

Clinical Communications

Perceived food allergy, sensitivity, or intolerance and its impact on breastfeeding practices

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Clinical Implications

- Mothers' perceptions regarding infants' adverse reactions to food may impact breastfeeding duration. Adverse reactions to foods were associated with earlier breastfeeding cessation, yet reactions to foods via breast milk were associated with longer breastfeeding duration than infants with no food concerns.

TO THE EDITOR:

Major medical societies recommend exclusive breastfeeding for the first 6 months of life, solid food introduction no sooner than 4 to 6 months, and a well-balanced, varied maternal diet.¹⁻⁵ Food-related adverse reactions are commonly reported in infants^{6,7}; symptoms may include cutaneous eruptions (ie, eczematous changes, urticaria, angioedema), gastrointestinal complaints, and, less commonly, anaphylaxis.⁸ These reactions to breastfeeding or solid foods are important to maternal and infant health as they may impact maternal diet, timing/selection of solid foods, and breastfeeding duration. However, little is known about how suspected allergic disease relates to these practices; thus, we sought to examine the association of reported infant food problems and breastfeeding duration.

Data were analyzed from the Infant Feeding Practices Study II, a longitudinal survey of US mothers administered by the US Food and Drug Administration (FDA) from 2005 to 2007. Mothers completed prenatal, neonatal, and monthly postnatal

surveys. Institutional review board approvals were obtained at the FDA and our local institution. For this study, 2577 mothers who indicated that they initiated breastfeeding and provided information on food problems were included. Mothers were asked to report ongoing breastfeeding at each postnatal survey or the infant's age at breastfeeding cessation. They were also asked to report on their infants' food reactions ("Has your baby ever had problems caused by food, such as an allergic reaction, sensitivity, or intolerance?") at 4, 9, and 12 months, and, if applicable, the cause of the food problems ("Food your baby ate including infant formula" and/or "Food your baby was exposed to through breast milk because of something you ate"). Infants were classified as: (1) no problems with food, (2) problems due to something the infant ate (direct exposure), (3) problems due to something the infant was exposed to through breast milk (indirect exposure), or (4) problems due to both sources (direct and indirect exposure). Age of earliest reported food problems was identified, as well as characterization of food problems, which included concern for eczema, colic, and gastrointestinal symptoms; anaphylaxis was not a response option in the original questionnaire. Mothers reported if cow's milk specifically was a problem, and also if their children were ultimately diagnosed with an allergy to food(s).

Kaplan-Meier curves with breastfeeding cessation as the event of interest were compared between groups; mean breastfeeding duration was estimated from survival curves. Women who were still breastfeeding during their last survey, due to dropout or study termination, were considered censored. Cox proportional hazards models were used to compare the risk of stopping breastfeeding based on infant food problems. Additional information on study methods, statistical analysis, survey methodology, classification of reaction/food problem symptoms, and food allergy diagnosis is described in the Online Repository at www.jaci-inpractice.org.

Of 2577 mothers, 2179 (84.6%) reported no food issues, 273 (10.6%) identified an adverse reaction due to something the infant ate, 63 (2.4%) due to a food the infant was exposed to via

