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Maternal Birthplace and Breastfeeding Initiation Among Term and Preterm Infants: A Statewide Assessment for Massachusetts

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ABSTRACT

OBJECTIVES. Among premature infants, formula feeding increases the risk for necrotizing enterocolitis, delayed brainstem maturation, decreased scoring on cognitive and developmental tests, and delayed visual development. With this in mind, many interventions are designed to increase breast milk consumption in preterm infants. Breastfeeding initiation rates among US premature infants are not collected nationally, however, and published data on breastfeeding rates in this population are limited. In addition, national surveys calculate breastfeeding rates among term infants according to maternal race/ethnicity, but maternal birthplace is not recorded. This is likely to be important, because breastfeeding is the cultural norm in the countries of origin for many non-US-born US residents. Massachusetts has a diverse racial/ethnic population, including many non-US-born women. The goals of this study were to compare breastfeeding initiation rates among preterm and term infants in Massachusetts in 2002 and to determine the effect of maternal race/ethnicity and birthplace on breastfeeding initiation rates among term and preterm infants.

METHODS. Massachusetts Community Health Information Profile, an online public health database that was created by the Massachusetts Department of Public Health, includes breastfeeding initiation data that are obtained from the electronic birth certificate, which we used to compare breastfeeding rates among preterm and term infants. Birth-linked demographics and data that also were accessed were maternal age, race/ethnicity, birthplace, and health insurance (public or private) as an indicator of socioeconomic status and infant's gestational age. We assessed the association between breastfeeding initiation and maternal birthplace, as well as race/ethnicity and the other potential confounders, using logistic regression.

RESULTS. There were 80 624 births in Massachusetts in 2002, and 8.2% (6611) of newborns had a gestational age <37 weeks. The state's overall breastfeeding initiation rate was 74.6%. We excluded records of mothers who were younger than 15 years and older than 39 years, nonsingleton births, infants with a gesta-

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Key Words

breastfeeding, premature, preterm infants, maternal birthplace, Massachusetts

Abbreviations

CDC—Centers for Disease Control and Prevention

MassCHIP—Massachusetts Community Health Information Profile

GA—gestational age

OR—odds ratio

AOR—adjusted odds ratio

CI—confidence interval

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tional age <24 weeks and >42 weeks, and records with missing data. Of the total births in Massachusetts, 67 884 (84%) met inclusion criteria for this study. Breastfeeding initiation rates were lowest among preterm infants of the youngest gestational ages. Breastfeeding initiation was 76.8% among term infants born at 37 to 42 weeks, 70.1% among infants born at 32 to 36 weeks, and 62.9% among infants born at 24 to 31 weeks. In univariate analysis, among preterm infants, a lower proportion of US-born black, Asian, and Hispanic mothers initiated breastfeeding than US-born white mothers; non-US-born black and non-US-born Hispanic mothers had the highest breastfeeding initiation rates. Among term infants, US-born black mothers had the lowest initiation rates, and non-US-born black and non-US-born Hispanic mothers had the highest. In multivariate logistic regression, however, after controlling for mother's age, race, birthplace, and insurance, US-born white mothers were least likely to breastfeed either term or preterm infants when compared with any other racial/ethnic group, including US-born black mothers. The likelihood that non-US-born Hispanic mothers would breastfeed was almost 8 times greater than that for US-born white mothers for a preterm infant and almost 10 times greater for a term infant. In multivariate logistic regression analysis stratified by gestational age for both preterm and term infants, older mothers and mothers with private health insurance were most likely to breastfeed.

CONCLUSIONS. In Massachusetts, preterm infants were less likely to receive breast milk than term infants, and the likelihood of receiving breast milk was lowest among the youngest preterm infants. In multivariate logistic regression, mothers who were born outside the United States were more likely than US-born mothers to breastfeed either term or preterm infants in all racial and ethnic groups. In an unexpected finding, US-born white mothers were less likely to breastfeed term or preterm infants than US-born black mothers or mothers of any other racial or ethnic group.

