

Racial and Ethnic Differences in Breastfeeding

Chelsea O. McKinney, PhD, MPH,^a Jennifer Hahn-Holbrook, PhD,^b P. Lindsay Chase-Lansdale, PhD,^c Sharon L. Ramey, PhD,^d Julie Krohn, MS, RDN, LDN,^e Maxine Reed-Vance, RN, MS,^f Tonse N.K. Raju, MD, DCH,^g Madeleine U. Shalowitz, MD, MBA,^{a,h} on behalf of the Community Child Health Research Network

abstract

OBJECTIVES: Breastfeeding rates differ among racial/ethnic groups in the United States. Our aim was to test whether racial/ethnic disparities in demographic characteristics, hospital use of infant formula, and family history of breastfeeding mediated racial/ethnic gaps in breastfeeding outcomes.

METHODS: We analyzed data from the Community and Child Health Network study ($N = 1636$). Breastfeeding initiation, postnatal intent to breastfeed, and breastfeeding duration were assessed postpartum. Hierarchical linear modeling was used to estimate relative odds of breastfeeding initiation, postnatal intent, and duration among racial/ethnic groups and to test the candidate mediators of maternal age, income, household composition, employment, marital status, postpartum depression, preterm birth, smoking, belief that “breast is best,” family history of breastfeeding, in-hospital formula introduction, and WIC participation.

RESULTS: Spanish-speaking Hispanic mothers were most likely to initiate (91%), intend (92%), and maintain (mean duration, 17.1 weeks) breastfeeding, followed by English-speaking Hispanic mothers (initiation 90%, intent 88%; mean duration, 10.4 weeks) and white mothers (initiation 78%, intent 77%; mean duration, 16.5 weeks); black mothers were least likely to initiate (61%), intend (57%), and maintain breastfeeding (mean duration, 6.4 weeks). Demographic variables fully mediated disparities between black and white mothers in intent and initiation, whereas demographic characteristics and in-hospital formula feeding fully mediated breastfeeding duration. Family breastfeeding history and demographic characteristics helped explain the higher breastfeeding rates of Hispanic mothers relative to white and black mothers.

CONCLUSIONS: Hospitals and policy makers should limit in-hospital formula feeding and consider family history of breastfeeding and demographic characteristics to reduce racial/ethnic breastfeeding disparities.



^aNorthShore University HealthSystem Department of Pediatrics and Research Institute, Evanston, Illinois; ^bCrean College of Health and Behavioral Sciences, Chapman University, Orange, California; ^cInstitute for Policy Research, Northwestern University, Evanston, Illinois; ^dVirginia Tech Carilion Research Institute, Virginia Tech, Roanoke, Virginia; ^eLake County Health Department and Community Health Center, Waukegan, Illinois; ^fBaltimore Healthy Start, Inc, Baltimore, Maryland; ^gPregnancy and Perinatology Branch, Eunice Kennedy Shriver National Institute of Child Health and Human Development, National Institutes of Health, Rockville, Maryland; and ^hDepartment of Pediatrics, University of Chicago, Pritzker School of Medicine, Chicago, Illinois

Dr McKinney conceptualized the research questions, helped design the data collection instruments, conducted data collection, helped conduct the analyses, and drafted the initial and revised manuscripts; Dr Hahn-Holbrook helped conceptualize the research questions, draft the initial and revised manuscripts, and conduct the analyses; Dr Chase-Lansdale critically reviewed the initial manuscript; Dr Ramey helped design the data collection instruments, coordinated and supervised data collection, and critically reviewed the initial and revised manuscripts; Mrs Krohn helped design the data collection instruments and critically reviewed the initial manuscript; Mrs Vance helped design the data collection instruments, coordinated and supervised data collection,

WHAT'S KNOWN ON THIS SUBJECT: Breastfeeding rates differ between racial/ethnic groups in the United States, resulting in considerable health disparities for infants. Black infants are breastfed for substantially shorter periods compared with white infants, and Hispanic infants are breastfed for significantly longer periods.

WHAT THIS STUDY ADDS: We show that demographic characteristics and in-hospital formula feeding explain breastfeeding gaps between black and white mothers, whereas demographic characteristics and family history of breastfeeding help explain higher rates of breastfeeding in Hispanic mothers compared with white and black mothers.

To cite: McKinney CO, Hahn-Holbrook J, Chase-Lansdale PL, et al. Racial and Ethnic Differences in Breastfeeding. *Pediatrics*. 2016;138(2):e20152388

Substantial research shows that breastfeeding benefits the neurologic, immunologic, digestive, and physical development of children.¹ The American Academy of Pediatrics recommends exclusive breastfeeding for the first 6 months of life, with continued breastfeeding and complementary foods at least until the child's first birthday. Despite this recommendation, approximately one-half of children in the United States are no longer breastfed by 6 months, with only a small percentage breastfed for the recommended period of 12 months.² Suboptimal levels of breastfeeding cost the US economy billions of dollars annually^{3,4} and contribute to an estimated 911 (predominantly infant) deaths each year.⁴ Importantly, the social, health, and economic burdens of low breastfeeding rates are not shared equally across racial and ethnic groups.

In the most recent US National Immunization Survey, only 66.4% of black mothers initiated breastfeeding in 2012, compared with 83% of white mothers and 82.4% of Hispanic mothers.² Racial/ethnic gaps in breastfeeding remained significant at 6 months, with only 35.3% of black mothers still breastfeeding, compared with 55.8% of white mothers and 51.4% of Hispanic mothers. Black women consistently remain at the bottom on all breastfeeding indices, although the gap between black mothers and other ethnic groups has narrowed by a few percentage points since 2000, suggesting breastfeeding promotion efforts have helped.

Many factors have been proposed to explain these racial/ethnic breastfeeding disparities. Black mothers, for example, tend to be younger, unmarried, and of lower income and education compared with white mothers, all factors linked to lower breastfeeding rates.⁵ Interestingly, although Hispanic mothers share many of these

demographic characteristics with black mothers, they have higher rates of breastfeeding than white mothers. Moreover, accounting for income and maternal education differences between black and white mothers does not eliminate disparities in breastfeeding.^{6,7} To address the persistent large gap in breastfeeding rates between black mothers and mothers of other groups, the current article includes these demographic factors, but it also considers other causes.

