

Prevalence of Exclusive Breastfeeding Among US Infants: The Third National Health and Nutrition Examination Survey (Phase II, 1991–1994)

Ruwei Li, MD, PhD, Cynthia Ogden, PhD, Carol Ballew, PhD, Cathleen Gillespie, BSc, and Laurence Grummer-Strawn, PhD

Because of the recognized benefits of exclusive breastfeeding,^{1–7} the American Academy of Pediatrics and the World Health Organization strongly encourage exclusive breastfeeding for the first 6 months of life.^{7,8} Unfortunately, national goals for exclusive breastfeeding in the United States are not yet established, at least in part because of a lack of data.

The Third National Health and Nutrition Examination Survey (NHANES III) sample is nationally representative and particularly valuable in providing data on exclusive breastfeeding. We used NHANES III data to examine the prevalence of exclusive breastfeeding among US infants to obtain baseline data for program evaluation and public health policymaking.

METHODS

NHANES, a series of cross-sectional surveys conducted by the National Center for Health Statistics (NCHS), is designed to produce nationally representative data on the civilian, noninstitutionalized US population. Details on the study's design and methods are described elsewhere.⁹ NHANES III, conducted between 1988 and 1994 in participants aged 2 months and older, was divided into phases I (1988–1991) and II (1991–1994). Surveys from phases I and II included questions regarding initiation and duration of breastfeeding, whereas only the phase II survey included a question on supplements to breast milk.

NCHS collected the breastfeeding data by means of a household youth questionnaire during a home interview with a parent or other proxy respondent for the child. The current study included only children younger than 6 years. We estimated the proportion of children *ever breastfed* from the question, "Was _____ ever breastfed or fed breastmilk?"; the proportion *exclusively breastfed* at a given age from "How old was _____ when _____ was first fed something other than breastmilk or water, including formula, juice, or solid foods?"; and the proportion *still breastfed* at a given age from "How old was _____ when _____ completely stopped breastfeeding or being fed breastmilk?"

The sociodemographic and environmental factors that we considered in this analysis were those identified in previous studies as important predictors of breastfeeding behaviors.^{10,11} NHANES III classified the race and ethnicity of respondents as non-Hispanic White, non-Hispanic Black, Mexican American, or other. The survey defined maternal age as that of the mother at the baby's birth. Education of household head was represented by the highest grade the family reference person completed. Smoking status referred to whether the mother smoked during pregnancy. We used self-reported maternal height and weight at the time of the household interview to calculate body mass index (BMI; weight in kg/height in m²), which was categorized as normal weight (BMI < 25), overweight (BMI = 25.0–29.9), and obese (BMI ≥ 30).¹²

NHANES III did not collect data on gestational age, maternal education, or parity, but

TABLE 1—Proportion of Children Exclusively Breastfed (BF), by Sociodemographic and Environmental Factors: NHANES III (Phase II, 1991–1994)