BREASTFEEDING IS THE optimal form of infant nutrition.¹ Among premature infants, formula feeding increases the risk for necrotizing enterocolitis,² delayed brainstem maturation,³ decreased scoring on cognitive and developmental tests,⁴⁻⁷ sepsis,⁸ and delayed visual development.^{9,10} With this in mind, many interventions are designed to increase breast milk consumption among preterm infants.¹¹⁻¹⁶ However, breastfeeding rates among US preterm infants are not available; the national surveys^{17,18} that report annual breastfeeding rates do not report gestational age. Although data are collected in states where gestational age and breastfeeding are recorded on the birth certificate, published work is restricted to a few small studies.¹⁹⁻²¹ One study reviewed

151 charts of infants who were ≤ 34 weeks' gestational age and admitted to the NICU in a rural Illinois hospital and found a breastfeeding initiation rate of 49.7%, with no significant association with maternal race/ethnicity.¹⁹ A study by Geraghty et al²⁰ examined breastfeeding rates among term and preterm infants, but the research was restricted to multiple births. In addition, although the Centers for Disease Control and Prevention (CDC) Pregnancy Risk Assessment Monitoring System collects both breastfeeding rates information^{22,23} and data on gestational age,²⁴ we have not been able to identify any Pregnancy Risk Assessment Monitoring System–based studies that examined both together.

National surveys calculate breastfeeding rates among term infants according to maternal race/ethnicity, but maternal birthplace is not recorded. Maternal birthplace likely is important because breastfeeding is the cultural norm in the countries of origin for many non-US-born US residents. The goals of this study were to compare breastfeeding initiation rates among preterm and term infants in Massachusetts in 2002 and to investigate the role of maternal birthplace and race/ethnicity on breastfeeding initiation.

METHODS

Massachusetts Community Health Information Profile (MassCHIP)²⁵ is a public health database that was created by the Massachusetts Department of Public Health and provides online public access to 32 data sets on health outcomes, program utilization, and demographic indicators at the local community and statewide levels. We created a custom report using the Massachusetts natality (vital records) database, accessed through MassCHIP, for 2002, the most recent year available in 2005 when the study began. Breastfeeding data in Massachusetts are obtained from the mother by the birthing hospital during the postpartum stay and entered into the electronic birth certificate. Each hospital is responsible for creating a protocol for obtaining these data. The birth certificate question is, "Are you breastfeeding, or do you intend to breastfeed? Yes or no." The Massachusetts Department of Public Health subsequently enters the birth certificate data into the MassCHIP database (masschip.state.ma.us).

Birth-linked demographics and data also accessed through MassCHIP were maternal age (categorized as 15–19, 20–29, or 30–39 years), race/ethnicity (categorized as white/non-Hispanic, black/non-Hispanic, Hispanic, or Asian/Pacific Islander/non-Hispanic), maternal birthplace (categorized as US-born [50 states; Washington, DC; and Puerto Rico] or non-US-born), health insurance (public or private) as an indicator of socioeconomic status, and infant's gestational age (GA; categorized as 24–31, 32–36, or 37–42 weeks). Race/ethnicity and birthplace were recoded into a single variable for analysis. For creation of a data set with broad

applicability, certain exclusions were made. We excluded mothers who were younger than 15 years (73) and older than 39 years (3085), nonsingleton births (3951), births to Native Americans (167), and infants with a GA <24 weeks (182) and >42 weeks (21). Native Americans were excluded because the number was too small to analyze, and infants at extreme ends of the gestational age range were excluded because of potential medical complications that might affect breastfeeding. We used health insurance as a marker for socioeconomic status; therefore, we excluded insurance types that did not clarify income (non-Medicaid/Medicare government insurance [2090] and self-pay [471]). An additional 4064 records were excluded because 1 of the following variables was missing: maternal age (176), insurance status (1918), race (1530), or birthplace (93) or infant's GA (347). A total of 12 740 births (fewer than the sum of the individual categories, because some exclusions fell into >1 category) were excluded, leaving 67 884 births for analysis.