The goal of the current study was to identify key nondemographic factors that might explain disparities in breastfeeding among black, white, and Hispanic mothers in the United States. We considered racial/ethnic differences in attitudes toward breastfeeding, family history of breastfeeding, in-hospital formula introduction, and participation in the Special Supplemental Nutrition Program for Women, Infants, and Children. Our objective was to determine whether racial/ethnic disparities in breastfeeding initiation, postnatal intent, and duration could be more fully explained by using statistical mediation techniques that included these hypothesized new factors.

METHODS

Study Sample

The sample consisted of 1636 mothers from the Community and Child Health Network, an National Institutes of Health multisite, community-based participatory research project designed to examine how community, family, and individual factors contribute to racial/ethnic health disparities for mothers and infants. The current study uses data from sites in Baltimore, Maryland, Washington, DC, and Lake County, Illinois. Each site sought to include mothers of low socioeconomic status (SES) from the 3 race/ethnicity groups, reflecting

the local population; oversampling was included when needed. Data were obtained when mothers enrolled between 2008 and 2010 during their postpartum hospital stay and from in-home interviews 1 and 6 months' postpartum. Mothers included in this study provided infant feeding data (regardless of feeding method) for at least 2 time points. Overall, <1% of initiation and postnatal intent data were missing, although 12% of mothers did not provide breastfeeding duration data and 30% lacked information on family breastfeeding history. We attempted to address this missing data issue by using the multiple imputation function in Stata,⁸ generating 10 possible data sets from which estimates were pooled.

Measures

Independent Variables

Racial/ethnic identification was based on mothers' self-report as either non-Hispanic white (hereafter referred to as white), non-Hispanic black (hereafter referred to as black), or Hispanic. The Community Child Health Research Network was designed to recruit mothers with these primary racial/ethnic identities (irrespective of legal status); thus, <1% also identified as other or mixed race. Participants who designated mixed race were placed in either the Hispanic or the black group to which they partially self-identified. Hispanic participants were further categorized as primarily English- or Spanish-speaking because markers of acculturation, including language spoken at home,⁸ have been shown to have a large impact on breastfeeding outcomes.⁹

Potential Mediators

Candidate mediators were chosen based on known associations with breastfeeding as rereported in the literature. We tested these factors for their ability to mediate or explain a significant proportion

of the variance in racial/ethnic disparities in breastfeeding outcomes. Demographic factors included maternal age,¹⁰ education, employment at 1 month postpartum,¹¹ poverty status¹⁰ (adjusted for family size by using federal guidelines¹²), relationship status¹³ (single, in a relationship, or married [mutually exclusive categories]), coresident father,¹⁴ and coresident grandparent.¹⁵ Health-related variables included 1 month postpartum depression,¹⁶ according to the Edinburgh Postnatal Depression Scale¹⁷ (scores ≥ 9 were categorized as depressed); smoking at 1 month¹⁸; and infant preterm birth¹⁹ (via medical records, gestation <37 weeks). We also collected maternal and paternal family history of breastfeeding²⁰ (determined by asking mothers and fathers “Did the woman who raised you breastfeed any children?”) and the mother’s belief²¹ that “breast is best” (assessed by asking “Which of the following do you think is the best way to feed a baby—breastfeeding, a mix of breast milk and formula, only formula, or either breast milk or formula?”). Mothers who indicated breastfeeding was the best feeding method were compared with those who did not. Mothers were asked during their in-hospital stay whether they had participated in the Special Supplemental Nutrition Program for Women, Infants, and Children²² at any time during the past year. Finally, patient medical records indicated whether formula was introduced during the hospital stay²³ after birth.

Outcome Variables

Primary outcomes of interest were breastfeeding initiation, postnatal breastfeeding intent, and breastfeeding duration. Breastfeeding initiation was measured at 1 month postpartum with the question “Have you ever breastfed your baby?” Mothers were categorized as having initiated breastfeeding if they breastfed at least once. Postnatal

breastfeeding intent was assessed during the in-hospital interview and derived from the question “How do you plan to feed your baby?” Mothers were categorized as intending to breastfeed if they planned to provide any amount of breast milk or not intending to breastfeed if they planned to provide only infant formula. Breastfeeding duration was defined as the number of weeks that the infant had been breastfed by the 6-month interview. Women who did not initiate breastfeeding were included in our duration measure and coded as 0. If the mother was no longer breastfeeding at the 1- or 6-month interviews, mothers were asked “How old was the child in weeks when you stopped breastfeeding?” to extrapolate total duration.

Statistical Analysis

Hierarchical linear modeling offers advantages over other statistical tools in evaluating nested data, which, in this case, adjusts for shared variance that participants (level 1) may have if they are from the same site and allows for heterogeneity of effect sizes for different sites (level 2).²⁴ All analyses were performed by using multilevel analysis, with study site added to the level 2 regression equation as a random factor, and independent and mediator variables included in univariate and multivariate models in the regression equation at level 1. Comparisons with Hispanic participants excluded the Baltimore site because only 4 Hispanic subjects were recruited, precluding good estimates at level 2. All analyses were conducted by using Stata version 14 (Stata Corp, College Station, TX).

Mediation Analysis

A mediator is a variable, or set of variables, hypothesized to explain or cause the observed association between an independent variable (ie, race/ethnicity) and a dependent

variable (eg, breastfeeding outcome). Using classic mediation criteria,²⁵ a variable can be said to mediate the relationship between an independent and dependent variable (Path C) if: (1) the independent variable significantly accounts for variation in the mediator (Path A); (2) the mediator significantly accounts for variation in the outcome variable (Path B); and (3) both the mediator and the independent variable are included in a multivariate model, and the relationship between the independent variable and the outcome variable is significantly reduced or no longer statistically significant (Path C’), while the mediator continues to predict significant variation in the outcome variable (Fig 1). There are often multiple mediators or causes of an association between an independent and dependent variable.²⁶ The same mediation criteria are used to test multiple mediators; however, all mediators must be added simultaneously to equations testing Path A, Path B, and Path C’ to ensure that each mediator accounts for a unique proportion of the variance shared between the independent and dependent variable.

