Factors Associated With Exclusive Breastfeeding in the United States

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WHAT'S KNOWN ON THIS SUBJECT: Exclusive breastfeeding has been established as the optimal feeding practice for infants younger than 6 months; however, the overall prevalence of exclusive breastfeeding remains low in the United States.

WHAT THIS STUDY ADDS: This study examined differences between the factors associated with exclusive breastfeeding and those associated with breastfeeding initiation. The results contribute to our understanding of the associations between race/ethnicity and maternal age and exclusive breastfeeding for 6 months.

abstract

OBJECTIVES: To estimate the proportions of US infants who were breastfed exclusively for 6 months, according to characteristics of the mother, child, and household environment, and to compare associations between those characteristics and exclusive breastfeeding with associations between those characteristics and breastfeeding initiation.

METHODS: Data were obtained from the 2007 National Survey of Children's Health, a nationally representative, cross-sectional survey. Multivariate logistic regression was used to calculate the adjusted odds ratios for breastfeeding among all infants and for breastfeeding exclusively for 6 months among infants who had initiated breastfeeding. All analyses were limited to children aged 6 months through 5 years for whom breastfeeding data were available ($N = 25 197$).

RESULTS: Of the nearly 75% of children in the study who had ever been breastfed, 16.8% had been breastfed exclusively for 6 months. Non-Hispanic black children were significantly less likely to have ever been breastfed compared with their non-Hispanic white counterparts (adjusted odds ratio: 0.54 [95% confidence interval: $0.44 - 0.66$]). However, no significant differences in the odds of exclusive breastfeeding according to race were observed. Children with birth weights of <1500 g were most likely to have ever been breastfed and least likely to have been breastfed exclusively. Maternal age was significantly associated with exclusive breastfeeding; however, maternal age was not associated with breastfeeding initiation.

CONCLUSIONS: In the United States, the prevalence of exclusive breastfeeding for 6 months remains low among those who initiate breastfeeding. Factors associated with breastfeeding exclusively for 6 months differ from those associated with breastfeeding initiation. *Pediatrics* 2011;128:1117–1125

Exclusive breastfeeding for the first 6 months of life has been recommended by numerous health and professional medical organizations,[1–4] including the American Academy of Pediatrics (AAP) Section on Breastfeeding, "for all infants in whom breastfeeding is not specifically contraindicated."[1] Previous research established the benefits of breastfeeding for both mothers and children,[5] and exclusive breastfeeding has been associated with greater reductions in infants' risks for specific negative health outcomes, including gastrointestinal and respiratory infections.[6] Results of a recent cost analysis indicated that if 90% of US newborns were breastfed exclusively for their first 6 months then direct medical costs could be reduced by $2.2 billion per year.[7]

The value of promoting exclusive breastfeeding has been recognized by the US Department of Health and Human Services and has been incorporated into national health policy. In 2007, an objective to have ≥17% of US newborns breastfeed exclusively for 6 months was added to Healthy People 2010, a 10-year plan for health promotion and disease prevention.[8] According to recent estimates from the National Immunization Survey, only 14.1% of children who were born in 2006 were exclusively breastfed for 6 months.[9] In Healthy People 2020, the prevalence target for 6-month exclusive breastfeeding was increased to 25.5% and the prevalence target for overall breastfeeding initiation was set at 81.9%.[10]

Previous estimates of the prevalence of exclusive breastfeeding for 6 months, derived from national survey data, showed disparities according to race, family income, population density of the area of residence, and the mother's age, education level, marital status, and BMI.[11,12] To our knowledge, nationally representative survey data have not been used to assess whether other characteristics found to be associated with breastfeeding initiation, such as the mother's emotional and mental health and nativity/immigrant status, the presence of a tobacco smoker in the home, and family structure, also are associated with exclusive breastfeeding.[13,14]

The 2007 National Survey of Children's Health (NSCH) allows for analyses of the prevalence of exclusive breastfeeding according to these previously unexplored characteristics. In this study, we assessed the extent to which these characteristics were associated with exclusive breastfeeding for 6 months and investigated how these associations differed from associations between the same characteristics and breastfeeding initiation.