Characteristic	Exclusively BF at 7 Days		Exclusively BF at 2 mo		Exclusively BF at 4 mo		Exclusively BF at 6 mo	
	n	Weighted % (SE)	n	Weighted % (SE)	n	Weighted % (SE)	n	Weighted % (SE)
All infants	3836	47.4 (2.7)	3836	32.2 (2.4)	3651	19.4 (1.4)	3463	9.5 (1.3)
Male infants	1928	48.8 (3.5)	1928	32.8 (3.4)	1836	19.2 (1.6)	1732	9.3 (1.3)
Female infants	1908	46.0 (2.4)	1908	31.6 (2.0)	1815	19.7 (1.7)	1731	9.6 (1.8)
Birthweight								
< 2500 g	324	25.8 (3.7)	324	17.5 (3.9)	307	13.2 (3.9)	297	7.3 (3.8)
Normal	3498	49.4 (2.9)	3498	33.5 (2.6)	3330	20.0 (1.5)	3152	9.7 (1.4)
Maturity								
Premature	304	28.4 (5.1)	304	14.7 (3.2)	291	5.2 (1.7)	282	2.7 (1.4)
Full term	2475	47.4 (3.3)	2475	31.9 (3.0)	2349	19.9 (1.8)	2221	9.6 (1.8)
Child race/ethnicity								
Non-Hispanic White	1398	55.0 (3.3)	1398	36.2 (3.2)	1290	22.3 (1.8)	1178	10.9 (1.7)
Non-Hispanic Black	1047	22.8 (2.1)	1047	16.2 (1.7)	1020	8.6 (1.5)	993	4.2 (0.9)
Mexican American	1112	47.7 (2.5)	1112	36.4 (2.1)	1081	21.4 (1.4)	1055	7.1 (0.9)
Other	279	42.6 (5.6)	279	30.5 (5.8)	260	18.2 (4.9)	237	11.5 (4.2)
Maternal age, y								
< 20	577	28.6 (3.4)	577	21.0 (3.0)	553	9.4 (2.3)	535	4.1 (1.4)
20–24	1105	37.5 (2.6)	1105	25.1 (2.7)	1059	12.6 (1.6)	993	5.1 (1.3)
25–29	1118	52.0 (2.7)	1118	32.6 (2.6)	1058	18.9 (1.5)	1009	8.1 (1.3)
≥ 30	1026	58.4 (4.1)	1026	42.0 (3.7)	971	29.3 (2.6)	916	16.3 (2.5)
Maternal education								
Less than high school	887	29.5 (3.6)	887	21.9 (3.2)	844	11.8 (2.9)	815	5.7 (2.6)
High school	1111	38.1 (2.6)	1111	24.9 (2.5)	1048	12.9 (1.7)	982	4.5 (0.6)
Some college	543	55.5 (4.1)	543	34.2 (4.2)	510	24.5 (3.4)	473	12.4 (2.9)
College graduate	157	72.6 (5.8)	157	53.6 (7.7)	147	38.0 (5.1)	132	19.5 (6.6)
Household head education								
Less than high school	1296	29.8 (3.4)	1296	24.5 (3.6)	1256	13.6 (2.8)	1212	7.1 (2.8)
High school	1302	39.2 (3.0)	1302	24.2 (2.5)	1228	11.6 (1.8)	1158	5.4 (1.5)
Some college	613	56.0 (2.3)	613	37.1 (2.7)	574	27.6 (2.7)	538	16.3 (3.1)
College graduate	578	73.2 (4.1)	578	49.9 (4.6)	547	31.8 (2.8)	512	13.1 (2.7)
Parity								
Primiparous	1359	47.0 (2.9)	1359	29.7 (2.5)	1296	17.8 (1.9)	1223	7.3 (1.2)
Multiparous	2008	47.5 (3.5)	2008	33.4 (3.1)	1907	20.1 (1.8)	1816	10.0 (1.9)
Smoking in pregnancy								
Yes	681	32.8 (3.3)	681	17.4 (3.1)	646	8.1 (1.8)	611	3.3 (1.3)
No	3141	51.7 (2.7)	3141	36.4 (2.7)	2991	22.6 (1.7)	2838	11.2 (1.5)
Mother's BMI								
Normal (<25)	2095	52.5 (2.7)	2095	35.4 (2.5)	1989	21.0 (1.5)	1874	9.4 (1.1)
Overweight (25–29)	881	39.5 (3.6)	881	28.2 (3.7)	827	18.3 (3.1)	783	10.6 (2.7)
Obese (≥30)	662	38.7 (5.0)	662	25.9 (4.3)	640	15.1 (2.8)	617	9.2 (3.4)
Residence								
Metropolitan	2108	50.3 (3.2)	2108	35.1 (3.2)	2018	19.8 (1.7)	1912	8.7 (1.4)
Rural	1728	44.1 (4.5)	1728	28.9 (3.7)	1633	18.9 (2.1)	1551	10.3 (2.1)
Region								
Northeast	516	42.4 (4.1)	516	25.5 (3.4)	485	17.1 (2.7)	453	11.7 (3.2)
Midwest	713	48.5 (3.3)	713	33.4 (3.2)	664	22.8 (2.2)	633	9.4 (0.9)
South	1775	37.9 (4.3)	1775	23.3 (2.9)	1703	12.1 (2.0)	1615	4.4 (0.6)
West	832	64.9 (4.3)	832	50.0 (3.8)	799	29.2 (1.7)	762	15.5 (2.5)
Poverty-income ratio								
0–99%	1378	32.2 (4.0)	1378	23.2 (3.5)	1329	13.2 (2.7)	1290	6.8 (2.4)
100–184%	822	42.5 (3.2)	822	29.1 (2.8)	781	17.0 (2.0)	731	10.4 (1.6)
185–349%	844	52.9 (3.4)	844	39.9 (3.6)	790	24.0 (2.4)	746	9.8 (1.5)
>350%	523	66.2 (3.8)	523	37.3 (3.1)	496	23.9 (3.2)	460	10.9 (3.2)
Missing values	269	37.5 (6.6)	269	29.2 (6.0)	255	17.4 (4.4)	236	11.9 (3.8)