Mediation analysis was performed to test whether the candidate mediators helped to explain racial/ethnic breastfeeding disparities (Figs 1 and 2). First, hierarchical linear modeling was used to obtain estimates of racial/ethnic gaps in breastfeeding outcomes (Path C). Racial/ethnic differences in potential mediators were next tested (Path A). The association between these potential mediators and breastfeeding outcomes was then assessed (Path B). Only variables that were significant at Paths C, A, and B, respectively, were considered further. To avoid introducing reverse causality when assessing mediators of racial/ethnic disparities in breastfeeding initiation and postnatal intent, we did not consider variables that occurred

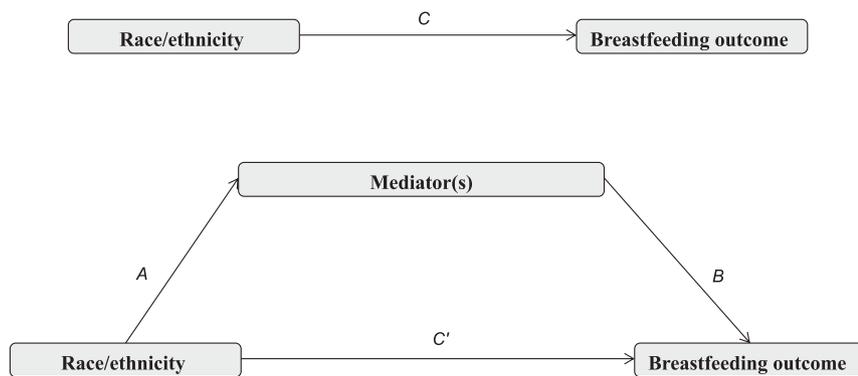


FIGURE 1 Mediation model pathways. Path C and C' differ in that path C is the raw association between the independent and outcome variables, and path C' is the residual association between the independent and outcome variables after the indirect effect of the mediator(s) is included in the model. Only racial/ethnic contrasts significant at Path C were pursued. Of those, mediation analysis was discontinued if Path A was not significant.

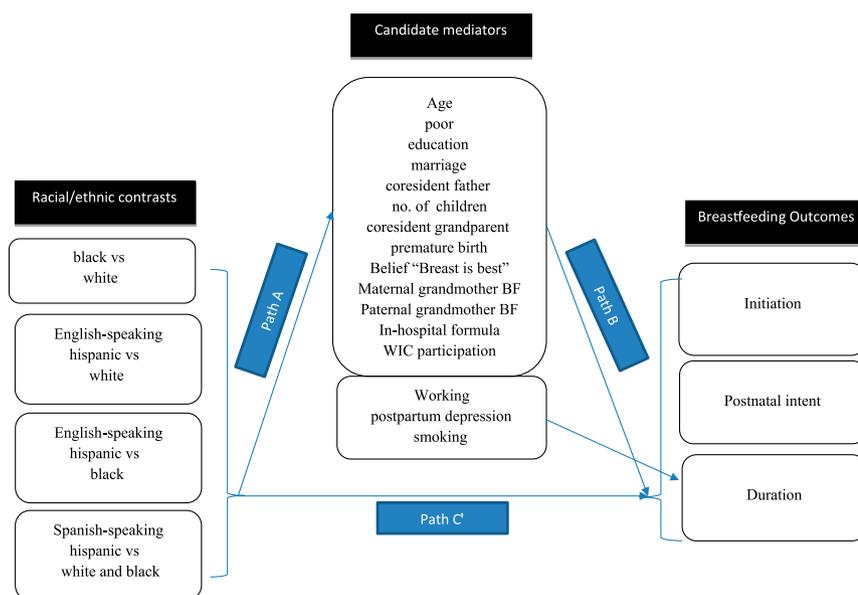


FIGURE 2 Summary of possible mediation relationships. Working, postpartum depression, and smoking were only tested with duration because they were measured at 1 month postpartum, which occurs after breastfeeding initiation and postnatal intent were measured in the hospital. BF, breastfed; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.

after the hospital stay (ie, working at 1 month, postpartum depression, smoking). Smoking, for instance, was measured at 1 month postpartum, which occurs after breastfeeding initiation and thus carries no predictive power.

The fourth and final step regressed significant mediator(s) on a breastfeeding outcome, with race/ethnicity included in the model to estimate the indirect effect (Path C').

Sobel tests were performed (data not shown) to ensure that mediators had significant indirect effects ($P < .05$) when the aforementioned mediation criteria were met. Once mediators are included in the model, a racial/ethnic gap in breastfeeding can be said to be partially mediated if the association between race/ethnicity and breastfeeding was reduced and C' is still statistically significant, and it is fully mediated

if C', representing the racial/ethnic disparity in breastfeeding, is no longer statistically significant.²⁵ Unstandardized betas (β) and confidence intervals are reported.

RESULTS

Consistent with previous findings, black mothers had significantly lower rates of breastfeeding initiation, postnatal intent, and duration compared with other racial/ethnic groups, whereas Spanish-speaking Hispanic mothers tended to have the highest breastfeeding indicators (Table 1). Many other significant differences emerged between racial/ethnic groups among our candidate mediator variables (Table 2), and candidate variables that did not differ (Path A) were not considered further. Tables 3, 4, 5, 6, and 7 report regression coefficients for all significant mediation pathways, which are summarized in Fig 1.

Disparities Between Black and White Mothers

Initiation

Black mothers were less likely to initiate breastfeeding than white mothers (Table 3, Path C). Black women also experienced higher rates of poverty and were less likely to have a college degree or be married compared with white women, all of which predicted less breastfeeding initiation (Table 3, Paths A and B). Together, poverty, college education, and marital status fully mediated the gap in breastfeeding initiation (Table 3, Path C').