## METHODS

Data Source and Analytic Variables

Data for this cross-sectional study were obtained from the 2007 NSCH. The NSCH is a random-digit-dial telephone survey designed and funded by the Health Resources and Services Administration, Maternal and Child Health Bureau, and conducted by the Centers for Disease Control and Prevention, National Center for Health Statistics (NCHS). The 2007 NSCH, which was conducted in all 50 states and the District of Columbia, was designed to produce national and state-level prevalence estimates of various aspects of children's physical, emotional, and mental health, as well as to provide data on children's family structure and demographic characteristics. The survey respondent for each interview was a parent or guardian familiar with the child's health. For homes in which multiple children resided, 1 child was selected randomly to be the subject of the interview. Informed consent was obtained from all respondents. A total of 91 642 interviews were conducted between April 2007 and July 2008 (interview completion rate:

66.0%). More details of the survey's methods and response rates can be found elsewhere.[15]

We limited our analyses to data for children who were aged 6 months through 5 years at the time of the interview and for whom breastfeeding data were available ($N = 25 197$). The selection of this study population is shown in Fig 1. Because we wanted to assess associations with exclusive breastfeeding for 6 months, independent of associations with breastfeeding initiation, we limited our analyses of exclusive breastfeeding to children who had been breastfed initially.

Of all interviews concerning children in this age range, 75.1% were conducted with the child's mother (biological, step, or adoptive), 19.4% were with the child's father, and 5.5% were with another guardian. Children were classified as breastfed if the parent responded positively to the question, "Was [child's name] ever breastfed or fed breast milk?" Those who indicated that initiation had occurred then were asked a series of questions to determine the duration of breastfeeding exclusivity. The specific wording of these questions is identical to that of the questions used in the 2011 National Immunization Survey[16,17] and can be found in Table 1. We classified a child as being exclusively breastfed for 6 months if the parent or guardian reported that the child was breastfed for the first 180 days of life and was introduced to no other foods or liquids, including water, during that period.

In our analyses, we assessed the relationships between the recommended breastfeeding behaviors and sociodemographic and behavioral health factors shown previously to be associated with breastfeeding initiation, that is, mother's age at the time of birth,[12] mother's education level,[12] mother's nativity/immigrant status,[13] mother's mental and emotional health status,[13]
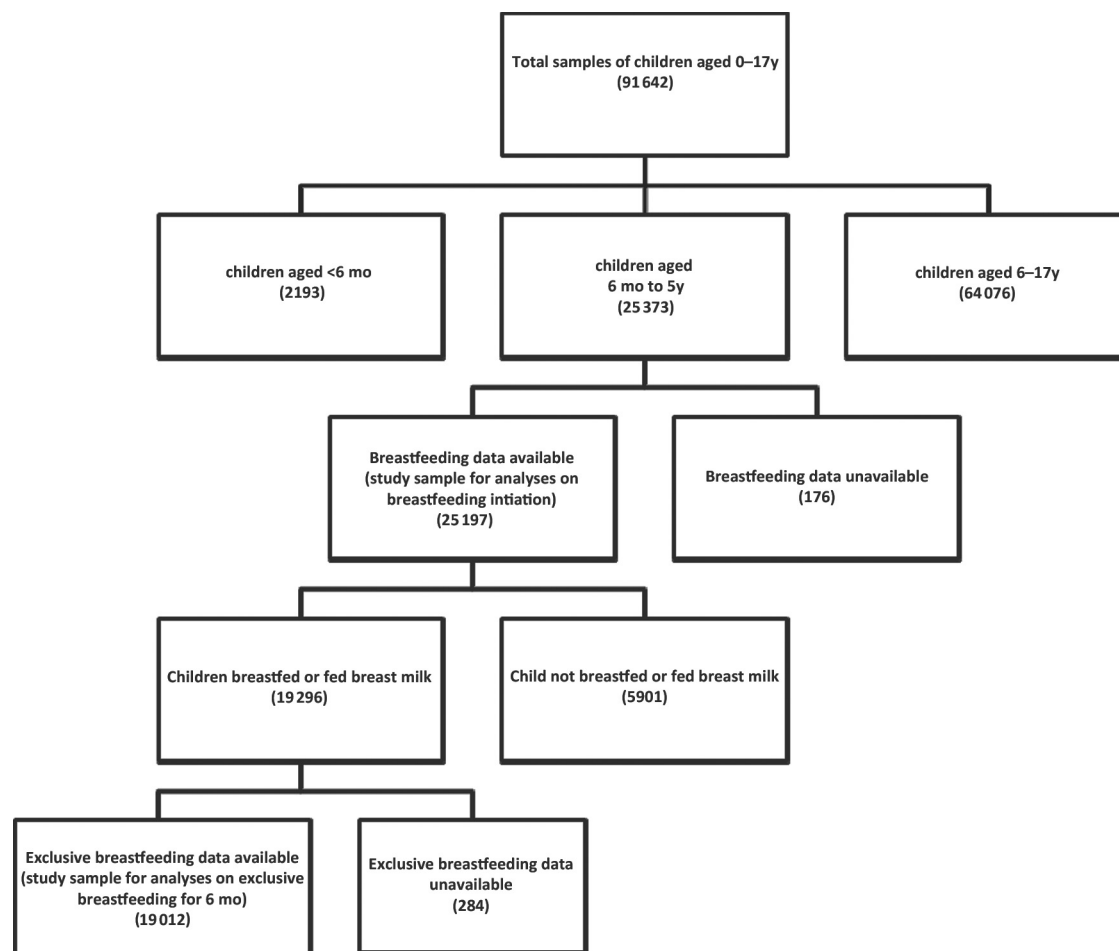
FIGURE 1
Flow diagram of study populations for analyses of breastfeeding initiation and exclusive breastfeeding for 6 months.

