Are US Mothers Meeting the Healthy People 2010 Breastfeeding Targets for Initiation, Duration, and Exclusivity? The 2003 and 2004 National Immunization Surveys

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Are US Mothers Meeting the *Healthy People 2010* Breastfeeding Targets for Initiation, Duration, and Exclusivity? The 2003 and 2004 National Immunization Surveys

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Abstract

Using data from the National Immunization Surveys (2003 and 2004), the authors model the influence of child, maternal, and state- or metropolitan-level factors on the initiation, duration, and exclusivity of breastfeeding to determine the characteristics of groups meeting the *Healthy People 2010* targets. Analyses indicate that only children of college graduates meet the targets for breastfeeding at initiation, 6 months, and 12 months; no groups meet the target for exclusive breastfeeding. Results indicate a low prevalence of breastfeeding among children of single mothers, less educated mothers, participants in the Women, Children, and Infants program, and those living in nonwestern states and in areas of high newborn risk. Hispanic children, children of college graduates, and children living in the West consistently have higher odds of breastfeeding. Only the prevalence of breastfeeding early postpartum is near the *Healthy People 2010* target of 75%, the percentages for 6 or 12 months and exclusive breastfeeding are well below. *J Hum Lact*. 24(3):278-288.

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Human milk provides the best nutrition for infant development and contains maternal antibodies that prevent disease[1-4]; it also promotes maternal health[5] and reduces health care and environmental costs.[6,7] Despite these benefits, duration rates remain low, particularly among high-risk populations. The American Academy of Pediatrics recommends exclusive breastfeeding to age 6 months and continued breastfeeding through at least the first year.[1] National data from 2001 and 2002, although based on different methodologies, report similar findings: the initiation of breastfeeding at 70%, breastfeeding at 6 months at about 34%, and breastfeeding at 16% at 1 year of age.[8,9] Estimates of exclusive breastfeeding vary depending on the methodology used. National data from 2001, collected monthly from mothers for each feeding age, report 17% exclusive breastfeeding at 6 months.[8] In contrast, national data from 2002 and 2004, collected in retrospective surveys of mothers of children aged 19 to 35 months, report exclusive breastfeeding at 6 months at 13% (2002) and 11% (2004), respectively.[9,10] In an effort to expand the health benefits of breastfeeding, targets have been set in *Healthy People 2010* at postpartum to 75%, at 6 months to 50%, and at 1 year to 25%. In addition, breastfeeding targets for exclusive breastfeeding to 6 months have been set at 25%.[11] Although the prevalence of breastfeeding initiation is nearing the *Healthy People* target, the prevalence at 6 months and exclusive breastfeeding still lag behind.

Maternal characteristics such as race and age are associated with breastfeeding as black mothers breastfeed less than nonblacks and teens less than older mothers.[8,9,12-15] Mothers with higher levels of education and income are more likely to breastfeed than their counterparts.[16] Other characteristics positively associated with breastfeeding include being married[13] and being foreign born.[16,17] In addition, living in the western United States is associated with a higher prevalence of breastfeeding.[12] Maternal factors negatively associated with breastfeeding include smoking[18] and returning to employment.[19]

Breastfeeding rates are lowest among young, black, poor mothers, although many of these women qualify for the Special Supplemental Nutrition Program for Women,

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Infants, and Children (WIC). Enrollment in the program, however, is associated with reduced breastfeeding,[8,15,20] even though WIC provides some incentives to breastfeeding women. In addition to basic incentives, some states have implemented aspects of the US Department of Agriculture (USDA) National Breastfeeding Promotion Campaign—"Loving support makes breastfeeding work." The goals of the campaign are to encourage breastfeeding among WIC participants, as well as to promote breastfeeding to the general public.[21] Studies indicate that WIC participation influences breastfeeding attitudes and, in some cases, promotes the initiation of breastfeeding but not the continuation.[22-24]

We define high-risk environments as areas in which health care services are lacking, nonmarital and teen births are prevalent, education levels are low, and poverty is highly concentrated. Such environments can negatively influence child well-being beyond the influence of individual factors. High health risk environments often do not provide adequate prenatal care, which is associated with low birth weight and preterm births.[25] Prenatal care is important in supporting breastfeeding, as the support of clinicians has been found to influence women's decisions to breastfeed or to continue to breastfeed.[26] Studies of low-income women indicate that attitudes toward breastfeeding are influenced by perceptions of social approval of breastfeeding in public, the support and approval of friends, and the support of health providers.[27] Less educated and low-income women are more likely to agree that infant formula is as good as breast milk, relative to higher income and educated mothers. This positive attitude toward formula increased between 1999 and 2003 in the United States, especially among adults from low socioeconomic backgrounds.[28] Community-level factors have been found to influence women's attitudes toward breastfeeding, as well as the resources and support women have access to.[27-30]

On the basis of this review, we examine maternal and child characteristics and resources associated with the initiation and duration of breastfeeding. In addition, we model the influence of the state or metropolitan environment in terms of factors promoting a healthy start for newborns. Our expectation is that mothers with more resources such as education, marital stability, and income will more closely mirror the *Healthy People 2010* targets for the initiation and duration of breastfeeding. We also expect that children living in healthier environments will be more likely to be breastfed, thus approaching the *Healthy People 2010* targets.