Postnatal Intent

Black mothers were less likely to intend to breastfeed than white mothers (Table 3, Path C). Again, poverty, a college degree, and being married fully mediated the gap in postnatal breastfeeding intent (Table 3, Path C').

TABLE 1 Breastfeeding Outcomes According to Race/Ethnicity

Outcome	Total (N = 1632)	White (n = 310)	Black (n = 907)	Hispanic-Spanish (n = 268)	Hispanic-English (n = 147)
Initiation	72	78 ^a	61 ^b	91 ^c	90 ^c
Postnatal intent	70	77 ^a	57 ^b	92 ^c	88 ^c
Duration, mean ± SD, wk	10.29 ± 13.13	16.51 ^a ± 15.88	6.40 ^b ± 9.86	17.09 ^a ± 14.66	10.44 ^c ± 12.50

Data are presented as the percent mean unless otherwise indicated. Values that differ in superscripts within the same row indicate that there is a significant difference ($P < .05$) between racial/ethnic groups. (For example: A value with *a* is significantly different from values with *b*, *c*, or *d* in the same row but not different from other values with *a* in the same row.)

TABLE 2 Differences in Potential Mediators as a Function of Race/Ethnicity

Variable	Total (N = 1632)	White (n = 310)	Black (n = 907)	Hispanic-Spanish (n = 268)	Hispanic-English (n = 147)
Mother's mean age, y	25.15	29.19 ^a	23.82 ^{a,b}	25.93 ^a	23.38 ^c
Poor	40	15 ^a	49 ^b	40 ^{a,b}	36 ^{a,b}
Working	24	25	24	24	26
Coresident father	62	86 ^a	44 ^b	87 ^a	78 ^a
Mean total no. of children	1.93	1.71 ^a	1.97 ^b	2.07 ^a	1.87 ^a
Coresident grandparent	34	16 ^a	42 ^b	20 ^{a,b,c}	49 ^{a,b}
Postpartum depression	17	14	18	19	17
Smoker	16	24 ^a	17 ^b	2 ^c	17 ^b
Premature birth	14	15	14	14	18
Maternal grandmother breastfed	57	62 ^a	39 ^a	93 ^b	77 ^b
Paternal grandmother breastfed	60	63 ^a	43 ^a	91 ^b	76 ^b
Mother: "Breastfeeding best for baby"	41	51	37	46	36
WIC participant	69	30 ^a	75 ^b	89 ^c	76 ^b
Fed formula at hospital	66	39 ^a	76 ^b	68 ^{a,b}	58 ^{a,b}
Education					
Less than high school (High school or GED)	21	5 ^a	18 ^{a,b}	46 ^c	26 ^{b,c}
Some higher education	41	23	48	40	44
College or beyond	24	21 ^a	28 ^a	11 ^b	23 ^a
College or beyond	14	51 ^a	6 ^b	3 ^c	8 ^b
Relationship status					
Single	15	6 ^a	22 ^b	6 ^b	9 ^{a,b}
In relationship (Married)	56	28 ^a	65 ^b	58 ^{a,b}	52 ^{a,b}
(Married)	29	66 ^a	13 ^b	36 ^{a,b}	38 ^c

Data are presented as the percent mean unless otherwise indicated. Means represent raw data, without imputation. Parentheses indicate reference category. Values that differ in superscripts within the same row indicate that there is a significant difference ($P < .05$) between racial/ethnic groups. (For example: A value with *a* is significantly different from values with *b*, *c*, or *d* in the same row but not different from other values with *a* in the same row.) GED, General Educational Development; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.

Duration

Black mothers weaned their infants 10.3 weeks earlier than did white mothers (Table 3, Path C). College education and marital status differed between groups and predicted shorter breastfeeding durations (Table 3, Paths A and B). In addition, white mothers were significantly less likely to experience in-hospital formula introduction than black mothers, which was the biggest predictor of breastfeeding duration, even in models controlling for racial/ethnic disparities in initiation and postnatal intent. Together, these factors fully mediated the disparity

in breastfeeding duration (Table 3, Path C'). Poverty was not a unique predictor of breastfeeding duration.

Disparities Between White and Spanish-speaking Hispanic Mothers

Initiation

Spanish-speaking Hispanic mothers were more likely to initiate breastfeeding compared with white mothers (Table 4, Path C). Spanish-speaking mothers were more likely to have had their own mothers breastfeed children, which predicted higher breastfeeding initiation (Table 4, Paths A and B). Maternal family history of breastfeeding fully

mediated the initiation gap between white and Spanish-speaking Hispanic mothers (Table 4, Path C').

Postnatal Intent

Spanish-speaking Hispanic mothers were significantly more likely to intend to breastfeed than were white mothers (Table 4, Path C). However, no variables met mediation criteria.

Duration

Spanish-speaking Hispanic and white mothers had comparable durations for breastfeeding. Mediation analysis was therefore not pursued.

Disparities Between White and English-speaking Hispanic Mothers

Initiation

English-speaking Hispanic mothers exhibited significantly higher rates of initiation than did white mothers (Table 5, Path C). English-speaking mothers were more likely to have had their own mothers breastfeed children, which predicted higher breastfeeding initiation (Table 5, Paths A and B). Maternal family history of breastfeeding fully mediated the initiation gap between white and English-speaking Hispanic mothers (Table 5, Path C').

Postnatal Intent

English-speaking Hispanic mothers were more likely to intend to breastfeed than were white mothers (Table 5, Path C), although no variables met mediation criteria.

Duration

White mothers breastfed ~6.9 weeks longer than did English-speaking Hispanic mothers (Table 5, Path C); the latter group tended to be younger and lack a college degree (Table 5, Path A), both of which fully mediated the gap in duration (Table 5, Path C').

Disparities Between Black and Spanish-speaking Hispanic Mothers

Initiation

Spanish-speaking Hispanic mothers had significantly higher rates of initiation than did black mothers (Table 6, Path C). Spanish-speakers were also more likely to have a mother who had breastfed (Table 6, Path A), which predicted greater breastfeeding initiation in the next generation (Table 6, Path B) and partially mediated this racial/ethnic disparity (Table 6, Path C').