TABLE 1 Questions Used in the 2007 NSCH to Determine Breastfeeding Initiation and Duration of Exclusive Breastfeeding

Was [child's name] ever breastfed or fed breast milk?
How old was [child's name] when [he/she] completely stopped breastfeeding or being fed breast milk?
How old was [child's name] when [he/she] was first fed formula?
This next question is about the first thing that [child's name] was given other than breast milk or formula. Please include juice, cow's milk, sugar water, baby food, or anything else that [child's name] might have been given, even water. How old was [child's name] when [he/she] was first fed anything other than breast milk or formula?

child's race/ethnicity,[13,18] child's birth weight,[19,20] family structure,[13] household poverty status,[12,13] whether a tobacco smoker resided in the home,[13,20] and population density of the area of residence.[13] We did not include primary language spoken at home as a factor in our analyses because of its strong correlation with mother's nativity status.

Statistical Analyses

The χ^2 test of independence was used to assess the statistical significance of the bivariate associations with missing or unknown observations excluded, to ensure that significant variation existed among the known response categories. Factors that were significantly associated ($P < .05$)

with breastfeeding initiation in these bivariate analyses were then used in logistic regression models to estimate unadjusted and adjusted associations of each covariate with the likelihoods of breastfeeding and of breastfeeding exclusively for 6 months. Although we included "missing or unknown" as a separate category in the multivariate analyses for mother's age, education level, nativity status, and mental and emotional health status, results for this category are not shown. These questions were asked only when the mother currently resided in the home; therefore, exclusion of missing or unknown responses for these variables in the regression models would have reduced the effective sample size for analyses significantly and would have

TABLE 2 Demographic Characteristics of Study Population in the 2007 NSCH ($N = 25\,197$)