Descriptive analysis included frequencies. We first assessed breastfeeding initiation rates for preterm (24–36 weeks' GA) and term infants, overall, and stratified by maternal factors (age, race/ethnicity/birthplace, and insurance). We then assessed the association between GA (preterm 24–31 weeks, preterm 32–36 weeks, and term), first on a univariate basis and then adjusted for all other variables in the model. Finally, we used univariate and multivariate logistic regression to assess the role of maternal factors in predicting breastfeeding initiation. Data were analyzed using Stata/SE 8.2 for Windows (Stata Corp, College Station, TX).

RESULTS

On the basis of MassCHIP data for 2002, there were 80 624 births in Massachusetts; 8.2% (6611) of new-

borns had a gestational age <37 weeks, and the overall breastfeeding initiation rate for Massachusetts in 2002 was 74.6%. Among the 67 884 births that met inclusion for this analysis, the initiation rate was 76.4%. Preterm infants with the youngest gestational ages breastfed the least: breastfeeding initiation was 76.8% among term infants (≥ 37 –42 weeks), 70.1% among infants who were born at 32 to 36 weeks, and 62.9% among infants who were born at 24 to 31 weeks. Demographic information and breastfeeding initiation rates by gestational age are presented in Table 1.

Among preterm infants, a lower proportion of US-born blacks, Asian, and Hispanic mothers initiated breastfeeding than US-born white mothers, whereas non-US-born black and non-US-born Hispanic mothers had the highest breastfeeding initiation rates (Table 2). Among term infants, US-born black mothers had the lowest initiation, followed closely by US-born white and Hispanic mothers. Again, non-US-born black and non-US-born Hispanic mothers had the highest initiation rates for term infants. For both preterm and term infants, breastfeeding initiation increased with increasing maternal age and private insurance status.

In multivariate analysis (Table 3), controlling for mother's age, insurance, race, and birthplace, infants who were born between 32 and 36 weeks had an adjusted odds ratio (AOR) of 0.73 (95% confidence interval [CI]: 0.68–0.79) for breastfeeding compared with term infants, and infants who were born between 24 and 31 weeks had an AOR of 0.53 (95% CI: 0.44–0.64). Although US-born black mothers were least likely to initiate breastfeeding in descriptive analysis and univariate logistic regression, once maternal age, insurance status, and gestational age were controlled for, US-born black mothers were statistically significantly more likely

TABLE 1 Population Sample Breastfeeding and Maternal Factors Stratified According to GA

	Young Preterm (24–31 wk; <i>N</i> = 534), <i>n</i> (%)	Older Preterm (32–36 wk; <i>N</i> = 3367), <i>n</i> (%)	Term (37–42 wk; <i>N</i> = 63 983), <i>n</i> (%)
Breastfeeding initiated	336 (62.9)	2361 (70.1)	49 149 (76.8)
Maternal age, y			
15–19	68 (12.7)	300 (8.9)	3603 (5.6)
20–29	204 (38.2)	1308 (38.9)	25 050 (39.2)
30–39	262 (49.1)	1759 (52.2)	35 330 (55.2)
Insurance status			
Private	324 (60.7)	2240 (66.5)	46 665 (72.9)
Public	210 (39.3)	1127 (33.5)	17 318 (27.1)
Maternal race/ethnicity and birthplace			
White, US born	285 (53.4)	2092 (62.1)	42 480 (66.4)
White, non-US born	23 (4.3)	190 (5.6)	4936 (7.7)
Asian, US born	3 (0.6)	37 (1.1)	438 (0.7)
Asian, non-US born	36 (6.7)	204 (6.1)	4112 (6.4)
Black, US born	69 (13)	225 (6.7)	2410 (3.8)
Black, non-US born	30 (5.6)	151 (4.5)	2077 (3.3)
Hispanic, US born	58 (11)	286 (8.0)	3905 (6.1)
Hispanic, non-US born	30 (5.6)	200 (5.9)	3625 (5.7)