Postnatal Intent

Black mothers were less likely to intend to breastfeed after leaving the hospital than were Spanish-speaking mothers (Table 6, Path C). Having a

TABLE 3 Mediation of Differences in Breastfeeding Initiation, Postnatal Intent, and Duration Between White and Black Mothers

Variable	β	95% Confidence Interval
Breastfeeding initiation		
Path C		
Black	-0.81	-1.15 to 0.46
Path A		
Poor	1.14	0.71 to 1.57
College	-1.64	-2.15 to -1.14
Married	-1.52	-1.94 to -1.10
Path B and Path C'		
Poor	-0.44	-0.71 to -0.17
College	1.64	1.00 to 2.28
Married	0.99	0.56 to 1.41
Black	0.26	-0.17 to 0.69
Breastfeeding postnatal intent		
Path C		
Black	-1.02	-1.35 to -0.68
Path A		
Poor	1.14	0.71 to 1.57
College	-1.64	-2.15 to -1.14
Married	-1.52	-1.94 to -1.10
Path B and Path C'		
Poor	-0.56	-0.83 to -0.29
College	1.73	1.09 to 2.37
Married	1.02	0.61 to 1.44
Black	0.13	-0.29 to 0.55
Breastfeeding duration		
Path C		
Black	-10.31	-12.04 to -8.58
Path A		
College	-0.29	-0.35 to -0.23
Married	-0.24	-0.30 to -0.19
Hospital formula	-0.08	-0.03 to -0.12
Path B and Path C'		
College	6.54	4.26 to 8.81
Married	4.34	2.52 to 6.17
Hospital formula	-9.79	-11.43 to -8.16
Black	-1.51	-3.36 to 0.34

In these models, white mothers were coded as 0, and black mothers were coded as 1.

TABLE 4 Mediation of Differences in Breastfeeding Initiation, Postnatal Intent, and Duration Between White and Spanish-speaking Hispanic Mothers

Variable	β	95% Confidence Interval
Breastfeeding initiation		
Path C		
Hispanic, Spanish-speaking	0.84	0.23 to 1.44
Path A		
Maternal grandmother breastfed	1.66	1.04 to 2.27
Path B and Path C'		
Maternal grandmother breastfed	0.75	0.09 to 1.42
Hispanic, Spanish-speaking	0.55	-0.09 to 1.19
Breastfeeding postnatal intent		
Path C ^a		
Hispanic, Spanish-speaking	0.94	0.33 to 1.52
Breastfeeding duration		
Path C ^a		
Hispanic, Spanish-speaking	-2.08	-4.91 to 0.75

In these models, white mothers were coded as 0, and Spanish-speaking Hispanic mothers were coded as 1.

^a Denotes contrasts in which no mediators were identified.

mother who breastfed also partially mediated the difference in postnatal intent (Table 6, Path C').

Duration

Black mothers nursed an estimated 10.3 weeks less than did Spanish-speaking Hispanic mothers (Table 6, Path C). Again, black mothers were less likely to have a family history of breastfeeding but were also less likely to live with the infant's father (Table 6, Path A). Together, these 2 variables partially explained the large gap in duration (Table 6, Path C').

Disparities Between Black and English-speaking Hispanic Mothers

Initiation

English-speaking Hispanic mothers initiated breastfeeding more often than did black mothers (Table 7, Path C). Mothers whose own mothers had breastfed were more prevalent among English-speakers than black mothers (Table 7, Path A), which partially mediated the initiation gap (Table 7, Path C').

Postnatal Intent

English-speaking Hispanic mothers were more likely to intend to breastfeed than were black mothers (Table 7, Path C). English-speaking Hispanic mothers were also more likely to have maternal and paternal mothers who had breastfed (Table 7, Path A). In this model, both family history variables predicted unique variations in postnatal intent and partially mediated the racial/ethnic gap in intent (Table 7, Paths B and C').

Duration:

Black women weaned their infants ~3.0 weeks earlier than English-speaking Hispanic women (Table 7, Path C). Black mothers were less likely to be married or have a maternal history of breastfeeding than English-speaking Hispanic

TABLE 5 Mediation of Differences in Breastfeeding Initiation, Postnatal Intent, and Duration Between White and English-speaking Hispanic Mothers

Variable	β	95% Confidence Interval
Breastfeeding initiation		
Path C		
Hispanic, English-speaking	0.77	0.11 to 1.42
Path A		
Maternal grandmother breastfed	0.60	0.02 to 0.06
Path B and Path C'		
Maternal grandmother breastfed	0.71	0.02 to 1.41
Hispanic, English-speaking	0.66	-0.01 to 1.32
Breastfeeding postnatal intent		
Path C ^a		
Hispanic, English-speaking	0.66	0.04 to 1.27
Breastfeeding duration		
Path C		
Hispanic, English-speaking	-6.89	-9.99 to -3.79
Path A		
College	-0.28	-0.41 to -0.16
Age	-0.02	-0.03 to -0.01
Path B and Path C'		
College	5.57	1.61 to 9.53
Age	0.84	0.53 to 1.14
Hispanic, English-speaking	-0.03	-3.36 to 3.29

In these models, white mothers were coded as 0, and English-speaking Hispanic mothers were coded as 1.

^a Denotes contrasts in which no mediators were identified.