	Unweighted Sample Size, n	Weighted Proportion of Sample, Estimate SE, %
Mother's age		
≤20 y	1661	7.3 (0.4)
21–29 y	9900	42.0 (0.8)
≥30 y	12 289	45.7 (0.8)
Unknown	1347	5.0 (0.3)
Mother's education		
Less than high school	2048	11.8 (0.6)
High school graduate	4100	22.6 (0.7)
More than high school	17 783	60.4 (0.8)
Unknown	1266	5.2 (0.4)
Mother's nativity		
United States-born	20 354	75.0 (0.8)
Foreign-born	3606	20.1 (0.8)
Unknown	1237	4.9 (0.4)
Mother's mental/emotional health		
Excellent	9222	33.3 (0.7)
Very good	9331	35.7 (0.8)
Good	4343	20.5 (0.7)
Fair/poor	1156	6.0 (0.4)
Unknown	1145	4.5 (0.3)
Child's race/ethnicity		
Non-Hispanic white	16 178	54.8 (0.8)
Hispanic	3775	22.3 (0.8)
Non-Hispanic black	2209	12.5 (0.5)
Non-Hispanic multiracial	1405	5.3 (0.4)
Non-Hispanic other	1231	5.1 (0.4)
Child's birth weight		
<1500 g	351	1.5 (0.3)
1500–2499 g	1791	7.9 (0.5)
≥2500 g	22 424	88.0 (0.6)
Unknown	631	2.6 (0.2)
Family structure		
2-parent family (biological/adoptive)	20 120	77.8 (0.7)
2-parent family (step)	442	2.6 (0.3)
Single mother	3496	16.1 (0.6)
Other	1003	3.5 (0.3)
Household poverty status		
<100% of FPL	3573	20.7 (0.7)
100%–199% of FPL	4542	22.5 (0.8)
200%–399% of FPL	8165	28.7 (0.7)
≥400% of FPL	8916	28.2 (0.7)
Smoker in household		
No	19 277	74.4 (0.7)
Yes	5749	25.6 (0.7)
Place of residence		
Within metropolitan area	17 768	83.9 (0.5)
Outside metropolitan area	7429	16.1 (0.5)

FPL indicates federal poverty level.

decreased the generalizability of the results.

We imputed the household poverty level by using a multiple-imputation technique designed by the NCHS to account for missing data on household income and household size. This technique involves 5 imputed data sets, which are used in 5 separate analyses, combined by following standard multiple-imputation rules, and then merged with the public use analysis files by using an unique household identifier.[15] Data on place of residence were imputed for subjects with suppressed residence data by using a method described previously by Singh et al,[21] in which subjects from largely metropolitan states are classified as urban and those from predominantly nonmetropolitan states are classified as rural. All statistical analyses were conducted by using SUDAAN software (Research Triangle Institute, Research Triangle Park, NC), to account for the complex sampling design of the NSCH. Statistical significance was set at $P < .05$.

RESULTS

Demographic characteristics of the study population are presented in Table 2. We found that approximately three-fourths of children aged 6 months through 5 years were breastfed or fed breast milk at least once (Table 3). The rates of breastfeeding initiation were highest for children born to mothers who were 30 years of age or older, who had more than a high school education, and whose annual household income was ≥400% of the federal poverty level (Table 3). Rates of breastfeeding initiation were significantly higher among Hispanic children (81.8%) and lower among non-Hispanic black children (55.5%) than among non-Hispanic white children (76.2%). In addition, a higher prevalence of breastfeeding initiation was observed among subjects who reported positive maternal mental and emotional health. A significantly smaller proportion (72.6%) of children of United States-born mothers were breastfed, compared with children of foreign-born mothers (89.6%). Children living in 2-parent biological or adoptive families were more likely to have been breastfed (80.4%), compared with children in other types of households. Children with a very low birth weight (VLBW) (<1500 g) were most likely to have been breastfed, and those with a moderately low birth weight (MLBW) (1500 to <2500 g) were least likely to have been breastfed.

TABLE 3 Percentage of US Children Aged 6 Months to 5 Years Who Were Ever Breastfed and Were Breastfed Exclusively for 6 Months in 2007 NSCH