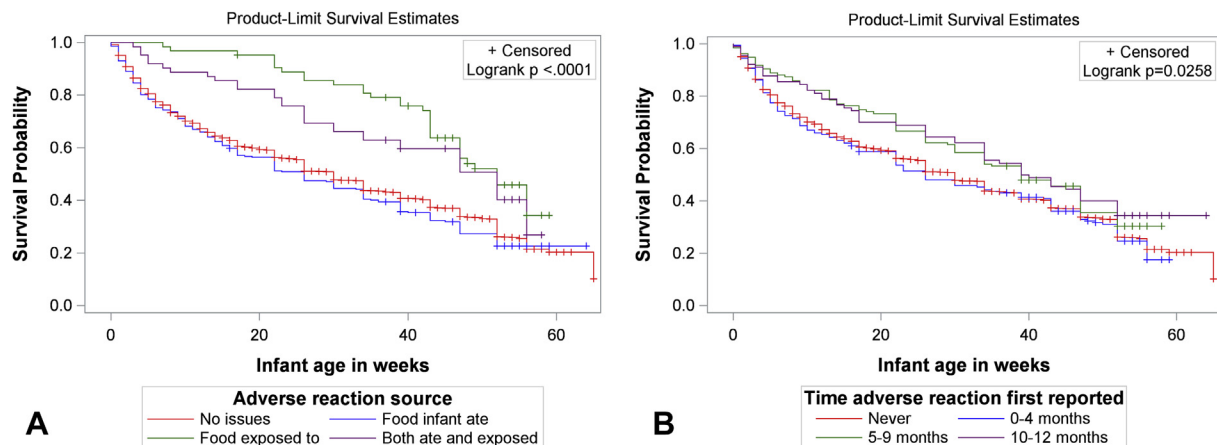


FIGURE 1. Breastfeeding duration event free survival estimate (Kaplan-Meier plot, proportion still breastfeeding) by: **A**, source of food problem: no problem, problem with food infant ate, food infant exposed to (via breast milk), or both; **B**, age at which problems first noted (never, 0-4 months, 5-9, months, 10-12 months).

TABLE I. Risk of stopping breastfeeding by adverse food reactions: results of Cox proportional hazards modeling

Adverse food reaction	Crude		Adjusted*	
	HR	95% CI	HR	95% CI
Source of adverse reaction [†]				
No issues	Reference	—	Reference	—
Food infant ate	0.94	0.78-1.12	0.98	0.82-1.18
Food infant exposed to	0.33	0.22-0.51	0.34	0.22-0.53
Both ate and exposed to	0.34	0.20-0.57	0.39	0.23-0.66
Source of adverse reaction ^{†,‡}				
Food infant ate	Reference	—	Reference	—
Food infant exposed to	0.15	0.09-0.25	0.15	0.09-0.26
Both ate and exposed to	0.12	0.06-0.27	0.15	0.07-0.32
Timing of adverse reaction [†]				
Never	Reference	—	Reference	—
0-4 mo	0.97	0.80-1.18	1.00	0.83-1.22
5-9 mo	0.69	0.52-0.90	0.73	0.55-0.96
10-12 mo	0.58	0.39-0.85	0.64	0.43-0.94
Eczema				
None	Reference	—	Reference	—
Food reaction, no eczema	0.96	0.82-1.12	0.98	0.83-1.15
Food reaction, with eczema	0.80	0.66-0.97	0.85	0.70-1.03
GI symptoms				
None	Reference	—	Reference	—
Food reaction, no GI symptoms	0.78	0.62-0.97	0.79	0.64-0.99
Food reaction, with GI symptoms	0.95	0.82-1.10	1.00	0.86-1.16
Colic				
None	Reference	—	Reference	—
Food reaction, no colic	0.85	0.72-1.00	0.89	0.75-1.05
Food reaction, with colic	0.94	0.79-1.13	0.97	0.81-1.16
Cow's milk				
None	Reference	—	Reference	—
Food reaction, without cow's milk issue	0.83	0.70-0.99	0.87	0.73-1.04
Food reaction with cow's milk issue	0.95	0.80-1.12	0.98	0.83-1.16
Food allergy diagnosis				
None	Reference	—	Reference	—
Food reaction, no allergy diagnosis	0.92	0.79-1.07	0.96	0.83-1.11
Food reaction, with allergy diagnosis	0.82	0.65-1.03	0.84	0.67-1.06

CI, Confidence interval; GI, gastrointestinal; HR, hazard ratio.

Data not shown regarding adjustment for family history of food allergy and education.

Bold indicates statistical significance ($P < .05$).

*Adjusted for race/ethnicity, income, and maternal age.

†Time-varying covariate included.

‡Among those with an adverse reaction only; controlling for age at which adverse reaction first occurred.

breast milk, and 62 (2.4%) due to both sources. Differences in breastfeeding duration were noted based on adverse food reactions ($P < .0001$) (Figure 1). Women who reported reactions due to exposure via breast milk, either alone (estimated mean duration 45.8 weeks) or in combination with food the infant ate (40.2 weeks), breastfed significantly longer than women who reported no reactions (32.0 weeks, $P = .002$ and $P = .008$, respectively) and longer than women who only reported reaction to a food the infant ate (27.3 weeks, $P = .0003$ and $P = .003$, respectively). Compared with those with no reported issues, women who reported adverse reactions via breast milk exposure were less likely to stop breastfeeding (breast milk alone: hazard ratio [HR] = 0.33; 95% confidence interval [CI], 0.22-0.51; breast milk and a food the infant ate: HR = 0.34; 95% CI, 0.20-0.57) (Table I). Results were unaffected by adjustment for race/

ethnicity, income, maternal age, family history of food allergy, or education. Among women who noted adverse reactions, those who reported adverse reactions via breast milk exposure were less likely to stop breastfeeding than those who noted a reaction due to foods the infant ate (HR = 0.15; 95% CI, 0.09-0.25) or those who had a reaction to both sources (HR = 0.12; 95% CI, 0.06-0.27), adjusted for timing of the reaction. Additional results regarding symptoms and food allergy diagnosis are included in the Online Repository at www.jaci-inpractice.org.