TABLE 6 Mediation of Differences in Breastfeeding Initiation, Postnatal Intent, and Duration Between Black and Spanish-speaking Hispanic Mothers

Variable	β	95% Confidence Interval
Breastfeeding initiation		
Path C		
Black	-1.57	-2.04 to -1.10
Path A		
Maternal grandmother breastfed	-2.84	-3.56 to -2.11
Path B and Path C'		
Maternal grandmother breastfed	0.90	0.37 to 1.43
Black	-1.12	-1.66 to -0.57
Breastfeeding postnatal intent		
Path C		
Black	-1.64	-2.11 to -1.16
Path A		
Maternal grandmother breastfed	-2.84	-3.56 to -2.11
Path B and Path C'		
Maternal grandmother breastfed	1.21	0.60 to 1.82
Black	-1.04	-1.60 to -0.48
Breastfeeding duration		
Path C		
Black	-10.25	-12.30 to -8.21
Path A		
Coresident father	-0.27	-0.33 to -0.21
Maternal grandmother breastfed	-0.36	-0.43 to -0.29
Path B and Path C'		
Coresident father	4.07	2.09 to 6.04
Maternal grandmother breastfed	4.68	2.55 to 6.81
Black	-6.07	-8.49 to -3.65

In these models, black mothers were coded as 0, and Spanish-speaking Hispanic mothers were coded as 1.

mothers (Table 7, Path A). Both variables fully mediated the disparity in duration (Table 7, Path C').

DISCUSSION

In line with previous reports,^{2,5} black mothers in the current sample

TABLE 7 Mediation of Differences in Breastfeeding Initiation, Postnatal Intent, and Duration Between Black and English-speaking Hispanic Mothers

Variable	β	95% Confidence Interval
Breastfeeding initiation		
Path C		
Black	-1.45	-2.04 to -0.87
Path A		
Maternal grandmother breastfed	-1.66	-2.36 to -0.96
Path B and Path C'		
Maternal grandmother breastfed	0.88	0.36 to 1.39
Black	-1.19	-1.80 to -0.58
Breastfeeding postnatal intent		
Path C		
Black	-1.26	-1.80 to -0.71
Path A		
Maternal grandmother breastfed	-1.32	-2.04 to -0.59
Paternal grandmother breastfed	-1.14	-1.81 to -0.47
Path B and Path C'		
Maternal grandmother breastfed	1.06	0.43 to 1.69
Paternal grandmother breastfed	0.72	0.19 to 1.24
Black	-0.78	-1.37 to -0.19
Breastfeeding duration		
Path C		
Black	-3.03	-5.16 to -0.90
Path A		
Married	-0.08	-0.15 to -0.02
Maternal grandmother breastfed	-0.17	-0.24 to -0.11
Path B and Path C'		
Married	7.25	4.92 to 9.58
Maternal grandmother breastfed	4.47	2.50 to 6.43
Black	0.11	-2.02 to 2.25

In these models, black mothers were coded as 0, and English-speaking Hispanic mothers were coded as 1.

intended, initiated, and maintained breastfeeding to a lesser degree than white mothers. Lower levels of breastfeeding initiation and postnatal intent among black mothers compared with white mothers were fully mediated by demographic factors. This finding is not surprising given that black women had higher rates of poverty and lower levels of education and marriage, variables that predicted lower rates of breastfeeding initiation and postnatal intent in the overall sample. Breastfeeding duration disparities between black and white women, however, were not fully explained by using demographic factors.

Poverty did not significantly mediate differences in duration between black and white mothers as it did for initiation and postnatal intent. Poverty may act as a proxy for in-hospital formula introduction, which more often occurs in

predominately black communities that may also be low-income.²⁷ In fact, the use of in-hospital formula feeding played the most important role for duration. Black mothers' newborns were much more likely to be fed formula in the hospital than newborns of white mothers. This difference was not explained by higher rates of breastfeeding intent and initiation in white mothers. Our finding echoes reports from the Centers for Disease Control and Prevention that documented higher rates of supplemental feeding in hospitals serving black communities. In-hospital supplementation of formula prohibits establishing a pattern of exclusive breastfeeding early on, which has been shown to hinder breastfeeding outcomes postdischarge.²⁸ Our study suggests that if only hospital formula introduction were eliminated, the black/white gap in breastfeeding duration could be reduced by

~1.8 weeks or 20% of the overall difference.

Consistent with notions that cultural norms regarding breastfeeding practices drive the effect of acculturation/immigrant status on breastfeeding outcomes, Spanish-speaking Hispanic women were more likely to have a family history of breastfeeding compared with white and English-speaking Hispanic women. Maternal family history of breastfeeding fully mediated the initiation disparity between white and both Spanish- and English-speaking Hispanic mothers. Racial/ethnic differences in maternal age and education fully explained disparities in duration between white and English-speaking Hispanic mothers. No mediators were found for postnatal intent or duration among Spanish-speaking Hispanic and white mothers, which speaks to previous evidence of the Hispanic paradox in US breastfeeding rates.²⁹ This paradox is a phenomenon in which Hispanic people in the United States experience good health outcomes despite low SES and common risk factors, particularly among recent immigrants.³⁰ Comparable duration of breastfeeding between white and Spanish-speaking Hispanic women in our sample suggests that breastfeeding norms of Spanish speakers' native countries³¹ may overcome adverse effects of low SES that characterizes this less acculturated group in the United States. It is also notable that no significant racial/ethnic differences were found in the belief that "breast is best" or maternal employment at 1 month postpartum, because both factors have been hypothesized to mediate racial/ethnic breastfeeding.³² It is possible, however, that the oversampling of low SES participants of all racial/ethnic groups in this study restricted variability on these factors, leading to null results.

Family history of breastfeeding, especially from the mother's side,

bolsters breastfeeding outcomes, and this intergenerational factor mediates racial/ethnic breastfeeding disparities. This finding complements previous research which found that markers of acculturation, such as language spoken at home,⁸ predict substantial differences in breastfeeding behavior.^{9,33} In addition to family history of breastfeeding, higher rates of coresident fathers and marriage among Hispanic women accounted for some of the breastfeeding disparities between black and both English- and Spanish-speaking Hispanic women. This finding supports previous research showing the important role that the infant's father can play in fostering positive breastfeeding outcomes.³⁴

The current study had several limitations. We cannot establish causality; interventions are needed to test whether decreasing the introduction of formula in hospitals serving black communities, for example, would reduce disparities

between black and white women in breastfeeding duration. Second, this study included an overrepresentation of mothers of low SES, and the results may not be generalizable to understanding racial/ethnic disparities in breastfeeding rates between white, black, and Hispanic mothers among the middle- or upper-class. Finally, future research is needed to explore additional potential mediators because many racial/ethnic disparities in breastfeeding were not fully explained by our analyses.