TABLE 2 Breastfeeding Initiation According to Maternal Factors, Stratified by GA

	Younger Preterm Infants (24–31 wk GA; N = 534), n (%) Breastfeeding	Older Preterm Infants (32–36 weeks GA; N = 3367), n (%) Breastfeeding	Term Infants (37–42 weeks GA; N = 63 983), n (%) Breastfeeding
Maternal age, y			
15–19	30 (44.1)	168 (56.0)	2316 (64.3)
20–29	128 (62.8)	879 (67.2)	18 348 (73.3)
30–39	178 (67.9)	1314 (74.7)	28 485 (80.6)
Insurance status			
Private	232 (71.6)	1707 (76.2)	37 349 (80.0)
Public	104 (49.5)	654 (58.0)	11 800 (68.1)
Maternal race/ethnicity and birthplace			
White, US born	180 (63.2)	1408 (67.3)	31 249 (73.6)
White, non-US born	17 (73.9)	151 (79.5)	4362 (88.4)
Asian, US born	2 (66.7)	24 (64.9)	349 (79.7)
Asian, non-US born	22 (61.1)	161 (78.9)	3352 (81.5)
Black, US born	40 (58.0)	133 (59.1)	1696 (70.4)
Black, non-US born	21 (70.0)	125 (82.8)	1895 (91.2)
Hispanic, US born	29 (50.0)	178 (66.4)	2849 (73.0)
Hispanic, non-US born	25 (83.3)	181 (90.5)	3397 (93.7)
Overall	336 (62.9)	2361 (70.1)	49 149 (76.8)

TABLE 3 Results of Logistic Regression for Breastfeeding Initiation, Entire Sample

	Unadjusted OR (95% CI)	AOR (95% CI)
Maternal age, y		
15–19	Reference	Reference
20–29	1.56 (1.45–1.67)	1.17 (1.08–1.26)
30–39	2.36 (2.20–2.53)	1.55 (1.43–1.68)
Insurance status		
Private	Reference	Reference
Public	0.52 (0.50–0.54)	0.41 (0.39–0.43)
Maternal race/ethnicity and birthplace		
White, US born	Reference	Reference
White, non-US born	2.68 (2.46–2.92)	3.32 (3.04–3.63)
Asian, US born	1.33 (1.07–1.66)	1.70 (1.35–2.13)
Asian, non-US born	1.58 (1.46–1.71)	1.79 (1.65–1.94)
Black, US born	0.82 (0.75–0.89)	1.43 (1.30–1.56)
Black, non-US born	3.44 (2.99–3.97)	5.39 (4.67–6.23)
Hispanic, US born	0.95 (0.89–1.02)	1.83 (1.70–1.98)
Hispanic, non-US born	5.23 (4.60–5.96)	9.41 (8.24–10.8)
GA		
Term (37–42 wk)	Reference	Reference
Older preterm (32–36 wk)	0.71 (0.66–0.76)	0.73 (0.68–0.79)
Younger preterm (24–31 wk)	0.51 (0.43–0.61)	0.53 (0.44–0.64)

Unadjusted OR is the OR from univariate logistic regression; AOR is the OR from multivariate logistic regression. The multivariate model controls for all variables presented (maternal age, insurance status, race/ethnicity, and birthplace and gestational age of infant).

to breastfeed than US-born white mothers (AOR: 1.43; 95% CI: 1.30–1.56).

In multivariate logistic regression analysis stratified by gestational age (Table 4) for both preterm and term infants, older mothers and mothers with private health insurance were most likely to breastfeed. For both term and preterm infants, US-born white mothers were least likely and non-US-born Hispanic mothers were most likely to breastfeed. The effect of prematurity on breast-

feeding initiation seemed to be greatest among non-US-born black mothers (term infants had an AOR of 5.81 compared with the referent group, and preterm infants had an AOR of 3.10; 95% CI: 2.09–4.61).

DISCUSSION

On the basis of 67 884 Massachusetts births from 2002, we found that when controlling for maternal age, insurance status, race, and birthplace, preterm infants in Massachusetts had lower breastfeeding rates than term infants, and the most premature infants were least likely to receive breast milk. We also found that US-born mothers in each racial/ethnic group were less likely to breastfeed both term and preterm infants than non-US-born mothers. The finding that, after controlling for confounding, US-born white mothers were less likely to breastfeed than US-born black mothers was unanticipated.