	Ever Breastfed		Breastfed Exclusively for 6 mo (Among Breastfed)	
	Estimate SE, %	P	Estimate SE, %	P
United States	74.9 (0.7)		16.8 (0.7)	
Mother's age		<.001		<.001
≤20 y	56.7 (2.6)		8.3 (1.1)	
21–29 y	76.0 (1.0)		16.3 (1.2)	
≥30 y	79.2 (0.9)		18.0 (1.0)	
Mother's education		<.001		.06
Less than high school	66.0 (2.5)		15.9 (2.6)	
High school graduate	67.4 (1.6)		13.8 (1.6)	
More than high school	81.3 (0.7)		17.9 (0.9)	
Mother's nativity		<.001		.46
United States-born	72.6 (0.8)		16.5 (0.8)	
Foreign-born	89.6 (1.0)		18.0 (1.8)	
Mother's mental/emotional health		.03		<.001
Excellent	77.7 (1.0)		18.8 (1.1)	
Very good	76.5 (1.1)		17.2 (1.2)	
Good	75.1 (1.5)		14.5 (1.7)	
Fair/poor	68.8 (3.0)		9.7 (2.3)	
Child's race/ethnicity		<.001		.54
Non-Hispanic white	76.2 (0.8)		18.0 (0.9)	
Hispanic	81.8 (1.6)		15.4 (1.8)	
Non-Hispanic black	55.5 (2.0)		15.3 (2.2)	
Non-Hispanic multiracial	72.6 (3.5)		15.7 (2.9)	
Non-Hispanic other	81.2 (2.3)		16.0 (2.7)	
Child's birth weight		.01		.02
<1500 g	85.3 (3.3)		6.7 (2.0)	
1500–2499 g	70.5 (2.3)		15.7 (3.3)	
≥2500 g	75.8 (0.7)		17.0 (0.7)	
Family structure		<.001		<.001
2-parent family (biological/adoptive)	80.4 (0.7)		17.8 (0.8)	
2-parent family (step)	57.1 (5.7)		5.9 (2.1)	
Single mother	59.5 (1.8)		12.6 (1.6)	
Other	39.4 (4.0)		17.7 (3.9)	
Household poverty status		<.001		.43
<100% of FPL	64.1 (1.8)		16.8 (2.1)	
100%–199% of FPL	72.3 (1.6)		14.8 (1.5)	
200%–399% of FPL	76.8 (1.1)		17.1 (1.1)	
≥400% of FPL	82.9 (1.0)		18.0 (1.3)	
Smoker in household		<.001		<.001
No	79.1 (0.7)		17.9 (0.8)	
Yes	62.7 (1.5)		12.9 (1.4)	
Place of residence		<.001		.35
Within metropolitan area	76.3 (0.7)		17.0 (0.8)	
Outside metropolitan area	67.7 (1.3)		15.7 (1.2)	

FPL indicates federal poverty level.

Exclusive breastfeeding for ≥6 months was reported for 16.8% of children who were ever breastfed, which corresponds to 12.6% of all children (data not shown). Higher rates of exclusivity were observed among children whose mothers were 30 years of age or older, reported positive maternal emotional and mental health, and lived in a home where a tobacco smoker was not present. Children with birth weights of ≥2500 g were most likely to have been exclusively breastfed, whereas only 15.7% of MLBW infants and 6.7% of VLBW infants were exclusively breastfed for 6 months. Children in 2-parent families (biological or adoptive) were most likely to have been exclusively breastfed, compared with children in any other family structure.

Adjusted analyses indicated that the mother's education level and nativity status were significantly associated with breastfeeding initiation with adjustment for all other covariates of interest (Table 4). In addition, they showed that the likelihood of being breastfed was significantly lower among non-Hispanic black children than among non-Hispanic white children (adjusted odds ratio [OR]: 0.54 [95% confidence interval [CI]: 0.44–0.66]). VLBW children were more likely than children born with normal or above-normal weights to have been breastfed (adjusted OR: 1.88 [95% CI: 1.19–2.95]). However, a significant difference in adjusted odds was not observed for MLBW children (adjusted OR: 0.89 [95% CI: 0.71–1.11]), compared with children who weighed ≥2500 g at birth. Children who lived in a home with a smoker were significantly less likely to have been breastfed, compared with children who did not (adjusted OR: 0.66 [95% CI: 0.56–0.78]).

Exclusive breastfeeding was significantly associated with maternal age in the adjusted analysis. Children born to mothers 20 years of age or younger were approximately one-half as likely to have been exclusively breastfed, compared with children born to mothers 30 years of age or older (adjusted OR: 0.53 [95% CI: 0.36–0.76]) (Table 4). The association of VLBW with exclusive breastfeeding differed from its association with breastfeeding initiation. With controlling for other covariates, children born VLBW were less likely to have been breastfed exclusively than were children born weighing ≥2500 g (adjusted OR: 0.38 [95% CI: 0.20–0.73]). Children born to mothers who reported fair or poor mental and emotional health were significantly less likely to have been exclusively breastfed than were children whose mothers who reported excellent mental and