In this large national survey that followed women from the prenatal period through their infants' first year of life, we found that reported problems with foods that infants ate were associated with earlier breastfeeding cessation, yet seemingly paradoxically, concern for adverse reactions related to foods that the infant was exposed to through breast milk was associated with longer

breastfeeding duration. Although the group of mothers with the shortest mean duration of breastfeeding (problems with foods the infant ate) reported some breastfeeding throughout their infants' first 6 months, on average, mothers who were concerned about an adverse reaction caused by an exposure via breast milk breastfed 18 weeks longer. The perception of allergy may have led to the desire to extend breastfeeding for protective reasons. Alternatively, mothers may have been anxious about introducing infant formulas or solid food out of concern for allergenicity, instead extending breastfeeding and modifying their own diets. Early onset symptoms may be associated with different decision-making processes, sources of information, or recommendations from health care providers.

Our study has some notable limitations, including a nonrepresentative population, the potential for misclassification due to participant dropout, reliance on mothers' recall, the structure of the primary question, inability to determine rates of anaphylaxis, and need to interpret results in a historical context.⁹ However, the original data were collected via a well-designed study with a large and nationally distributed population, and our research begins to address an unmet need in understanding the relationship of early feeding and allergic concerns. A better understanding of early dietary practices and how specific factors (ie, race, income, maternal and gestational age, family history of atopy) affect these decisions is needed, especially in light of continued questions about the role of early infant diet in allergy development and new perspectives regarding early food allergen introduction.

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ONLINE REPOSITORY

STUDY DESIGN

The Infant Feeding Practices Study II sample was identified via a national consumer opinion poll, and women who identified as being pregnant were further recruited for participation in the study based on their expected due date.^{E1} To participate, women were required to be more than 18 years of age and give birth to a single healthy infant after at least 35 weeks' gestation. The infant was required to weigh at least 5 pounds at birth and could not be diagnosed with any medical conditions that would affect developmentally appropriate feeding. Mothers completed a prenatal survey and both a neonatal survey and a brief phone interview at the time of the infant's birth. They were then mailed 10 postnatal surveys approximately monthly, corresponding to the age of the infant (months 2, 3, 4, 5, 6, 7, 9, 10.5, 12). For the purposes of this study, only data from the postnatal surveys were used.

MEASURES

Demographic variables

Mothers identified their race/ethnicity as white, black, Hispanic, Asian/Pacific Islander, or other. Mothers also reported on parity, identifying as either primiparous or multiparous, and household income, defined as the total yearly income of all household members before taxes. A poverty index variable, defined as a ratio of household income to the poverty threshold by household size, was used to categorize mothers into 3 poverty index groups: <185%, 185% to 349%, and ≥350%. Family history of food allergy was assessed via the question, "As best you know, which of the following health conditions do you yourself or your baby's other relatives have?" Mothers then had the option to select food allergy and indicate which relatives had a food allergy diagnosis: the mother, the baby's father, the baby's brother or sister, and/or the baby's grandparents, aunts, or uncles.

Breastfeeding

Mothers were asked to report breastfeeding at each postnatal survey. If they indicated that they were no longer breastfeeding, they were asked to indicate the infant's age at breastfeeding cessation, which was rounded to the nearest week of life. In order to evaluate duration of breastfeeding, survival curves were used with cessation of breastfeeding defined as the event of interest. Women who were still breastfeeding during their last survey, whether due to dropout, study termination, or at 12 months of infant age, were considered censored observations.