Low breastfeeding rates among premature infants are of particular concern given the importance of breast milk for these infants.^{2–7,9,10} However, these rates are not unexpected and have been reported in smaller studies.^{19–21} Breastfeeding a preterm infant is more complex than breastfeeding a term infant, requiring additional knowledge, support, and equipment such as a breast pump. Because less affluent mothers are less likely to be able to afford a breast pump²⁶ and may have additional practical problems, such as transportation to the NICU, low breastfeeding rates among poorer mothers of preterm infants might be anticipated.

One might expect, however, that considerable proportions of immigrant mothers would be affected by similar issues as poor mothers, such as lack of access to breast pumps. We found that non-US-born mothers had significantly higher breastfeeding initiation rates than US-born mothers for preterm as well as for term infants.

TABLE 4 Results of Logistic Regression: Factors That Are Associated With Breastfeeding Initiation, Stratified According to GA

	Preterm Infants (Born 24–36 wk; N = 3901)		Term Infants (Born 37–42 wk; N = 63 983)	
	Unadjusted OR (95% CI)	AOR (95% CI)	Unadjusted OR (95% CI)	AOR (95% CI)
Maternal age, y				
15–19	Reference	Reference	Reference	Reference
20–29	1.71 (1.36–2.16)	1.50 (1.17–1.92)	1.52 (1.41–1.64)	1.14 (1.05–1.24)
30–39	2.42 (1.93–3.04)	1.70 (1.31–2.20)	2.31 (2.15–2.49)	1.53 (1.41–1.66)
Insurance status				
Private	Reference	Reference	Reference	Reference
Public	0.42 (0.37–0.49)	0.35 (0.29–0.41)	0.53 (0.51–0.55)	0.41 (0.39–0.43)
Maternal race/ethnicity and birthplace				
White, US born	Reference	Reference	Reference	Reference
White, non-US born	1.85 (1.32–2.61)	2.40 (1.69–3.42)	2.73 (2.50–2.99)	3.39 (3.10–3.72)
Asian, US born	0.92 (0.48–1.78)	1.28 (0.64–2.56)	1.41 (1.12–1.78)	1.75 (1.38–2.23)
Asian, non-US born	1.60 (1.17–2.17)	1.85 (1.35–2.55)	1.59 (1.46–1.72)	1.79 (1.65–1.94)
Black, US born	0.71 (0.55–0.91)	1.27 (0.97–1.66)	0.85 (0.78–0.93)	1.44 (1.31–1.59)
Black, non-US born	2.07 (1.42–3.03)	3.10 (2.09–4.61)	3.74 (3.21–4.36)	5.81 (4.97–6.80)
Hispanic, US born	0.86 (0.68–1.10)	1.73 (1.32–2.26)	0.97 (0.90–1.04)	1.84 (1.70–1.99)
Hispanic, non-US born	4.26 (2.77–6.56)	7.61 (4.88–11.9)	5.35 (4.67–6.13)	9.60 (8.35–11.0)

Unadjusted OR is the OR from univariate logistic regression; AOR is the OR from multivariate logistic regression. The multivariate model controls for all variables presented (maternal age, insurance status, race/ethnicity, and birthplace).

For example, non-US-born black mothers were 3.1 times more likely to initiate breastfeeding in their preterm infants than US-born white mothers, and non-US-born Hispanic mothers were 7.6 times more likely.

Breastfeeding rates among black mothers of preterm infants are particularly noteworthy because black infants are almost twice as likely to be born preterm as white infants²⁷ (a trend that was apparent in our study [Table 1]). In addition to our findings on non-US-born black mothers and infants, we note that, among both preterm and term infants, US-born black mothers had the lowest breastfeeding initiation rates, but after controlling for maternal factors and gestational age, US-born black mothers had higher breastfeeding initiation rates than US-born white mothers. Black mothers are reported consistently at the national level as having the lowest breastfeeding rates.^{18,28} However, these data do not consider birthplace and are not adjusted for confounding.