CONCLUSIONS

Large ethnic/racial gaps in breastfeeding rates exist in the United States among black, white, and Hispanic infants and their mothers. In line with previous speculations, intergenerational experience with breastfeeding seems to be an important predictor of infant feeding behaviors and helps explain why Hispanic women have

better breastfeeding outcomes. Just as importantly, the negative impact of hospital infant formula feeding practices on black women warrants strong consideration.³⁵ Changing hospital relationships with formula companies that relinquish fiscal dependency on free formula is a notorious challenge for many hospitals that strive to improve breastfeeding outcomes.³⁶ Change is possible, however, as evidenced by the emergence of "baby-friendly hospitals," some of which serve areas with largely low-income and minority patient populations.³⁷ This active inquiry into functional variables that can yield healthier outcomes for infants and mothers has produced new findings and may support planned interventions at the levels of individual families and health care providers.

ABBREVIATION

SES: socioeconomic status

and critically reviewed the initial manuscript; Dr Raju provided *Eunice Kennedy Shriver* National Institute of Child Health and Human Development leadership for the Community and Child Health Network and critically reviewed the initial manuscript; Dr Shalowitz helped conceptualize the study, helped design data collection instruments, coordinated and supervised data collection, and critically reviewed and gave feedback on the initial and revised manuscripts; and all authors approved the final manuscript as submitted.

DOI: 10.1542/peds.2015-2388

Accepted for publication May 11, 2016

Address correspondence to Chelsea O. McKinney, PhD, MPH, NorthShore University HealthSystem Department of Pediatrics and Research Institute, 1001 University Place, Suite 348, Evanston, IL 60201. E-mail: chelseaomckinney@gmail.com

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

Copyright © 2016 by the American Academy of Pediatrics

FINANCIAL DISCLOSURE: The authors have indicated they have no financial relationships relevant to this article to disclose.

FUNDING: All phases of this study were supported by grants to the Community and Child Health Network through cooperative agreements with the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development (UHD44207, U HD44219, UHD44226, U HD44245, U HD44253, U HD54791, U HD54019, UHD44226-05S1, U HD44245-06S1, and R03 HD59584) and the National Institute for Nursing Research (U NR008929). Funded by the National Institutes of Health (NIH).

POTENTIAL CONFLICT OF INTEREST: The authors have indicated they have no potential conflicts of interest to disclose.

REFERENCES

1. American Academy of Pediatrics Section on Breastfeeding. Policy statement: breastfeeding and the use of human milk. *Pediatrics*. 2012;129(3). Available at: www.pediatrics.org/cgi/content/full/129/3/e827
2. Centers for Disease Control and Prevention. Breastfeeding among US children born 2002–2012, national immunization surveys. Available at: www.cdc.gov/breastfeeding/data/nis_data/rates-any-exclusive-bf-socio-dem-2012.htm
3. Bartick M, Reinhold A. The burden of suboptimal breastfeeding in the United States: a pediatric cost analysis.

- Pediatrics*. 2010;125(5). Available at: www.pediatrics.org/cgi/content/full/125/5/e1048
4. Bartick MC, Stuebe AM, Schwarz EB, Luongo C, Reinhold AG, Foster EM. Cost analysis of maternal disease associated with suboptimal breastfeeding. *Obstet Gynecol*. 2013;122(1):111–119
 5. Grummer-Strawn LM, Shealy KR. Progress in protecting, promoting, and supporting breastfeeding: 1984-2009. *Breastfeed Med*. 2009;4(suppl 1):S31–S39
 6. Centers for Disease Control and Prevention (CDC). Racial and socioeconomic disparities in breastfeeding—United States, 2004. *MMWR Morb Mortal Wkly Rep*. 2006;55(12):335–339
 7. Li R, Grummer-Strawn L. Racial and ethnic disparities in breastfeeding among United States infants: Third National Health and Nutrition Examination Survey, 1988-1994. *Birth*. 2002;29(4):251–257
 8. Berry JW. Immigration, acculturation, and adaptation. *Appl Psychol*. 1997;46(1):5–34
 9. Singh GK, Kogan MD, Dee DL. Nativity/immigrant status, race/ethnicity, and socioeconomic determinants of breastfeeding initiation and duration in the United States, 2003. *Pediatrics*. 2007;119(suppl 1):S38–S46
 10. US Department of Health and Human Services, Health Resources and Services Administration. *Women's Health USA 2011*. Rockville, MD: US Department of Health and Human Services; 2011
 11. Ryan AS, Zhou W, Arensberg MB. The effect of employment status on breastfeeding in the United States. *Womens Health Issues*. 2006;16(5):243–251
 12. Sebelius K. *Annual Update of the HHS Poverty Guidelines*. Washington, DC: US Department of Health and Human Services; 2011
 13. Kiernan K, Pickett KE. Marital status disparities in maternal smoking during pregnancy, breastfeeding and maternal depression. *Soc Sci Med*. 2006;63(2):335–346
 14. Jones JR, Kogan MD, Singh GK, Dee DL, Grummer-Strawn LM. Factors associated with exclusive breastfeeding in the United States. *Pediatrics*. 2011;128(6):1117–1125
 15. Pilkauskas NV. Breastfeeding initiation and duration in coresident grandparent, mother and infant households. *Matern Child Health J*. 2014;18(8):1955–1963
 16. Dennis CL, McQueen K. The relationship between infant-feeding outcomes and postpartum depression: a qualitative systematic review. *Pediatrics*. 2009;123(4). Available at: www.pediatrics.org/cgi/content/full/123/4/e736
 17. Cox JL, Holden JM, Sagovsky R. Detection of postnatal depression. Development of the 10-item Edinburgh Postnatal Depression Scale. *Br J Psychiatry*. 1987;150:782–786
 18. Liu J, Rosenberg KD, Sandoval AP. Breastfeeding duration and perinatal cigarette smoking in a population-based cohort. *Am J Public Health*. 2006;96(2):309–314
 19. Callen J, Pinelli J. A review of the literature examining the benefits and challenges, incidence and duration, and barriers to breastfeeding in preterm infants. *Adv Neonatal Care*. 2005;5(2):72–88, quiz 89–92
 20. Bentley ME, Dee DL, Jensen JL. Breastfeeding among low income, African-American women: power, beliefs and decision making. *J Nutr*. 2003;133(1):305S–309S
 21. Cox KN, Giglia RC, Binns CW. The influence of infant feeding attitudes on breastfeeding duration: evidence from a cohort study in rural Western Australia. *Int Breastfeed J*. 2015;10(25):25
 22. Ryan AS, Zhou W. Lower breastfeeding rates persist among the Special Supplemental Nutrition Program for Women, Infants, and Children participants, 1978-2003. *Pediatrics*. 2006;117(4):1136–1146
 23. Centers for Disease Control and Prevention (CDC). Breastfeeding-related maternity practices at hospitals and birth centers—United States, 2007. *MMWR Morb Mortal Wkly Rep*. 2008;57(23):621–625
 24. Raudenbush SW, Bryk AS. *Hierarchical Linear Models: Applications and Data Analysis Methods*. Thousand Oaks, CA: Sage Publications; 2002
 25. Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *J Pers Soc Psychol*. 1986;51(6):1173–1182
 26. Preacher KJ, Hayes AF. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behav Res Methods*. 2008;40(3):879–891
 27. Lind JN, Perrine CG, Li R, Scanlon KS, Grummer-Strawn LM; Centers for Disease Control and Prevention (CDC). Racial disparities in access to maternity care practices that support breastfeeding—United States, 2011. *MMWR Morb Mortal Wkly Rep*. 2014;63(33):725–728
 28. UNICEF/WHO. Baby-friendly hospital initiative: revised, updated and expanded for integrated care, section 1, background and implementation, preliminary version. Available at: www.who.int/nutrition/topics/BFHI_Revised_Section1.pdf. Accessed May 5, 2008
 29. Kimbro RT, Lynch SM, McLanahan S. The influence of acculturation on breastfeeding initiation and duration for Mexican-Americans. *Popul Res Policy Rev*. 2008;27(2):183–199
 30. Franzini L, Ribble JC, Keddie AM. Understanding the Hispanic paradox. *Ethn Dis*. 2001;11(3):496–518
 31. Lauer JA, Betrán AP, Victora CG, de Onís M, Barros AJ. Breastfeeding patterns and exposure to suboptimal breastfeeding among children in developing countries: review and analysis of nationally representative surveys. *BMC Med*. 2004;2(26):26
 32. Centers for Disease Control and Prevention (CDC). Progress in increasing breastfeeding and reducing racial/ethnic differences—United States, 2000-2008 births. *MMWR Morb Mortal Wkly Rep*. 2013;62(5):77–80