Methods

Our data are drawn from the National Immunization Surveys (NIS) of 2003 and 2004. The NIS is conducted annually by the US Centers for Disease Control and Prevention. The data are collected primarily to calculate estimates of vaccination coverage; however, beginning in 2001, questions on breastfeeding were added to the survey.[31] The NIS uses a multistage sampling design and random-digit dialing telephone methods to identify and survey households with 1 or more age-eligible children. The data are weighted to represent the US population of children 19 to 35 months of age.[32] The weights reflect each child's probability of being selected into the sample. They adjust for the number of phone lines in the household, nonresponse to the household interview, noncoverage of households that do not have telephones, and nonresponse by providers. Our analyses are based on a weighted sample of 61 218 children. Data indicating whether age-eligible children were ever breastfed, breastfed exclusively, and the duration of breastfeeding in days were obtained from the survey respondent.[31]

On the basis of frequency distributions of the ever breastfed measure and duration responses, we code whether each age-eligible child was ever breastfed, breastfed for 6 months (182 days or more), or breastfed for 1 year (343 days or more). In addition, data on exclusive breastfeeding are used to measure exclusive breastfeeding to 6 months (182 days or more). Each of these outcomes is a dichotomous measure. Our first outcome measure includes all children in the survey (n = 61 218). This sample is used to provide descriptive characteristics (Table 1), determine groups meeting the *Healthy People* targets (Table 2), and predict the likelihood of initiating breastfeeding (Table 3). Of those initiating breastfeeding (n = 44 513), we examine 3 outcome measures: breastfeeding to 6 months versus stopping before 6 months (Table 4), breastfeeding exclusively for 6 months versus stopping exclusive feeding before (Table 5), and breastfeeding to 1 year versus stopping before (Table 6).

We include measures of the age and sex of the child, race/ethnicity, and whether he or she was the firstborn child in the family. Race and ethnicity are only provided for the child in the NIS and is measured by 4 exclusive categories: non-Hispanic white, non-Hispanic black, Hispanic, and non-Hispanic other race. Maternal characteristics include receiving WIC benefits for the child, maternal education, age, and marital status (see Table 1 for measurement categories). Based on measures reported in previous research, WIC receipt is measured by 3 categories: child ever received benefits, child never received

benefits but eligible, and child never received benefits and not eligible.[15] Measures of household characteristics include poverty-to-income ratio[15] and census region (see Table 1 for categories). In some cases, an adult in the household other than the mother of the focal child (eg, the father or grandparent) answered the survey. To control for who answered the survey in the household, we include a measure (0 = not mother of child; 1 = mother of child) in the model. In addition, we include a control for survey year (0 = 2003; 1 = 2004).

We also include aggregate data matched to the 78 NIS Immunization Action Plan (IAP) areas, which include the 50 states, the District of Columbia, plus 27 metropolitan areas. The first state-level variable is a dichotomous measure that identifies whether the child lives in a state piloting the USDA National Breastfeeding Promotion Campaign as part of WIC.[20] In a second IAP measure, we average 7 characteristics of neonatal risk drawn from 8 state and metropolitan area indicators. The neonatal risk data are from the *Right Start for America's Newborns* indicators, which we matched to the 78 NIS IAP areas.[25] These *Right Start* indicators are based on data collected by the National Center for Health Statistics and are available through Child Trends/KIDS COUNT. *Right Start* provides 8 aggregate measures, which reflect high-risk environmental factors for newborns in the United States. Measures are available for each state, as well as for 50 major cities. Data for each of the 8 indicators from *Right Start* were matched to the 78 NIS IAP areas. State data were used, except for the District of Columbia, and the 27 metropolitan areas that were matched to the major city data provided by *Right Start*. The *Right Start* indicators include percentages of teen births (mean 11%), repeat teen births (mean 20%), births to unmarried women (mean 39%), births to mothers with low educational attainment (mean 22%), late or no prenatal care (mean 4%), low birth weight births (mean 9%), maternal smoking (mean 11%), and percentages of preterm births (mean 13%).[25]

A principal axis factor analysis indicated that a single factor explained the shared variance among 7 of these items (eigenvalue = 4.57, percentage of variance explained = 85.9%; Cronbach's alpha = 0.80). Maternal smoking did not load with the other measures and was excluded. Hence, we created a combined scale by taking the mean of the 7 items for each IAP area. The scale is a continuous measure that indicates how healthy the IAP area environment is for newborns, with higher values indicating a higher percentage of