Our results regarding maternal birthplace expand on those published in a recent, smaller study, which analyzed data on 4207 mothers and found that, looking at all ethnicities combined, US-born mothers had an 85% reduction in the odds of initiating breastfeeding (OR: 0.150; $P < .01$) and a 66% reduction in the odds of breastfeeding at 6 months (OR: 0.344; $P < .01$) when compared with non-US-born mothers. That study also found that each additional year of living in the United States was associated with a 4% decrease in the odds of initiating breastfeeding (OR: 0.96; $P < .01$) and a 3% decrease in the odds of breastfeeding at 6 months (OR: 0.97; $P < .05$). Given these findings, we suggest that national surveys, which currently report breastfeeding rates only on the basis of race, need consistently to consider maternal place of birth.

Because rates of breastfeeding are so relatively high in

certain non-US-born groups (Table 3), we examined the makeup of non-US-born Massachusetts residents. According to the 2000 US census, 772 983 (12%) Massachusetts residents were born outside the United States. Within this group, the largest proportions were from Europe (32.2%), Latin America (30.0%; comprising Caribbean [14.5%], South America [9.3%], and Central America [6.5%]), and Asia (26.1%).²⁵

One possible limitation of the study is whether exclusions led to outcomes that were not representative of the entire state. Exclusions were made to limit outlying cases that might affect breastfeeding initiation, such as extremely preterm infants with high mortality (<24 weeks). We also excluded multiple births, which are common in preterm deliveries, but with the limited data available, any reasons for variation in breastfeeding rates within this group would be difficult to control for. It also is a limitation of this study that we do not have information on factors that are known to affect breastfeeding initiation, such as substance abuse or maternal illness. These variables may be responsible in part for the low rates among preterm infants, rather than prematurity alone.

The main limitation of the study, however, lies on our reliance on breastfeeding rate data from the electronic birth certificate. In this regard, we are reassured by the knowledge that the 2002 breastfeeding initiation rate obtained from the Massachusetts birth certificate (75%)²⁸ is comparable to the 2002 initiation rate for Massachusetts described by the 2 prime sources of breastfeeding rate data nationally: the Ross Mothers' Survey (73%)¹⁸ and the CDC National Immunization Survey (74%),²⁸ which use different data collection methods. Generally, birth certificate data are widely used in research, and published studies that have used

such data include reports from the CDC's Morbidity and Mortality Weekly.^{17,20,29-35} Other recently published studies specifically used Massachusetts birth certificate data.^{36,37}

Hypothetically, the wording of the question ("Are you breastfeeding, or do you intend to breastfeed?") may lead to misleading answers, from mothers of preterm infants in particular, because barriers to breastfeeding a preterm infant may be too difficult for mothers to overcome, even if they state intent to breastfeed. However, our study found a significantly lower rate of breastfeeding/"intent to breastfeed" among mothers of preterm infants than among mothers of term infants. If, nonetheless, more mothers of preterm than term infants are stating intent than are actually breastfeeding, then our study is underestimating the gap between breastfeeding rates of preterm and term infants. Exaggeration of breastfeeding in mothers of preterm infants specifically would inflate the preterm breastfeeding rate and bring it closer to the term rate. Therefore, we do not believe that our results exaggerate the difference between breastfeeding initiation rates in term and preterm infants.

CONCLUSIONS

According to data from the electronic birth certificate, breastfeeding initiation rates among preterm infants in Massachusetts are lower than rates among term infants. In addition, breastfeeding initiation rates are considerably higher among non-US-born mothers, for both term and preterm infants, than among US-born mothers. After adjustment for confounding variables, US-born white mothers have the lowest breastfeeding initiation rates, lower even than those of US-born black mothers. The data on higher breastfeeding rates in non-US-born mothers are consistent with other, smaller studies, but our findings on US-born black mothers are unexpected and differ from previous studies and traditional concepts. Additional investigation into breastfeeding practices related to race/ethnicity and maternal birthplace, using additional data sources, is warranted. Measuring breastfeeding rates in terms of race alone is misleading: maternal birthplace must be considered as a significant explanatory factor when performing breastfeeding research or designing interventions.

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