Infant adverse reactions to food

Mothers were asked to report on their infants' reactions to food at 3 postnatal survey time points (4, 9, and 12 months). The survey item read, "Has your baby ever had problems caused by food, such as an allergic reaction, sensitivity, or intolerance?" If mothers indicated yes, they were asked to indicate the cause of the food problems ("Food your baby ate including infant formula" and/or "Food your baby was exposed to through breast milk because of something you ate"), which resulted in classification of infants into 1 of 4 categories: (1) no problems with food, (2) problems with food due to something the infant ate, (3) problems with food due to something the infant was exposed to

through breast milk, or (4) problems with food due to both sources.

Mothers also reported on the age of the infant, in months, when the adverse reaction to food first occurred by answering the question, "How old was your baby the first time he or she had a problem with food?" For purposes of this study, time of problems with food was classified into 4 categories: (1) never, (2) early: 0 to 4 months, (3) mid: 5 to 9 months, and (4) late: 10 to 12 months. This study used mothers' first survey report when mothers provided conflicting data across survey time points.

Medical symptoms, food allergy diagnosis, and cow's milk concerns

Mothers who indicated that their infant had an adverse reaction to food were asked to further explain the symptoms that their infant experienced by answering the question, "What symptoms of a problem with food has your baby had?" For the purpose of this study, eczema and colic were considered. In addition, a composite gastrointestinal (GI) symptoms variable was created for infants who experienced gassiness, vomiting, diarrhea, constipation, and/or blood in stool. Mothers were asked to indicate the presence of a food allergy diagnosis by answering the question: "Was your baby diagnosed by a medical doctor as having an allergy to any food?" They were also asked to indicate whether or not cow's milk specifically was a food to which the infant had an adverse reaction on a checklist, for which the cow's milk option said, "Cow's milk or other dairy products (including infant formula made with cow milk)." These additional variables were assessed as bivariate exposures in combination with any reported food issues.

STATISTICAL ANALYSES

Analyses were completed using SAS 9.4, and a 2-tailed *P* value of .05 was considered significant. χ^2 tests and analysis of variance were used to compare demographics between exposure groups based on adverse food reactions. To assess differences in breastfeeding duration based on infant problems with food, Kaplan-Meier survival curves were compared between groups using logrank tests; mean breastfeeding duration was estimated from survival curves accounting for censored observations. Cox proportional hazards models were used to compare the risk of stopping breastfeeding based on infant problems with food; a time-varying interaction term was included in models that did not meet the proportional hazards assumption. In these analyses, the hazard ratio (HR) can be interpreted as the likelihood of stopping breastfeeding at a given time point assuming that both individuals have continued to breastfeed up to that time point. The decision was made *a priori* to adjust all models for race/ethnicity and income given the established relationship between these demographic variables and breastfeeding duration in prior literature^{E2}; additional adjustment for maternal education did not change findings and was not included. All models control for maternal age as it was significantly associated with food problems in the current study.

RESULTS

The majority (83.3%) of respondents were white, and white participants were slightly more likely to report adverse reactions than non-white participants (*P* = .08). Women who reported infant adverse reactions were slightly older than those who did not

($P = .01$). Infants who had adverse reactions to food were more likely to have an immediate family member (mother, father, or sibling) with a history of food allergy. Taken as a whole, 26.2% of infants who had a reaction to a food they ate, 42.9% of infants who had a reaction with exposure via breast milk, and 38.6% of those who had both had an immediate family member with a food allergy, according to mothers, compared with 17.5% of those with no problems ($P < .0001$). No other demographic or food history associations were noted among groups.

FOOD PROBLEMS AND SYMPTOMS

Survival estimates for food reactions in combination with other symptoms are shown in [Figure E1, A-C](#). For each of these analyses, we assessed differences in survival curves for infants who did not experience an adverse reaction to food, infants who experienced an adverse reaction to food but did not experience the target symptom (eg, eczema), and infants who experienced an adverse reaction and the target symptom (eg, eczema). Overall, minor differences in survival curves were noted for eczema ($P = .07$) and GI symptoms ($P = .06$), though not for colic ($P = .13$). Infants who experienced both adverse reactions to food and eczema breastfed longer than those without any food problems (35.0 weeks vs 32.0 weeks, $P = .03$), though differences with adverse reactions only (30.1 weeks) were not significant. Conversely, no differences were seen for those with adverse reactions with GI or colic symptoms compared with those with no adverse reactions (35.4 weeks vs 32.0 weeks, $P = .20$ and 31.8 weeks vs 32.0 weeks, $P = .16$), respectively. However, those

with adverse reactions without GI and colic were breastfed longer than those with no adverse reactions (35.4 weeks, $P = .02$ and 33.4 weeks, $P = .04$). Similar findings were noted in Cox modeling ([Table E1](#)); women who reported adverse reactions to food and eczema were less likely to stop breastfeeding than those with no food problems (HR = 0.80; 95% confidence interval [CI], 0.66-0.97), though results were no longer significant after adjustment for race/ethnicity and income.