TABLE 4 Unadjusted and Adjusted Odds of Being Ever Breastfed and of Being Breastfed Exclusively for 6 Months Among Children Aged 6 Months to 5 Years in the 2007 NSCH

	Ever Breastfed		Breastfed Exclusively (Among Breastfed)	
	OR (95% CI)	Adjusted OR (95% CI)[a]	OR (95% CI)	Adjusted OR (95% CI)[a]
Mother's age				
≤20 y	0.34 (0.27–0.43)	0.86 (0.50–1.47)	0.41 (0.30–0.57)	0.53 (0.36–0.76)
21–29 y	0.83 (0.71–0.97)	0.88 (0.65–1.18)	0.89 (0.72–1.10)	0.94 (0.77–1.17)
≥30 y	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
Mother's education				
Less than high school	0.45 (0.35–0.56)	0.37 (0.28–0.49)	0.87 (0.59–1.28)	0.91 (0.55–1.52)
High school graduate	0.47 (0.40–0.56)	0.55 (0.45–0.68)	0.73 (0.55–0.97)	0.81 (0.59–1.12)
More than high school	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
Mother's nativity				
United States-born	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
Foreign-born	3.25 (2.59–4.07)	3.89 (2.88–5.27)	1.11 (0.85–1.45)	1.29 (0.94–1.75)
Mother's mental/emotional health				
Excellent	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
Very good	0.94 (0.79–1.10)	1.01 (0.85–1.20)	0.90 (0.72–1.12)	0.91 (0.73–1.13)
Good	0.87 (0.72–1.05)	1.07 (0.87–1.31)	0.73 (0.54–0.99)	0.77 (0.57–1.04)
Fair/poor	0.64 (0.47–0.85)	1.10 (0.81–1.49)	0.47 (0.28–0.78)	0.53 (0.31–0.92)
Child's race/ethnicity				
Non-Hispanic white	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
Hispanic	1.40 (1.13–1.75)	1.21 (0.90–1.63)	0.83 (0.62–1.11)	0.75 (0.54–1.04)
Non-Hispanic black	0.39 (0.33–0.47)	0.54 (0.44–0.66)	0.82 (0.58–1.17)	0.89 (0.63–1.26)
Non-Hispanic multiracial	0.83 (0.58–1.19)	1.12 (0.74–1.69)	0.85 (0.55–1.32)	0.88 (0.55–1.39)
Non-Hispanic other	1.35 (0.99–1.84)	0.74 (0.51–1.06)	0.86 (0.58–1.30)	0.76 (0.46–1.25)
Child's birth weight				
<1500 g	1.85 (1.10–3.10)	1.88 (1.19–2.95)	0.35 (0.18–0.67)	0.38 (0.20–0.73)
1500–2499 g	0.76 (0.61–0.96)	0.89 (0.71–1.11)	0.91 (0.55–1.50)	0.95 (0.57–1.59)
≥2500 g	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
Family structure				
2-parent family (biological/adoptive)	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
2-parent family (step)	0.32 (0.20–0.51)	0.55 (0.34–0.89)	0.29 (0.14–0.61)	0.43 (0.20–0.93)
Single mother	0.36 (0.30–0.43)	0.64 (0.52–0.79)	0.67 (0.49–0.90)	0.74 (0.53–1.04)
Other	0.16 (0.11–0.22)	0.37 (0.11–1.24)	0.99 (0.58–1.71)	0.98 (0.41–2.36)
Household poverty status				
<100% of FPL	0.37 (0.30–0.45)	0.61 (0.47–0.81)	0.92 (0.65–1.30)	1.44 (0.97–2.14)
100%–199% of FPL	0.54 (0.44–0.66)	0.83 (0.65–1.06)	0.79 (0.59–1.05)	1.08 (0.80–1.45)
200%–399% of FPL	0.68 (0.57–0.82)	0.85 (0.70–1.02)	0.94 (0.75–1.19)	1.06 (0.83–1.35)
≥400% of FPL	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
Smoker in household				
No	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
Yes	0.44 (0.38–0.51)	0.66 (0.56–0.78)	0.68 (0.52–0.88)	0.77 (0.59–1.02)
Place of residence				
Within metropolitan area	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
Outside metropolitan area	0.65 (0.57–0.75)	0.86 (0.73–1.01)	0.91 (0.74–1.11)	0.95 (0.77–1.18)

FPL indicates federal poverty level.

