.3)	1.0 (Referent)
Education			
< High School	363	58.4 (53.7,63.1)	0.7 (0.5,0.9)
High School	635	52.8 (49.2,56.4)	0.6 (0.5,0.8)
> High School	1,808	71.0 (68.8,73.2)	1.0 (Referent)
Age			
<20	194	45.4 (39.4,51.4)	0.5 (0.3,0.7)
20-24	553	53.4 (49.5,57.3)	0.5 (0.3,0.7)
25-34	1,640	70.0 (67.7,72.3)	0.8 (0.6,1.0)
35+	424	74.9 (70.4,79.4)	1.0 (Referent)
Marital Status			
Not Married	515	50.7 (46.6,54.8)	0.6 (0.4,0.8)
Married	2,296	68.0 (66.1,69.9)	1.0 (Referent)
MATERNAL FACTORS			
Medicaid/WIC Status			
On WIC/On Medicaid	719	55.6 (52.2,59.0)	1.1 (0.9,1.5)
Not on WIC/On Medicaid	202	65.0 (58.1,71.9)	1.7 (1.1,2.5)
On WIC/Not on Medicaid	165	55.0 (47.9,62.1)	0.8 (0.6,1.2)
Not on WIC/Not on Medicaid	1,690	70.0 (67.8,72.2)	1.0 (Referent)
Pre-Pregnancy Weight			
Obese (BMI >= 30)	369	54.8 (50.0,59.6)	0.7 (0.5,0.8)
Not Obese	2,435	65.8 (63.9,67.7)	1.0 (Referent)
Postpartum Depression			
Very Depressed	180	53.0 (45.4,60.6)	0.8 (0.5,1.2)
Not/Moderately Depressed	2,611	64.9 (63.0,66.8)	1.0 (Referent)
Previous Live Birth			
Yes	1,443	67.9 (65.5,70.3)	1.2 (1.1,1.5)
No	1,350	59.9 (57.3,62.5)	1.0 (Referent)
Multivitamin Use			
Not Every Day/ Not At All	1,803	60.6 (58.4,62.8)	0.7 (0.6,0.9)
Took Every Day	998	72.1 (69.2,75.0)	1.0 (Referent)
Smoking			
Yes	204	45.8 (39.6,52.0)	0.6 (0.4,0.8)
No	2,585	66.1 (64.3,67.9)	1.0 (Referent)
Postpartum Birth Control			
Yes	2,311	62.5 (60.6,64.4)	0.6 (0.5,0.7)
No	480	73.9 (69.5,78.3)	1.0 (Referent)
Intendedness			
Unintended	881	58.0 (54.9,61.1)	1.0 (0.8,1.2)
Intended	1,829	67.9 (65.7,70.1)	1.0 (Referent)
INFANT AND ENVIRONMENTAL FACTORS			
Infant Nights in Hospital			
3 or More	1,395	61.4 (58.3,64.5)	0.9 (0.8,1.1)
Less Than 3	1,404	65.4 (63.2,67.6)	1.0 (Referent)
Health Care Worker Discussed Breastfeeding			
Yes	2,374	63.5 (61.6,65.4)	1.1 (0.8,1.4)
No	391	67.8 (62.9,72.7)	1.0 (Referent)

All estimates are weighted; number breastfeeding at eight weeks is the unweighted number. The sample excludes women with data missing on breastfeeding at eight weeks. Total sample size for 1997-2001 of women who initiated breastfeeding is 4,520. CI = confidence interval. Statistically significant odds ratios are shown in bold print.

Discussion

We did observe an increasing trend for breastfeeding initiation between 1997 and 2001. By 2001, 67.5 percent of all mother initiated breastfeeding, an increase of 8.6 percentage points. This is higher than for the South generally and comparable to the U.S. average in 2001.⁸ However, it is still below the Healthy People 2010 goal of 75 percent of women initiating. There is no Healthy Carolinans objective specific to breastfeeding.