DIAGNOSIS OF FOOD ALLERGY AND COW'S MILK-SPECIFIC CONCERNS

A total of 117 mothers (4.5%) reported that their infant was diagnosed with food allergy by a medical doctor. No differences in survival curves were seen for adverse reactions with cow's milk as an issue ($P = .10$) or for medically diagnosed food allergy ($P = .13$) ([Figure E1, D and E](#)). Infants who experienced a food problem without an issue with cow's milk were breastfed slightly longer (33.1 weeks) than those with a cow's milk issue (31.1 weeks) or those with no issues (32.0 weeks). Conversely, those with a diagnosed food allergy breastfed slightly longer (34.4 weeks) than those without a diagnosis (30.8 weeks) or those with no issues (32.0 weeks), though differences were not significant. Similar findings were seen in Cox modeling ([Table E1](#)), with nonsignificant decreases in the likelihood of stopping breastfeeding noted for cow's milk reactions (HR = 0.95; 95% CI, 0.80-1.12) and food allergy diagnosis (HR = 0.82; 95% CI, 0.65-1.03).

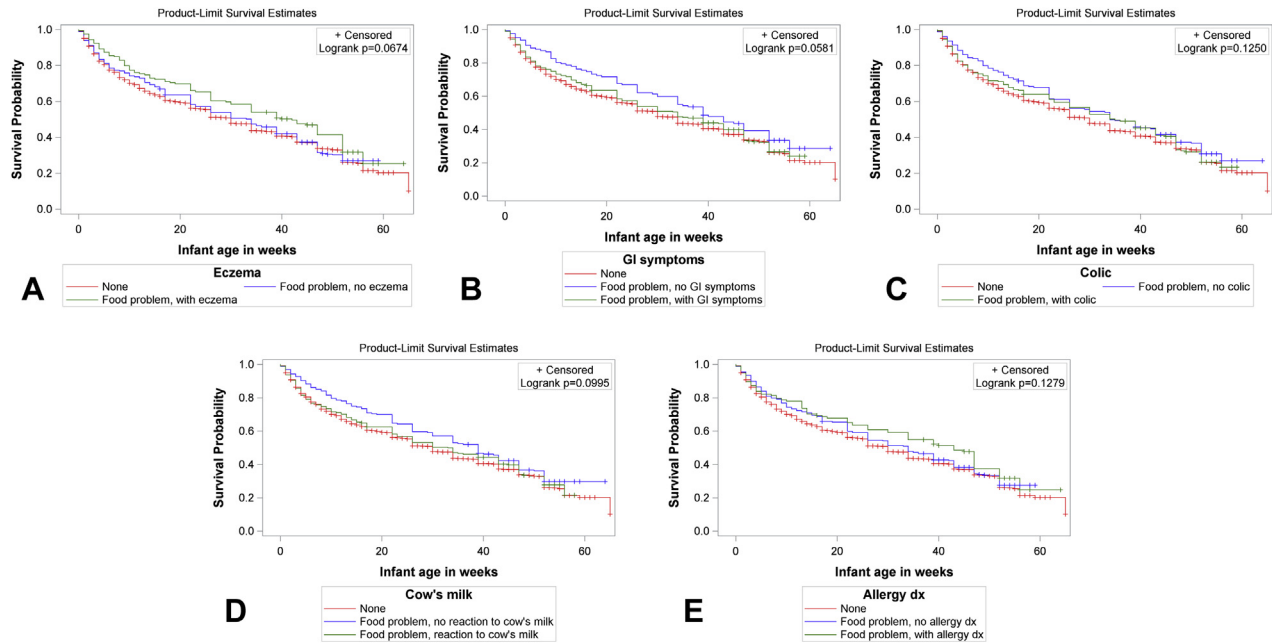


FIGURE E1. Breastfeeding duration survival estimate (Kaplan-Meier) by the presence of food problem $\pm$ specific concerns, compared with infants with no food problems noted: **A**, eczema; **B**, GI symptoms (gassiness, vomiting, diarrhea, constipation, and/or blood in stool); **C**, colic; **D**, adverse reaction specifically to cow's milk; and **E**, diagnosis of food allergy. *GI*, Gastrointestinal.