[a] Adjusted for all other variables in the table.

emotional health (adjusted OR: 0.53 [95% CI: 0.31–0.92]). Some differences in the likelihood of exclusive breastfeeding according to family structure were observed. Children living in families with a stepparent were less likely to have been exclusively breastfed, compared with children living in other 2-parent families (adjusted OR: 0.43 [95% CI: 0.20–0.93]).

DISCUSSION

Our results showed that, although nearly 75% of US children were breastfed, the vast majority were not breastfed exclusively for 6 months. Consistent with previous research on racial disparities in breastfeeding outcomes,[13,14,22] we found that non-Hispanic black women were less likely than non-Hispanic white women to initiate breastfeeding. This disparity in breastfeeding initiation may result in part from increased comfort with formula feeding among black women, compared with nonblack women,[23] and this initial acceptance of formula feeding is an important consideration for the promotion of both breastfeeding initiation and exclusive breastfeeding for 6 months. However, the results of

our analyses among children who had ever been breastfed, which showed no significant association between race and the likelihood of having been breastfed exclusively for 6 months, suggested that the difference in rates of exclusive breastfeeding between black and white infants was primarily the result of lower rates of breastfeeding initiation among black infants.

Our results also indicated that although VLBW was associated with an increased likelihood of being breastfed, it also was associated with a decreased likelihood of being breastfed exclusively, compared with normal or above-normal birth weight. We speculate that the greater likelihood of breastfeeding initiation among VLBW children may be attributable in part to their spending time in a NICU, because, with adjustment for gestational age, preterm infants who were admitted to a NICU were found to be more likely to have been breastfed than were preterm infants who were not admitted.[24] Results from another study found that nearly one-half of all preterm infants were fed breast milk at their first enteral feeding, regardless of their birth weight categories,[25] which illustrates a tendency in the NICU to provide breast milk over other food options when possible. Despite high rates of breastfeeding initiation, unique challenges in achieving exclusive breastfeeding exist for VLBW infants. Fortification of expressed breast milk with vitamins and minerals is indicated for some VLBW infants[1,26] and is not a violation of exclusive breastfeeding. However, it is not known how parents might report this fortification. In addition, prolonged hospitalizations, medical complications, and the mothers' potential for stress-induced insufficiency of milk production might reduce the likelihood that VLBW infants would be breastfed exclusively for 6 months.[27] Interventions to increase

breastfeeding initiation within NICUs have proven effective,[19] and it is likely that efforts to address the challenges of continued breastfeeding despite prolonged separation between mothers' and their hospitalized infants would increase the proportions of VLBW and MLBW infants who are breastfed exclusively or are breastfed with the indicated supplementation for ≥6 months.

We found maternal mental and emotional health to be significantly associated with exclusive breastfeeding for 6 months but not associated with breastfeeding initiation. In a previous study, postpartum depression was shown to increase the odds of early breastfeeding cessation[28]; however, early recognition of depressive symptoms and provision of appropriate treatment have been shown to reduce the risk of adverse maternal health outcomes[29] and to increase the likelihood that affected mothers will continue breastfeeding.[30] In addition to the necessary treatment by a physician, other sources of emotional and mental support can help counteract mothers' feelings of frustration and isolation and increase the likelihood that they will continue to breastfeed. For example, telephone-based peer support was shown to increase the duration of breastfeeding among all women who received it[31] and to increase rates of exclusive breastfeeding among adolescents.[32]

Our adjusted findings showing that the mother's age was strongly associated with the likelihood of breastfeeding exclusively for 6 months is of particular relevance to pediatricians. Results of the Periodic Survey of Fellows conducted by the AAP showed that pediatricians in 2004 were >5 times as likely as pediatricians in 1995 to recommend that a mother of a term infant not breastfeed or discontinue breastfeeding if the mother was considered

"too young or immature."[33] Although our results did not show a significant relationship between breastfeeding initiation and the mother's age, it might be concluded logically that an ongoing lack of breastfeeding support for younger mothers would have a greater influence on their likelihood of breastfeeding exclusively for 6 months than on their likelihood of initiating breastfeeding. Improvements in this area can be made, as Feldman-Winter et al[34] found that rates of 6-month exclusive breastfeeding increased significantly at institutions that implemented the AAP breastfeeding residency curriculum.