Table 1. Characteristics of the Sample, National Immunization Surveys, 2003-2004

Characteristic	*Point Estimate, %*	*95% Confidence Intervals, %*
Ever breastfed	70.9	68.0-73.7
Breastfed for 6 months	36.4	34.3-38.6
Breastfed exclusively for 6 months	15.2	14.0-16.3
Breastfed for 12 months	17.7	16.1-19.3
Maternal characteristics		
Education		
Less than high school	20.1	18.1-22.2
High school graduate	31.5	30.3-32.5
Some college	22.0	21.2-22.8
College graduate	26.4	25.5-27.3
Marital status		
Married	69.2	67.0-71.4
Never married	21.9	20.2-23.6
Divorced, separated or widowed	8.9	7.8-9.5
Age of mother		
19 years or younger	2.8	2.4-3.2
20-29 years	45.4	43.3-47.5
30 years or older	51.8	49.8-53.8
Poverty-to-income ratio		
Ratio < 1.00	21.3	20.2-22.3
1.00 ≤ ratio < 1.85	18.1	17.4-18.7
1.85 ≤ ratio < 3.00	28.7	27.9-29.4
3.00 ≤ ratio	32.0	30.6-33.3
Recipient of WIC		
Yes	53.4	50.4-56.6
No, but eligible	11.1	10.3-11.9
No, ineligible	35.4	32.9-37.9
Resides in WIC experiment state	29.0	13.1-45.0
Region		
Northeast	17.2	7.3-27.1
Midwest	22.5	10.1-34.8
South	37.3	21.7-52.8
West	23.0	8.5-37.5
Unhealthy environment—IAP area (mean)[a]	16.4	15.7-17.1
Child characteristics		
Race/ethnicity		
Non-Hispanic white	55.1	52.4-58.4
Non-Hispanic black	13.1	10.2-15.9
Hispanic	23.3	17.1-29.5
Non-Hispanic other race	8.5	7.3-9.7
First born to mother	37.4	36.4-38.3
Male child	50.9	50.6-51.2
Age of child at interview		
19-23 months	29.9	29.7-30.1
24-29 months	34.3	34.0-34.6
30-35 months	35.8	35.6-36.0
Mother responded to survey questions	84.8	84.4-85.3

The sample size is 61 218. The results are based on weighted data that are adjusted for the multistage sampling design of the National Immunization Surveys. IAP, Immunization Action Plan; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.

[a] The IAP unhealthy environment measure is a percentage scale that ranges from low risk (9.8%) to high risk (26.5%) to newborns.

unhealthy or high-risk conditions (mean 16.4%; range, low 9.8% to high 26.5%). It should be noted that except for the 27 metropolitan areas, the IAP areas are entire states. Therefore, as an indicator of an unhealthy environment, the IAP measure is relatively crude and does not represent a local community. Correlations between the IAP unhealthy environment measure and the other independent variables in the model are all $r = .2$ or lower, with the exception of living in the South, which is correlated at $r = .35$. This suggests that the unhealthy environment IAP indicator is largely independent of the other variables in our analyses. Given no major problems with collinearity between the IAP indicator and region measures, we chose to keep region in the model to separate regional characteristics from the unhealthy environment indicator.

The outcome variables—binary indicators of ever breastfeeding, breastfeeding for 6 months, exclusively for 6 months and for 12 months—are estimated using binary logistic regression.[33] The models that estimate breastfeeding for 6 or 12 months use the subsample of respondents (n = 44 513) who reported that the child had ever been breastfed. The results are presented as odds ratios, which represent the increase or decrease in the odds of breastfeeding associated with a unit or category change in the independent variables. All models are estimated using STATA 9.2 and take into account the multistage sampling design and the sample weights. Hence, the standard errors used to compute the significance tests and confidence intervals of the odds ratio are adjusted for the clustered sampling design of the NIS.

Results

Descriptive statistics are provided in Table 1. Consistent with previous research,[8,9] the percentage of children, aged 19 to 35 months, never breastfed is about 29%, whereas those who were breastfed at least 6 months is about 36%, and those breastfed for at least 12 months is only about 18%. Only about 15% of the children were breastfed exclusively for 6 months. Note that the prevalence of breastfeeding early postpartum is near the target of 75%, but the prevalence for at least 6 or 12 months and exclusive breastfeeding are well below the desired percentages listed in *Healthy People 2010* (50%, 25%, and 25%).

The remaining percentages mirror national estimates, with most children born to married women (69%), women in their 20s and 30s (97%), and women with at least a high school diploma (80%). More than a third of the children are first births. About 78% live in households at or above the poverty threshold, yet about 53% of the survey children have participated in WIC. Twenty-nine percent of the children live in WIC breastfeeding campaign pilot states. The unhealthy environment IAP measure is a percentage scale, with low values indicating a healthy environment for newborns (low risk) and high values indicating an unhealthy environment (high risk) for newborns. The average on the scale is about 16%, with a range from a low of 9.8% to a high of 26.5%.

Table 2 provides estimates of the percentage of children ever breastfed, breastfed for 6 months, breastfed exclusively for 6 months, and breastfed for 12 months by the various maternal and child characteristics. Percentages in bold indicate those groups that are at least 10 points below the *Healthy People 2010* target percentages. Note that only a few groups are at or within 10 percentage points of the 4 targets: children of college graduates, married women, women in their 30s, those who do not participate in WIC, and those who live in the western United States. The following groups are consistently well below the target percentages: non-Hispanic black children, children of women with at most a high school education, single mothers, teenage mothers, WIC participants, and children living in the unhealthiest IAP areas. The estimates also indicate that there is a substantial drop-off of breastfeeding from initiation to 6 months for most groups. For example, whereas 8 of the 36 groups represented in the table meet the target for ever breastfeeding (75% or higher), only 1 group—children of college graduates—meets the target for breastfeeding at least 6 months or 12 months, but even among this group, exclusive breastfeeding to 6 months is low (17%). Exclusive breastfeeding is highest among children living in the West (21%) but still below target.