TABLE E1. Demographic characteristics by the source of adverse food reactions (n = 2577)

Demographics, n (%)	Overall	Source of adverse reaction				P value*
		No issues (n = 2179)	Food infant ate (n = 273)	Food infant exposed to via breast milk (n = 63)	Both ate and exposed to via breast milk (n = 62)	
Race/ethnicity						.08†
White	2100 (83.5)	1753 (82.7)	233 (87.3)	55 (90.2)	53 (88.3)	
Black	120 (4.8)	106 (5.0)	11 (4.1)	0 (0.0)	1 (1.7)	
Hispanic	168 (6.7)	150 (7.1)	14 (5.2)	3 (4.9)	1 (1.7)	
Asian/PI	76 (3.0)	66 (3.1)	7 (2.6)	1 (1.6)	1 (1.7)	
Other	52 (2.1)	44 (2.1)	2 (0.7)	2 (3.3)	4 (6.7)	
Maternal age (mean, SD)	28.8 (5.5)	28.7 (5.5)	29.5 (5.4)	29.5 (4.8)	30.1 (5.4)	.01
Parity						.25
Primiparous	766 (30.4)	630 (29.7)	95 (35.6)	19 (30.6)	20 (32.8)	
Multiparous	1756 (69.6)	1493 (70.3)	172 (64.4)	43 (69.4)	41 (67.2)	
No. of children (mean, SD)	1.2 (1.2)	1.2 (1.2)	1.0 (1.2)	1.1 (1.0)	1.1 (1.1)	.20
Income (% of poverty level)						.13
<185%	1041 (40.3)	900 (41.3)	94 (34.4)	18 (28.6)	24 (38.7)	
185%-349%	941 (36.4)	785 (36.0)	109 (39.9)	26 (41.3)	20 (32.3)	
≥350%	604 (23.4)	494 (22.7)	70 (25.6)	19 (30.2)	18 (29.0)	
Education						.0002
High school or less	443 (18.5)	386 (16.5)	43 (16.5)	5 (8.2)	7 (12.3)	
Some college	977 (40.7)	844 (41.9)	91 (35.0)	18 (29.5)	19 (33.3)	
College degree or more	979 (40.8)	782 (38.9)	126 (48.5)	38 (62.3)	31 (54.4)	
Family food allergy history‡						.003
Mother food allergy						
No	1995 (89.9)	1690 (90.8)	205 (86.5)	47 (83.9)	45 (78.9)	
Yes	225 (10.1)	172 (9.2)	32 (13.5)	9 (16.1)	12 (21.1)	
Father food allergy						<.0001
No	2074 (93.4)	1751 (94.0)	220 (92.8)	44 (78.6)	53 (93.0)	
Yes	146 (6.6)	111 (6.0)	17 (7.2)	12 (21.4)	4 (7.0)	
Sibling food allergy						<.0001
No	2098 (94.5)	1776 (95.4)	220 (92.8)	49 (87.5)	45 (79.0)	
Yes	122 (5.5)	86 (4.6)	17 (7.2)	7 (12.5)	12 (21.0)	
Any immediate family						<.0001
No	1784 (80.4)	1536 (82.5)	175 (73.8)	32 (57.1)	35 (61.4)	
Yes	436 (19.6)	326 (17.5)	62 (26.2)	24 (42.9)	22 (38.6)	
Timing of food introduction						
Solid foods						.17
By 4 mo	649 (32.9)	526 (33.4)	88 (32.9)	13 (21.0)	18 (30.0)	
Between 5 and 9 mo	1187 (60.2)	938 (59.6)	158 (59.2)	48 (77.4)	38 (63.3)	
Between 10 and 12 mo	137 (6.9)	111 (7.0)	21 (7.9)	1 (1.6)	4 (6.7)	

PI, Pacific Islander; SD, standard deviation.

Bold indicates statistical significance ($P < .05$).*P value based on χ^2 (categorical) or analysis of variance (continuous).

†P value based on condensed white vs non-white groups due to small numbers in some categories.

‡Self-reported by mothers.

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