Notes. (SE) = standard error. Missing numbers for each factor can be derived from the difference between the total number of infants and the summary number for each factor (see the example given under "Poverty-Income Ratio").

TABLE 2—Ever Breastfed and Breastfeeding Duration, by Sociodemographic and Environmental Factors: NHANES III (Phases I and II, 1988–1994)

Characteristic	Ever Breastfed		Breastfeeding at 6 mo		Breastfeeding at 12 mo	
	n	Weighted % (SE)	n	Weighted % (SE)	n	Weighted % (SE)
All infants	8215	53.6 (1.7)	7363	22.4 (1.2)	6123	8.9 (0.8)
Male infants	4062	53.7 (2.1)	3636	23.0 (1.7)	3009	9.2 (1.2)
Female infants	4153	53.6 (1.7)	3727	21.9 (1.2)	3114	8.5 (0.8)
Birthweight						
< 2500 g	669	34.1 (3.0)	617	11.8 (2.2)	533	3.9 (1.5)
Normal	7350	55.5 (1.8)	6557	23.5 (1.3)	5417	9.3 (0.9)
Maturity						
Premature	709	35.7 (4.3)	650	11.1 (2.3)	554	6.5 (2.0)
Full term	5597	54.2 (1.8)	4997	23.4 (1.6)	4158	9.0 (1.0)
Child race/ethnicity						
Non-Hispanic White	3067	60.2 (2.0)	2580	26.6 (1.6)	1863	10.6 (1.3)
Non-Hispanic Black	2172	26.3 (1.5)	2033	8.3 (0.8)	1842	2.7 (0.6)
Mexican American	2479	56.0 (2.0)	2325	22.5 (1.4)	2112	9.9 (0.8)
Others	497	53.6 (3.5)	425	19.0 (2.8)	306	6.5 (1.8)
Maternal age, y						
< 20	1265	32.5 (2.7)	1155	9.5 (1.7)	981	4.0 (1.0)
20–24	2321	44.8 (1.9)	2084	13.4 (1.4)	1737	4.4 (0.9)
25–29	2494	58.5 (1.9)	2236	24.8 (1.7)	1877	9.8 (1.4)
≥ 30	2104	65.3 (2.3)	1857	33.3 (2.0)	1497	13.7 (1.4)
Maternal education						
Less than high school	1584	30.3 (2.1)	1426	10.0 (1.7)	1187	3.9 (1.1)
High school	2201	45.4 (2.3)	1941	16.0 (1.2)	1522	5.7 (1.2)
Some college	994	62.1 (2.6)	865	26.3 (2.8)	661	8.2 (1.9)
College graduate	283	81.8 (3.4)	233	43.6 (5.8)	159	20.7 (5.4)
Household head education						
Less than high school	2839	35.8 (2.1)	2616	14.9 (1.9)	2276	7.2 (1.3)
High school	2690	46.0 (2.1)	2391	15.9 (1.1)	1955	6.5 (1.2)
Some college	1349	60.1 (1.9)	1182	24.9 (1.9)	979	10.0 (1.6)
College graduate	1149	80.2 (2.2)	1002	39.1 (2.4)	770	13.5 (2.0)
Parity						
Primiparous	2895	55.2 (1.7)	2582	19.1 (1.4)	2096	6.0 (0.8)
Multiparous	4355	52.2 (2.0)	3903	24.6 (1.6)	3246	10.2 (1.2)
Smoking in pregnancy						
Yes	1632	35.9 (2.1)	1452	9.4 (1.0)	1161	4.4 (1.0)
No	6551	59.1 (1.7)	5884	26.4 (1.4)	4937	10.2 (1.0)
Mother's BMI						
Normal (<25)	4617	58.1 (1.7)	4107	25.0 (1.3)	3345	10.0 (1.0)
Overweight (25–29)	1833	46.4 (2.4)	1621	17.3 (1.7)	1361	5.7 (0.9)
Obese (≥ 30)	1262	44.8 (3.6)	1166	16.9 (2.8)	1011	5.6 (1.8)
Residence						
Metropolitan	4370	58.8 (2.2)	3920	24.1 (1.8)	3290	9.8 (1.2)
Rural	3845	48.5 (2.9)	3443	20.8 (2.0)	2833	7.9 (1.2)
Region						
Northeast	1058	47.6 (3.5)	906	18.2 (2.4)	703	8.2 (1.4)
Midwest	1575	56.2 (2.1)	1398	24.8 (1.6)	1081	9.3 (2.0)