Table 3 presents the first binary logistic regression results predicting breastfeeding. The odds of any breastfeeding are lower among the following groups of infants: those whose mothers have less than a college education; those whose mothers are never married or are divorced, separated, or widowed; those who have participated in WIC; and those who are not the first-born child to the mother. The odds of any breastfeeding are higher among children who reside in the western United States relative to those who reside in the northeastern United States. Consistent with past studies,[8,9,12,14] non-Hispanic black children are less likely than non-Hispanic white children to experience any breastfeeding. However, the odds of any breastfeeding are twice as high among Hispanic children as among white children.

Table 2. Percentage of Children Breastfed, by Maternal, Child, and IAP Characteristics, National Immunization Surveys, 2003-2004

Characteristic	*Ever Breastfed*	*Breastfed 6 Months*	*Breastfed 6 Months Exclusively*	*Breastfed 12 Months*
Healthy People targets	75.0	50.0	25.0	25.0
Education				
Less than high school	**64.2**	**29.7**	**12.8**	15.7
High school graduate	**63.2**	**28.4**	**12.9**	**13.4**
Some college	73.9	**36.6**	15.2	17.0
College graduate	84.1	52.4	16.9	25.3
Marital status				
Married	76.9	42.5	17.8	21.1
Never married	**55.7**	**22.0**	**9.9**	**9.8**
Divorced, separated, or widowed	**63.4**	**26.7**	**11.2**	**11.3**
Age of mother				
19 years or younger	**51.4**	**14.4**	**6.9**	**6.0**
20-29 years	67.3	**30.4**	**13.1**	**14.1**
30 years or older	75.4	43.4	18.0	21.6
Poverty-to-income ratio				
Ratio < 1.00	66.6	**31.8**	**14.1**	15.5
1.00 ≤ ratio < 1.85	68.4	**33.7**	**14.4**	16.4
1.85 ≤ ratio < 3.00	71.6	**37.0**	15.6	18.5
3.00 ≤ ratio	75.1	40.9	17.0	19.2
Recipient of WIC				
Yes	**64.5**	**28.6**	**12.3**	**13.8**
No, but eligible	76.6	45.2	19.1	22.7
No, ineligible	79.8	46.7	19.1	22.5
Resides in WIC experiment state				
No	69.5	**35.5**	**14.9**	16.8
Yes	74.1	**38.8**	16.7	19.8
Region				
Northeast	69.6	**36.3**	15.4	17.8
Midwest	67.3	**33.6**	**14.3**	15.3
South	65.6	**31.8**	**12.8**	**14.7**
West	83.1	46.3	20.9	24.2
Unhealthy environment—IAP area				
First quartile (low)	75.1	41.4	18.1	20.2
Second quartile	72.4	**37.8**	16.2	18.7
Third quartile	69.5	**34.6**	**14.4**	16.7
Fourth quartile (high)	**63.9**	**30.3**	**12.0**	**13.4**
Race/ethnicity				
Non-Hispanic white	72.1	**38.5**	16.2	18.1
Non-Hispanic black	**50.3**	**21.3**	**8.9**	**8.3**
Hispanic	78.7	**39.4**	17.0	20.7
Non-Hispanic other race	70.4	**37.4**	16.9	19.6
First born to mother				
No	70.0	**37.4**	16.1	18.8
Yes	72.3	**34.9**	**14.5**	15.9
Sex of child				
Female	70.9	**37.5**	16.1	18.5
Male	70.9	**35.4**	**14.8**	16.8
Age of child at interview				
19-23 months	71.3	**36.6**	15.3	17.3
24-29 months	71.2	**36.1**	**14.9**	17.3
30-35 months	70.3	**36.7**	16.2	18.3
Total	70.9	**36.4**	15.5	17.7

All breastfeeding outcomes in this table are based on a sample size of 61 218. The results are based on weighted data that are adjusted for the multistage sampling design of the National Immunization Surveys. Bolded percentages indicate at least 10 points below target percent. IAP, Immunization Action Plan; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.

Table 3. Effects of Maternal, Child, and IAP Characteristics on the Odds of Ever Breastfeeding Child, National Immunization Surveys, 2003-2004