We did not observe as large of an increase in duration at eight weeks. Of those who initiated, 62.4 percent were still breastfeeding at all at eight weeks in 1997, compared to 66.1 percent in 2001. Exclusive breastfeeding at eight weeks is lower at 41 percent. By eight weeks, only about 40 percent of all women are still breastfeeding at all, which is lower than the Healthy People 2010 goal of having 50 percent still breastfeeding at 6 months.¹³ Since many of the benefits of breastfeeding are dependent upon exclusive breastfeeding for four or more months, it is essential that we increase family, institutional, and community support for breastfeeding. Programs such as in-home breastfeeding and peer support programs for low-income women, hospital-based post-discharge support groups, lactation support in pediatricians' offices, worksite lactation programs, and community support for breastfeeding all have the potential to increase duration.¹⁴⁻¹⁷

Factors associated with breastfeeding

Similar to national data, North Carolina data show Hispanic women are more likely to initiate and to continue breastfeeding at eight weeks than non-Hispanic white women, while non-Hispanic African American women have the lowest rates. However, results from logistic regression indicate that after controlling for other factors, breastfeeding at eight weeks (among those who initiated) is the same for non-Hispanic African American and white women, although both groups are still less likely to be breastfeeding than Hispanic women.

It should be mentioned that the adjusted odds ratio of 6.3 for initiation of breastfeeding for Hispanic women in Table 1 may be somewhat misleading. The unadjusted percentage of Hispanic women who initiated breastfeeding was 87.2, compared to 67.7 percent for white non-Hispanic women (the reference group), for a ratio of 1.29. The adjusted odds ratio from logistic regression will depart substantially from the "relative risk" ratio when the prevalence is high (for breastfeeding initiation, it is well over 50 percent). Using a method to correct the odds ratio in studies of common outcomes to approximate the relative risk,¹⁸ the adjusted relative risk for initiation of breastfeeding by Hispanic women is 1.37. This implies that Hispanic ethnicity increases the likelihood of initiating breastfeeding by 37 percent (controlling for the other variables in Table 1), rather than more than six times, which the adjusted odds ratio might imply.

Many studies have found that women on WIC are less likely to breastfeed than other groups.⁹ In this study, after controlling for other factors, women on WIC, regardless of Medicaid status, were not significantly less likely to be breastfeeding than women not on WIC or Medicaid. However, the group significantly more likely to still be breastfeeding at eight weeks was those *on* Medicaid but *not on* WIC. It is possible that low-income WIC-eligible women who are committed to breastfeeding choose not to seek WIC services.

This study found that women who have lower income and less education, are unmarried, obese, depressed, or smoke are less likely to breastfeed, similar to what is seen in national data.¹⁹⁻²¹ Women who took folic acid were significantly more likely to initiate and to continue breastfeeding at eight weeks. It is possible that many women who do not smoke and who do use folic acid and breastfeed engage in a variety of health-promoting behaviors. However, some women may believe that if they smoke, they should not breastfeed. Although it is certainly best that women, particularly pregnant women and new mothers, not smoke, the Centers

for Disease Control and Prevention recommends that women who do smoke should breastfeed since human milk is associated with reduced asthma in children (<http://www.cdc.gov/breastfeeding/faq.htm>). Breastfeeding promotion programs that seek to increase initiation of breastfeeding should target women who have less than high school education, who smoke, are overweight, unmarried, depressed, or did not take folic acid regularly before pregnancy. Programs and supports to increase breastfeeding duration should additionally target young women without other children.

Our results indicate that in North Carolina infants who spend three or more days in the hospital are as likely to receive human milk as are those who are discharged within two days of birth. It is probable that some of these infants who are still in the hospital at 3 days are in intensive care units and that their mothers are pumping milk rather than breastfeeding. This finding suggests that hospitals are doing a good job of helping mothers of sick infants understand the benefits human milk has for these babies and of giving them assistance with pumping. It is encouraging as well that the mothers of these infants are just as likely to still be breastfeeding at eight weeks as the mothers of infants discharged within two days.

The value of the PRAMS data set for analysis of breastfeeding in North Carolina is that it provides a view of the entire birth population. But, the North Carolina PRAMS survey has so far provided limited information on many of the factors we would like to investigate that are associated with breastfeeding initiation and termination. For example, the PRAMS survey does not ask about return to work, which is an important factor to consider when looking at health behavior in the postpartum period. Nonetheless, these PRAMS results are valuable in that they provide a method for monitoring changes over time in breastfeeding initiation and duration and can identify populations that could benefit from additional education, support, or services.

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