Continued

we obtained this information from data linkages with the children's birth certificates. We defined prematurity as a gestational age of less than 37 weeks. Maternal education was classified the same way as for household-head education, and parity was classified as primiparous (i.e., the mother had had no previous live births) or multiparous.

The entire 6-year NHANES III sampled a total of 8765 children younger than 6 years. The overall interview response rate for these children was approximately 94%. Data on ever breastfeeding, exclusive breastfeeding, and breastfeeding duration were available for approximately 99% of the interviewed children. We calculated the weighted percentages and their standard errors with SUDAAN to take into account the complex sample design.¹³

RESULTS

The proportions of children exclusively breastfed were approximately 47% at 7 days after birth, 32% at 2 months, 19% at 4 months, and 10% at 6 months, whereas the proportions of children still being breastfed at these ages were approximately 52%, 40%, 29%, and 22%, respectively. Table 1 shows that at each of these time points, exclusive breastfeeding was least common among low-birthweight, premature, or non-Hispanic Black infants and those of mothers who were younger than 20 years, had lower education or income, smoked during pregnancy, or lived in the South.

The proportions of children ever breastfed and still being breastfed at 6 and 12 months were also stratified by sociodemographic and environmental factors (Table 2). We observed patterns similar to those for the exclusively breastfed children. In addition, we found lower breastfeeding initiation and duration among mothers who were overweight or obese and among families living in rural areas. Although primiparous mothers had a higher rate of initiating breastfeeding than did multiparous mothers, they had a lower rate of continuing breastfeeding throughout the infant's first year.

DISCUSSION

Less than half of the children in NHANES III began exclusive breastfeeding. At age 2

TABLE 2—Continued

South	3360	44.1 (1.8)	3024	16.0 (1.7)	2588	5.4 (1.2)
West	2222	69.8 (3.6)	2035	32.7 (2.5)	1751	14.0 (1.6)
Poverty-income ratio						
0-99%	2857	36.5 (2.6)	2636	14.3 (1.7)	2286	7.6 (1.1)
100-184%	1758	50.1 (1.9)	1572	20.3 (1.5)	1307	6.5 (1.2)
185-349%	1847	58.5 (1.9)	1625	27.3 (1.9)	1302	11.9 (1.8)
> 350%	994	75.4 (2.2)	854	30.7 (2.7)	657	9.2 (2.0)
Missing value	759	45.8 (3.6)	676	14.9 (1.9)	571	6.4 (1.6)

Notes. (SE) = standard error. Missing numbers for each factor can be derived from the difference between the total number of infants and the summary number for each factor (see the example given under "Poverty-Income Ratio").

months, the percentage of infants still being exclusively breastfed was considerably lower than the percentage who were receiving any breast milk at this point. By the age of 6 months, slightly less than 10% of infants were being exclusively breastfed.

Although the factors that influence the initiation and duration of breastfeeding have been broadly studied,^{10,11} previous studies have rarely examined the factors associated with exclusive breastfeeding. Our study indicates that the proportion of infants exclusively breastfed varied by subgroup, with the lowest rate found among non-Hispanic Black and premature infants and the highest rate among infants of mothers who had graduated from college. Our study also suggests that the factors associated with exclusive breastfeeding were similar to those associated with the initiation and duration of any breastfeeding.^{10,11}

Our results regarding the initiation and duration of breastfeeding are similar to those from previous Ross Laboratories Mothers' Surveys.¹⁴ Our analysis showed that only 3 subgroups in NHANES III met the Healthy People 2010 goal¹⁵ of 75% for breastfeeding initiation: mothers who had graduated from college (81.8%), families with a household head who had graduated from college (80.2%), and families with an income exceeding 350% of the poverty-income ratio (75.4%). None of the subgroups met the goals for breastfeeding at 6 months (50%) or 12 months (25%).