Characteristic	*Odds Ratio*	*95% Confidence Intervals*
Maternal characteristics		
Education		
Less than high school	0.36***	0.32-0.41
High school graduate	0.40***	0.36-0.44
Some college	0.61***	0.56-0.67
College graduate[a]	1.00	
Marital status		
Married[a]	1.00	
Never married	0.56***	0.51-0.61
Divorced, separated, or widowed	0.72***	0.66-0.78
Age of mother		
19 years or younger	0.86	0.68-1.08
20-29 years	1.05	0.99-1.11
30 years or older[a]	1.00	
Poverty-to-income ratio		
Ratio < 1.00	0.99	0.90-1.11
1.00 ≤ ratio < 1.85	0.98	0.90-1.12
1.85 ≤ ratio < 3.00	1.01	0.93-1.10
3.00 ≤ ratio[a]	1.00	
Recipient of WIC		
Yes	0.73***	0.66-0.82
No, but eligible	0.96	0.83-1.11
No, ineligible[a]	1.00	
Resides in WIC experiment state		
Yes	0.94	0.82-1.07
No[a]	1.00	
Region		
Northeast[a]	1.00	
Midwest	0.99	0.80-1.23
South	1.00	0.78-1.27
West	2.07***	1.69-2.55
Unhealthy environment—IAP area	0.98*	0.96-0.99
Child characteristics		
Race/ethnicity		
Non-Hispanic white[a]	1.00	
Non-Hispanic black	0.74***	0.64-0.87
Hispanic	2.21***	1.91-2.56
Non-Hispanic other race	0.96	0.85-1.08
First born to mother		
Yes	1.14**	1.06-1.23
No[a]	1.00	
Sex of child		
Male	1.00	0.95-1.05
Female[a]	1.00	
Age of child at interview		
19-23 months[a]	1.00	
24-29 months	0.98	0.90-1.06
30-35 months	0.94	0.87-1.01
Survey characteristics		
Survey respondent		
Mother	1.27***	1.18-1.35
Other adult[a]	1.00	
Year of survey		
2003[a]	1.00	
2004	0.99	0.93-1.05

The sample size is 61 218. The results are based on a logistic regression analysis using weighted data that are adjusted for the multistage sampling design of the National Immunization Surveys. IAP, Immunization Action Plan; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.
[a] Reference category.
*$P < .05$. **$P < .01$. ***$P < .001$.

As noted previously, the IAP measure is a percentage scale with low percentages indicating healthier environments (lower risk to newborns) and higher ends of the scale indicating unhealthy environments (high risk to newborns). The IAP characteristics of the place of residence are associated with breastfeeding. Each percentage increase in unhealthy conditions in an area is associated with a 2% decrease in the odds of ever breastfeeding. Note that this relationship remains significant even after controlling for all maternal, household, and child characteristics in the model.

Table 4 provides the results of a logistic regression model that estimates the association between the maternal, child, and IAP characteristics and the odds of breastfeeding for at least 6 months among children who initiated breastfeeding. The results are similar to those for ever breastfeeding, with a decreased odds of breastfeeding among the following groups: non-Hispanic blacks, whites relative to Hispanics, mothers who did not graduate from college, single mothers, WIC recipients, children residing outside the West, and infants living in areas with unhealthy conditions for children. However, there are also 2 key differences. First, whereas the age of the mother made little difference in the odds of ever breastfeeding, teenage mothers and those in their 20s were less likely than older mothers to breastfeed for 6 months. Second, first-born children had higher odds of ever being breastfed but lower odds than subsequent born children of being breastfed for at least 6 months.

Table 5 provides the results of the model that estimates the odds of exclusive breastfeeding for 6 months among children who initiated breastfeeding. The odds ratios indicate few significant predictors of exclusive breastfeeding. Children of ethnicities other than Hispanic or black have higher odds of exclusive breastfeeding than white children, mothers in their 20s have lower odds of exclusive breastfeeding than mothers in their 30s, recipients of WIC have lower odds of exclusive breastfeeding, and children who reside in the western United States have higher odds of exclusive breastfeeding. There are also lower odds of exclusive breastfeeding for first-born children and male children. As with breastfeeding ever or at least 6 months, the odds of exclusive breastfeeding are lower for infants who live in areas with a high prevalence of unhealthy conditions. Interestingly, children in homes below the poverty level are more likely to be breastfed exclusively compared with higher income children.

The results of the final model that predicts the odds of breastfeeding for 12 months among children who initiated breastfeeding are shown in Table 6. They are

Table 4. Effects of Maternal, Child, and IAP Characteristics on the Odds of Breastfeeding Child at Least 6 Months Among Children Ever Breastfed, National Immunization Survey, 2003-2004

Characteristic	*Odds Ratio*	*95% Confidence Intervals*
Maternal characteristics		
Education		
Less than high school	0.68***	0.58-0.79
High school graduate	0.63***	0.54-0.72
Some college	0.68***	0.63-0.74
College graduate[a]	1.00	
Marital status		
Married[a]	1.00	
Never married	0.77***	0.68-0.86
Divorced, separated, or widowed	0.72***	0.66-0.79
Age of mother		
19 years or younger	0.48***	0.36-0.63
20-29 years	0.80***	0.74-0.88
30 years or older[a]	1.00	
Poverty-to-income ratio		
Ratio < 1.00	1.03	0.91-1.17
1.00 ≤ ratio < 1.85	1.01	0.89-1.15
1.85 ≤ ratio < 3.00	1.04	0.97-1.12
3.00 ≤ ratio[a]	1.00	
Recipient of WIC		
Yes	0.76***	0.70-0.83
No, but eligible	1.07	0.96-1.26
No, ineligible[a]	1.00	
Resides in WIC experiment state		
Yes	0.94	0.86-1.02
No[a]	1.00	
Region		
Northeast[a]	1.00	
Midwest	0.95	0.84-1.06
South	0.95	0.84-1.07
West	1.26***	1.14-1.40
Unhealthy environment—IAP area	0.98*	0.97-0.99
Child characteristics		
Race/ethnicity		
Non-Hispanic white[a]	1.00	
Non-Hispanic black	0.98	0.82-1.18
Hispanic	1.20***	1.08-1.33
Non-Hispanic other race	1.02	0.86-1.20
First born to mother		
Yes	0.82***	0.76-0.90
No[a]	1.00	
Sex of child		
Male	0.89**	0.83-0.95
Female[a]	1.00	
Age of child at interview		
19-23 months[a]	1.00	
24-29 months	0.97	0.89-1.04
30-35 months	1.01	0.95-1.08
Survey characteristics		
Survey respondent		
Mother	0.92*	0.85-0.99
Other adult[a]	1.00	
Year of survey		
2003[a]	1.00	
2004	1.02	0.96-1.08