A main study limitation was our reliance on parental reports of breastfeeding behaviors. Although mothers' recall of breastfeeding initiation and duration has been found to be reliable and valid when investigated within 3 years after the practice,[35] our study included children through 5 years of age. Measuring breastfeeding exclusivity presents unique challenges, as Li et al[35] found that the validity and reliability of mothers' recall of introducing foods and fluids other than breast milk were less satisfactory than those for other breastfeeding behaviors. Furthermore, our study was limited in that the data were collected by using a landline-based telephone survey. Noncoverage of households without landlines might have biased our results by excluding families who use cell phones exclusively. However, sampling weights provided by the NCHS are adjusted to match sociodemographic population estimates from the Census Bureau. This adjustment reduces the likelihood of coverage bias.[36]

It is important to note that some factors, such as mother's education level, mother's mental and emotional health status, and household income at the time of the survey, might not reflect accurately the conditions of

the child's infancy. Other limitations included our use of breastfeeding data collected from survey respondents other than the biological mothers of the study subjects and the lack of detailed data on maternal employment. Early breastfeeding cessation has been associated with decreased maternity leave,[37] and employment-related challenges to breastfeeding may be more pronounced among younger mothers who lack job control, paid maternity leave, and the financial resources necessary to make use of the Family Medical Leave Act, which does not provide for paid leave.

CONCLUSIONS

Despite a substantial increase in the national rate of breastfeeding initiation over the past 25 years, we found that few US children are breastfed exclusively for the first 6 months of their lives. The determinants of exclusive breastfeeding for 6 months differ somewhat from those of breastfeeding initiation; therefore, significant differences in breastfeeding initiation rates according to sociodemographic factors do not necessarily result in differences in rates of exclusive breastfeeding. Younger mothers, mothers with poor mental or emotional health, and mothers of VLBW infants are the least likely to breastfed exclusively; however, population-wide promotion of exclusive breastfeeding will be necessary to achieve national Healthy People 2020 targets.

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BLACK DEATH: *The Black Plague. The Black Death. These are but two terms for the great pandemic that swept through Europe in the mid-14th century. After arriving in Italy in late 1347, the plague spread rapidly across the continent. Within five years, between one-third and one-half of Western Europe's populations had succumbed to the disease. For some time, scientists assumed that* Yersinia pestis *was the etiologic agent of the Black Death. However, because the signs and symptoms of* Y. pestis *seem different now than historical records of the Black Plague, some questioned this assumption. As reported in* The New York Times *(Science: October 12, 2011), any remaining doubts about the relationship between* Y. pestis *and the Black Death were put to rest last year after the identification of* Y. pestis *DNA in plague victims from across Europe. Researchers, however, were still perplexed by the virulence of the organism in 14th century Europe. To better understand how the organism killed so many people and so quickly, researchers isolated and sequenced the entire genome of* Y. pestis *from the teeth of four plague victims who died in London in 1348. The genome was then compared to that of modern strains. Little difference was detected between the ancient and modern strains. Of the 4.6 million DNA base pairs found in* Y. pestis'*s single chromosome, only 97 are different between the two. Moreover, only a dozen or so changes occur in genes coding for structural properties. While scientists plan to recreate and study the 1348 organism, so far the genetic analysis suggests that other factors played a large role in the mortality associated with the Black Plague. At the time the plague arrived, malnutrition was endemic. The weather had cooled and become much wetter, crop failures were common, food was scarce and the Hundred Years War had begun in 1337. All of these factors contributed to a highly susceptible population. While recovering fragments of microbial DNA cannot reveal everything about an organism, the exact order of base pairs plays an important role in determining virulence. This type of investigation opens the door into exploration of other epidemics and a better understanding between host-parasite relationships. Sequencing an ancient microbe is quite an amazing feat.*

Noted by WVR, MD