In summary, this is the first nationally representative study available that indicates that initiation and maintenance of exclusive breastfeeding are low in the United States. Public health efforts are needed to improve the rate of exclusive breastfeeding—and, in particular,

the duration of such feeding—among non-Hispanic Blacks and socioeconomically disadvantaged groups. ■

About the Authors

Ruowei Li, Carol Ballew, Cathleen Gillespie, and Laurence Grummer-Strawn are with the Division of Nutrition and Physical Activity, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, Ga. Cynthia Ogden is with the Division of Health Examination Statistics, the National Center for Health Statistics, Hyattsville, Md.

Requests for reprints should be sent to Ruowei Li, Division of Nutrition and Physical Activity, Mail Stop K-25, Centers for Disease Control and Prevention, 4770 Buford Hwy NE, Atlanta, GA 30341-3717 (e-mail: ril6@cdc.gov).

This article was accepted May 1, 2001.

Contributors

R. Li planned the study, analyzed the data, and wrote the brief. C. Gillespie extracted the data set and conducted preliminary analysis for this study. C. Ogden linked the NHANES III with children's birth certificates and analyzed data for gestational age, maternal education, and parity. C. Ballew and L. Grummer-Strawn assisted with study design, supervised data analysis, and contributed to the writing of the brief.

References

1. Cushing AH, Samet JM, Lambert WE, et al. Breastfeeding reduces risk of respiratory illness in infants. *Am J Epidemiol.* 1998;147(9):863-870.
2. Scariati PD, Grummer-Strawn LM, Fein SB. A longitudinal analysis of infant morbidity and the extent of breastfeeding in the United States. *Pediatrics.* 1997;99(6):E5.
3. Duncan B, Ey J, Holberg CJ, et al. Exclusive breast-feeding for at least 4 months protects against otitis media. *Pediatrics.* 1993;91(5):867-872.
4. Raisler J, Alexander C, O'Campo P. Breast-feeding and infant illness: a dose-response relationship? *Am J Public Health.* 1999;89(1):25-30.
5. Dewey KG, Heinig MJ, Nommsen-Rivers LA. Differences in morbidity between breast-fed and formula-fed infants. *J Pediatr.* 1995;126(5 Pt 1):696-702.
6. Howie PW, Forsyth JS, Ogston SA, et al. Protec-

tive effect of breast feeding against infection. *BMJ.* 1990;300(6716):11-16.

7. Work Group on Breastfeeding, American Academy of Pediatrics. Breastfeeding and the use of human milk. *Pediatrics.* 1997;100(6):1035-1039.
8. World Health Organization: The optimal duration of exclusive breastfeeding. Note for the Press No. 7, April 2, 2001. Available at: www.who.int/inf-pr-2001/er/note2001-07.html. Accessed May 13, 2002.
9. National Center for Health Statistics. Plan and operation of the Third National Health and Nutrition Examination Survey 1988-1994. *Vital Health Stat.* 1994;1(32).
10. Scott JA, Binns CW. Factors associated with the initiation and duration of breastfeeding: a review of the literature. *Breastfeeding Rev.* 1999;7(1):5-16.
11. Tan JC, Jeffery HE. Factors that influence the choice of infant feeding. *J Paediatr Child Health.* 1995;31(5):375-378.
12. World Health Organization Expert Committee. Physical status: the use and interpretation of anthropometry. *World Health Organ Tech Rep Ser.* 1995;854:1-452.
13. Shah BV, Barnwell BG, Bieler GS. *SUDAAN User's Manual, Release 7.5.* Research Triangle Park, NC: Research Triangle Institute; 1997.
14. Ryan AS. The resurgence of breastfeeding in the United States. *Pediatrics.* 1997;99(4):1-5.
15. *Healthy People 2010.* Washington, DC: US Department of Health and Human Services; 2000.