The sample size is 44 513. The subsample is limited to children who have ever been breastfed. The results are based on a logistic regression analysis using weighted data that are adjusted for the multistage sampling design of the National Immunization Surveys. IAP, Immunization Action Plan; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.

[a] Reference category.

*$P < .05$. **$P < .01$. ***$P < .001$.

Table 5. Effects of Maternal, Child, and IAP Characteristics on the Odds of Breastfeeding Child Exclusively 6 Months Among Children Ever Breastfed, National Immunization Survey, 2003-2004

Characteristic	*Odds Ratio*	*95% Confidence Intervals*
Maternal characteristics		
Education		
Less than high school	1.00	0.86-1.18
High school graduate	0.94	0.84-1.05
Some college	0.86**	0.78-0.95
College graduate[a]	1.00	
Marital status		
Married[a]	1.00	
Never married	0.95	0.85-1.07
Divorced, separated, or widowed	0.82*	0.68-0.99
Age of mother		
19 years or younger	0.72	0.45-1.18
20-29 years	0.90*	0.82-0.97
30 years or older[a]	1.00	
Poverty-to-income ratio		
Ratio < 1.00	1.13*	1.02-1.27
1.00 ≤ ratio < 1.85	1.06	0.89-1.25
1.85 ≤ ratio < 3.00	1.04	0.93-1.18
3.00 ≤ ratio[a]	1.00	
Recipient of WIC		
Yes	0.86*	0.76-0.96
No, but eligible	1.10	0.84-1.23
No, ineligible[a]	1.00	
Resides in WIC experiment state		
Yes	0.96	0.88-1.05
No[a]	1.00	
Region		
Northeast[a]	1.00	
Midwest	0.97	0.83-1.13
South	0.93	0.80-1.08
West	1.20**	1.06-1.36
Unhealthy environment—IAP area	0.98**	0.96-0.99
Child characteristics		
Race/ethnicity		
Non-Hispanic white[a]	1.00	
Non-Hispanic black	1.06	0.90-1.26
Hispanic	1.07	0.92-1.25
Non-Hispanic other race	1.13*	1.02-1.26
First born to mother		
Yes	0.85***	0.78-0.92
No[a]	1.00	
Sex of child		
Male	0.90**	0.84-0.96
Female[a]	1.00	
Age of child at interview		
19-23 months[a]	1.00	
24-29 months	0.97	0.88-1.06
30-35 months	1.10	0.99-1.22
Survey characteristics		
Survey respondent		
Mother	0.75***	0.68-0.82
Other adult[a]	1.00	
Year of survey		
2003[a]	1.00	0.96-1.12
2004	1.04	

The sample size is 44 513. The subsample is limited to children who have ever been breastfed. The results are based on a logistic regression analysis using weighted data that are adjusted for the multistage sampling design of the National Immunization Surveys. IAP, Immunization Action Plan; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.

[a] Reference category.

*$P < .05$. **$P < .01$. ***$P < .001$.

Table 6. Effects of Maternal, Child, and IAP Characteristics on the Odds of Breastfeeding Child at Least 12 Months Among Children Ever Breastfed, National Immunization Surveys, 2003-2004

Characteristic	*Odds Ratio*	*95% Confidence Intervals*
Maternal characteristics		
Education		
Less than high school	0.90	0.75-1.07
High school graduate	0.75***	0.67-0.83
Some college	0.78***	0.70-0.87
College graduate[a]	1.00	
Marital status		
Married[a]	1.00	0.66-0.83
Never married	0.74***	0.54-0.80
Divorced, separated, or widowed	0.66***	
Age		
19 years or younger	0.48***	0.36-0.64
20-29 years	0.81***	0.73-0.89
30 years or older[a]	1.00	
Poverty-to-income ratio		
Ratio < 1.00	1.05	0.88-1.25
1.00 ≤ ratio < 1.85	1.04	0.89-1.21
1.85 ≤ ratio < 3.00	1.13*	1.02-1.24
3.00 ≤ ratio[a]	1.00	
Recipient of WIC		
Yes	0.83***	0.75-0.92
No, but eligible	1.13	0.96-1.34
No, ineligible[a]	1.00	
Resides in WIC experiment state		
Yes	0.99	0.91-1.08
No[a]	1.00	
Region		
Northeast[a]	1.00	
Midwest	0.89	0.78-1.02
South	0.92	0.80-1.07
West	1.21***	1.09-1.34
Unhealthy environment—IAP area	0.98**	0.97-0.99
Child characteristics		
Race/ethnicity		
Non-Hispanic white[a]	1.00	
Non-Hispanic black	0.84*	0.71-0.98
Hispanic	1.27***	1.14-1.43
Non-Hispanic other race	1.15	0.99-1.33
First born to mother		
Yes	0.80***	0.73-0.88
No[a]	1.00	
Sex of child		
Male	0.88**	0.81-0.95
Female[a]	1.00	
Age of child at interview		
19-23 months[a]	1.00	
24-29 months	0.99	0.88-1.12
30-35 months	1.09	0.99-1.19
Survey characteristics		
Survey respondent		
Mother	0.92	0.83-1.01
Other adult[a]	1.00	
Year of survey		
2003	1.00	
2004[a]	1.06	0.99-1.14