33. Topolyan I, Wang Q, Xu X. Peer effects in breastfeeding: evidence from the IFPS II Study. *Review of Economics and Finance*. 2015;5(3):33–44
34. Pisacane A, Continisio GI, Aldinucci M, D'Amora S, Continisio P. A controlled trial of the father's role in breastfeeding promotion. *Pediatrics*. 2005;116(4). Available at: www.pediatrics.org/cgi/content/full/116/4/e494
35. Radford A, Southall DP. Successful application of the baby-friendly hospital initiative contains lessons that must be applied to the control of formula feeding in hospitals in industrialized countries. *Pediatrics*. 2001;108(3):766–768
36. Merewood A, Philipp BL. Becoming baby-friendly: overcoming the issue of accepting free formula. *J Hum Lact*. 2000;16(4): 279–282
37. Merewood A, Philipp BL. Implementing change: becoming baby-friendly in an inner city hospital. *Birth*. 2001;28(1):36–40

Racial and Ethnic Differences in Breastfeeding

Chelsea O. McKinney, Jennifer Hahn-Holbrook, P. Lindsay Chase-Lansdale, Sharon L. Ramey, Julie Krohn, Maxine Reed-Vance, Tonse N.K. Raju, Madeleine U. Shalowitz and on behalf of the Community Child Health Research Network
Pediatrics originally published online July 12, 2016;

Updated Information & Services	including high resolution figures, can be found at: http://pediatrics.aappublications.org/content/early/2016/07/11/peds.2015-2388
References	This article cites 30 articles, 8 of which you can access for free at: http://pediatrics.aappublications.org/content/early/2016/07/11/peds.2015-2388#BIBL
Subspecialty Collections	This article, along with others on similar topics, appears in the following collection(s): Nutrition http://www.aappublications.org/cgi/collection/nutrition_sub Breastfeeding http://www.aappublications.org/cgi/collection/breastfeeding_sub
Permissions & Licensing	Information about reproducing this article in parts (figures, tables) or in its entirety can be found online at: http://www.aappublications.org/site/misc/Permissions.xhtml
Reprints	Information about ordering reprints can be found online: http://www.aappublications.org/site/misc/reprints.xhtml

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™



PEDIATRICS®

OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

Racial and Ethnic Differences in Breastfeeding

Chelsea O. McKinney, Jennifer Hahn-Holbrook, P. Lindsay Chase-Lansdale, Sharon L. Ramey, Julie Krohn, Maxine Reed-Vance, Tonse N.K. Raju, Madeleine U. Shalowitz and on behalf of the Community Child Health Research Network

Pediatrics originally published online July 12, 2016;

The online version of this article, along with updated information and services, is located on the World Wide Web at:

<http://pediatrics.aappublications.org/content/early/2016/07/11/peds.2015-2388>

Pediatrics is the official journal of the American Academy of Pediatrics. A monthly publication, it has been published continuously since 1948. Pediatrics is owned, published, and trademarked by the American Academy of Pediatrics, 141 Northwest Point Boulevard, Elk Grove Village, Illinois, 60007. Copyright © 2016 by the American Academy of Pediatrics. All rights reserved. Print ISSN: 1073-0397.

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™