The sample size is 44 513. The subsample is limited to children who have ever been breastfed. The results are based on a logistic regression analysis using weighted data that are adjusted for the multistage sampling design of the National Immunization Surveys. IAP, Immunization Action Plan; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.
[a] Reference category.
*$P < .05$. **$P < .01$. ***$P < .001$.

quite similar to the results from Table 4. The odds of breastfeeding for 12 months are lower among mothers who did not graduate from college, single mothers, mothers in their teens and 20s, recipients of WIC, and those living outside the western United States. Infants living in areas with a higher prevalence of risk conditions also have lower odds of being breastfed for at least 12 months. First-born children and male children are less likely to be breastfed to 1 year than other children. Non-Hispanic blacks report lower odds and Hispanics report higher odds of breastfeeding for 12 months relative to whites.

Three consistent findings emerge from the 4 logistic regression models. First, mothers and their children who participate in the WIC program consistently have lower odds of breastfeeding, whether this involves any breastfeeding, for 6 months, for 12 months, or exclusively for 6 months. Second, children who reside in the western United States have higher odds of being breastfed than children residing in the northeastern United States. Third, there is a consistent association between living in an unhealthy environment—as gauged by a high prevalence of teen births, repeat teen births, births to unmarried women, births to mothers with low educational attainment, late or no prenatal care, low birth weight births, and preterm births—and lower odds of breastfeeding. Figure 1 provides the predicted probabilities of ever breastfeeding for children living in low-risk, medium-low-risk, medium-high-risk, and high-risk environments (divided into quartiles). These predicted probabilities are based on the logistic regression analysis in Table 3 and adjust for all of the variables in the model. They show a step function of decreasing probabilities of breastfeeding across the 4 risk categories, thus illustrating how living in a high-risk area is associated with a higher risk of not being breastfed even after adjusting for the effects of a host of individual-level characteristics.

Discussion

Although the initiation of breastfeeding is near the *Healthy People 2010* target of 75%, durations to 6 and 12 months still lag well behind, especially at 6 months. Exclusive breastfeeding rates are also well below the 25% six-month target. The large decline from initiating breastfeeding to breastfeeding to 6 months suggests that many women start, but too few continue. College-educated mothers are the only women currently meeting 3 of the *Healthy People 2010* breastfeeding targets, although exclusive breastfeeding to 6 months is still low among even these mothers. This finding concurs with other research indicating that children with the greatest gains in resources (parental

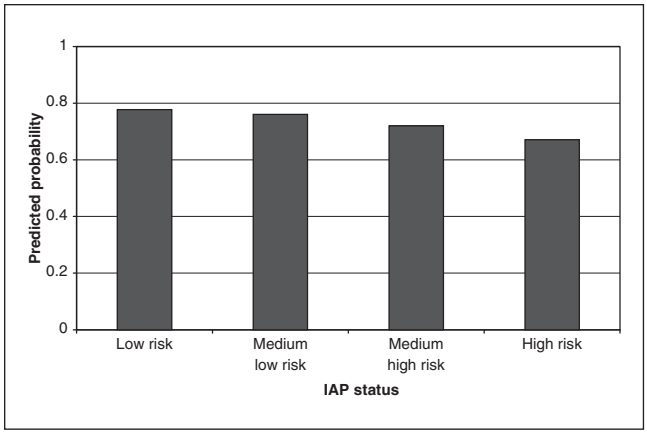

Figure 1. Predicted probabilities of ever breastfeeding, by Immunization Action Plan (IAP) status, National Immunization Surveys, 2003-2004. The IAP status variable is divided into quartiles. The predicted probabilities are based on the logistic regression analysis in Table 3. Hence, they are adjusted for the effects of the other variables listed in the table.

time and money) are those with the most educated parents, whereas children with the fewest gains are concentrated among the least educated parents.[34] Thus, breastfeeding is yet another parental resource separating children in terms of health and economic well-being in the United States.

Government programs such as WIC are important in providing needed nutrition to low-income children, but they are not sufficient to encourage the initiation and continuation of breastfeeding among young, single, less educated mothers.[20] Although mothers in WIC are generally aware of the benefits of breastfeeding, the incentives provided by WIC do not appear sufficient to support continued breastfeeding.[20,35] There may be a selectivity effect in that mothers who have already decided to bottle-feed may choose to apply to WIC to receive free formula. Previous research correcting for self-selection found that prenatal WIC participation, in conjunction with breastfeeding advice and support, increased the initiation of breastfeeding but not the duration.[22] Greater incentives are needed to increase breastfeeding duration among WIC participants. These mothers need greater emotional, social, and possibly financial support to begin and continue breastfeeding over formula feeding.

WIC mothers often face physical and social barriers that deter breastfeeding. These mothers need resources and feasible solutions, rather than interventions that simply reaffirm the importance of breastfeeding.[36] Support from babies' fathers, as well as medical providers, positively influence the breastfeeding intentions of disadvantaged women on WIC.[35] In addition, employment can be an obstacle to breastfeeding for low-income women, particularly if employed full-time.[19,27] Many women are also unprepared for the pain and discomfort experienced during the initial stages of breastfeeding.[37] Being unprepared for the physical challenges may be one explanation for the high initiation rates of breastfeeding but lack of continuation. Studies have found that if women perceive the physical discomfort as temporary, and if they have supportive resources among family members, friends, and health care practitioners, they are more likely to continue breastfeeding beyond the difficult phase.[37]

Interventions by clinicians and other health care workers can make a difference in promoting breastfeeding. Studies indicate that women are more likely to stop breastfeeding if their health care provider recommends formula supplementation or if their clinician does not think his or her opinion matters.[26] In contrast, women receiving breastfeeding counseling from health care providers report more positive experiences with breastfeeding compared with women receiving only routine care.[38] In the end, greater emphasis is needed among clinicians and breastfeeding consultants to increase breastfeeding duration rates, especially among mothers without a college education and those living in high-risk areas, to meet the *Healthy People 2010* targets. The National Breastfeeding Awareness Campaign launched in 2004 by the US Department of Health and Human Services' Office on Women's Health is one example of moving in this direction.

Living in a state that has piloted the USDA National Breastfeeding Promotion Campaign as part of WIC was not associated with breastfeeding initiation or duration in our study, even among analyses of only WIC participants. However, living in an area at high risk for newborns is associated with reduced breastfeeding above and beyond individual-level factors. Based on the *Right Start for America's Newborns* indicators, we conclude that the metropolitan cities and states with the least healthy environments are also the least likely to have mothers who breastfeed. Communities in the top 10% of the worst environments (based on the 7 indicators) are largely in the South (Atlanta, Mississippi, New Orleans, and Memphis), the Southwest (Dallas, El Paso, Houston, Phoenix, Albuquerque), the Midwest (Chicago, Detroit, Cleveland, and Milwaukee), and the Northeast (Baltimore and Philadelphia). Policy makers and health providers should be aware of the newborn risk factors in their area so that

they can target women and high-risk children to more effectively promote and support breastfeeding.

Although these results are not surprising, there are limitations to this study, including the potential for measurement error, that urge caution in interpretation. Measures of breastfeeding initiation and duration are based on recall responses of the adult interviewed. We control for the relationship of the respondent to the child in an effort to reduce this bias, but recall responses are still subject to error. Given that the focal children were 19 to 35 months of age, the recall period in the NIS regarding breastfeeding is a limitation that we acknowledge. In addition, our designations of 6 months and 12 months breastfeeding are based on natural breaks observed in the breastfeeding duration measures rather than specific cutoff points such as 365 days for 12 months. Another limitation of the data is that the IAP areas in many cases are entire states, and thus our healthy environment measure is not a community-level indicator and must be interpreted accordingly. Despite such study limitations, comparisons to other breastfeeding studies increase confidence in our findings. Nevertheless, our results regarding the duration of breastfeeding (see Table 1) are very similar to those reported in the 2002 National Survey of Family Growth.[39] Overall, our findings underscore the importance of maternal and environmental resources in the initiation and continuation of breastfeeding. If mothers who lack resources such as education, marital stability, income, and healthy environments do not receive support to breastfeed, the health and well-being gap between children born to women with resources and those born to disadvantaged mothers will only widen.[34] Particular attention is needed to support breastfeeding among less educated mothers, as well as mothers in high-risk areas, to achieve the proposed *Healthy People 2010* targets.

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Resumen

A través de la utilización de datos de la Encuesta Nacional de Inmunización (2003 & 2004), se formularon los factores que influenciaron al niño, madres y estados o areas metropolitanas en la iniciación, duración y exclusividad de la lactancia materna para determinar las características de grupos de acuerdo a las metas de Healthy People 2010. El análisis indica que solo los hijos de personas con grados universitarios cumplen con las metas de iniciación de lactancia, 6 meses, y 12 meses y ningún grupo cumplió con la meta de lactancia materna exclusiva. Los resultados indican una baja prevalencia de lactancia materna en los hijos de madres solteras; menos educadas; participantes del programa WIC; que viven en estados que nos son del Oeste; y que viven en áreas de alto riesgo para el recién nacido. Los niños hispanos, niños de graduados universitarios, y niños que viven en el Oeste tienen consistentemente índices más altos de lactancia materna. Solo la prevalencia de lactancia materna en el postparto temprano esta cerca de la meta de 75% del Healthy People 2010, los porcentajes de 6 o 12 meses y de lactancia materna exclusiva están bastante bajos.