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Maternal mobile device use during a structured parent-child interaction task

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Abstract

Objective—Examine associations of maternal mobile device use with the frequency of mother-child interactions during a structured laboratory task.

Methods—Participants included 225 low-income mother-child pairs. When children were ~6 years old, dyads were videotaped during a standardized protocol in order to characterize how mothers and children interacted when asked to try familiar and unfamiliar foods. From videotapes, we dichotomized mothers based on whether or not they spontaneously used a mobile device, and counted maternal verbal and nonverbal prompts toward the child. We used multivariate Poisson regression to study associations of device use with eating prompt frequency for different foods.

Results—Mothers were an average of 31.3 (SD 7.1) years old and 28.0% were of Hispanic/non-white race/ethnicity. During the protocol, 23.1% of mothers spontaneously used a mobile device.

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Device use was not associated with any maternal characteristics, including age, race/ethnicity, education, depressive symptoms, or parenting style. Mothers with device use initiated fewer verbal (RR 0.80 [95% CI: 0.63, 1.03]) and nonverbal (0.61 [0.39, 0.96]) interactions with their children than mothers who did not use a device, when averaged across all foods. This association was strongest during introduction of halva, the most unfamiliar food (0.67 [0.48, 0.93] for verbal and 0.42 [0.20, 0.89] for nonverbal interactions).

Conclusions—Mobile device use was common and associated with fewer interactions with children during a structured interaction task, particularly nonverbal interactions and during introduction of an unfamiliar food. More research is needed to understand how device use affects parent-child engagement in naturalistic contexts.

Keywords

Mobile device; mobile phone; parent-child interaction; parenting

Introduction

The importance of responsive face-to-face parent-child interactions in the development of language, cognitive, and self-regulation abilities during early childhood is undisputed.[1,2,3,4,5] These crucial daily interactions can be disrupted through family use of media. For example, adults utter fewer words,[6] respond to fewer bids for attention,[7] and have lower-quality interactions[8] with the children in their care when a television (TV) is on in the room with them. As screens become more portable and instantly accessible through the widespread use of mobile devices (e.g., smartphones and tablet computers),[9,10,11] the potential for interruption of family interactions by media is heightened.

Parent-child interactions during eating in particular show a protective effect on child health outcomes such as obesity,[12] asthma,[13] and adolescent risk behaviors.[14] These findings have been attributed to the positive family communication and emotional connection that mealtime routines allow;[13,15] however, media use during meals mitigates these benefits.[16]

Despite increasing ubiquity of mobile technology, use of these devices has received little study.[17] Only one study has addressed the issue of parent mobile device use its potential associations with interactions with young children.[18] In an anonymous observational study of caregivers sitting with young children during meals in fast food restaurants, Radesky and colleagues observed that when caregivers directed a high degree of engagement or attention to mobile devices rather than to the children accompanying them, there appeared to be less mealtime conversation and more occurrences of caregiver-child conflict. This study used qualitative methods, so was not able to test associations between caregiver device use and the quality or quantity of parent-child interactions.

The purpose of the present study is to test this association empirically through analysis of previously collected videotapes of a structured parent-child eating interaction protocol, which were recorded as part of an ongoing longitudinal cohort study. Because many mothers in this sample were noted to spontaneously use their mobile device during the protocol, we found this to be a unique opportunity to contribute to the knowledge base regarding parent

mobile device use and parent-child interactions. Eating interactions have frequently been used as a window into the parent-child dynamic, as a common routine in which families engage regularly.[19] We hypothesized that mothers exhibiting mobile device use would show fewer verbal and nonverbal interactions with their children during the task, especially during presentation of unfamiliar foods, as this represents a situation in which children need more modeling or support from caregivers.[20]

Methods

Study Design and Participants

We performed a secondary analysis of videotapes that were previously recorded as part of an ongoing longitudinal cohort study examining the contributions of maternal feeding interactions, child eating behaviors, and biobehavioral stress to child obesity risk.[21,22] For the parent study, 380 children were recruited at age 3-4 years from Head Start, a free, federally-funded preschool program for low-income children, in Southeastern Michigan between 2009 and 2011. Eligibility criteria included that the child was born at term without significant perinatal complications and had no significant current medical or developmental problems, that mother and child were English speaking, that mother did not hold ≥ a 4 year college degree, and that the child was not in foster care.

All study participants were invited to take part in an additional wave of data collection when children were approximately 6 years old (June 2011 – May 2013) and 301 (79.2%) agreed to participate. Compared to mothers who did not choose to participate in this data collection wave, included mothers were older (mean age 31.2 [SD 7.1] years vs. 29.1 [7.0] years, $p = .0004$) and more likely to be a single parent (42.7% vs. 35.4%, $p = 0.07$). This data collection protocol included a structured mother-child eating interaction in 228 mother-child dyads (75.7% of the study cohort) after exclusions for a history of food allergies or adverse food reactions in mother or child (n = 49), mother did not attend the structured protocol visit (n = 8), protocol violations (n = 8), or videotape problems (n = 8). The present analysis included 225 mother-child dyads who completed the videotaped protocol and had complete data for all covariates. Of the 301 children in this data collection wave, included participants were less likely to be of non-white or Hispanic race/ethnicity (28.0%) compared to excluded participants (46.1%, $p = 0.004$).

This study was approved by the University of Michigan Institutional Review Board and was deemed exempt from review by the Boston University Medical Center Institutional Review Board. At study enrollment and at the follow-up data collection wave, participating mothers gave written informed consent.

Mother-Child Eating Interaction Protocol

The purpose of the structured eating task was to quantify mother-child interactions in a controlled setting (usually a quiet room at a community center, Head Start location, or other building that was familiar to the family) without distractions (i.e., compared to meals at home), which would allow reliable assessment of differences in parent and child eating-

related behaviors. It was not a goal of this protocol to assess mobile device use, which occurred spontaneously.

During the protocol, mother and child were seated alone at a table while four foods were presented individually and sequentially in random order. The four foods differed in sweetness and presumed familiarity: green beans (familiar vegetable), artichoke hearts (unfamiliar vegetable), cupcakes (familiar dessert), and halva (unfamiliar dessert). Table 1 shows the actual number of mothers and children reported to be familiar with each food. These foods were specifically chosen to provide a "press" for mother-child interaction in different contexts. For each food, a standardized script was used: "Once you and [your child] are comfortable, I will bring two servings of a food into the room. You can either choose to try it or not. [Your child] can either choose to try it or not. We will do this with 4 different foods. You are welcome to give them a try and tell me what you think of them. If you really don't want to try them, though, you don't have to. Okay?" The mother and child were given individual servings, a research assistant identified the food for them (e.g., "These are artichokes. It is a kind of vegetable."), asked mother if she or the child had ever tried the food before, and said to both: "Give it a try if you'd like and tell me what you think of it when I come back in a couple of minutes."

Mother and child were then left alone for four minutes while videotaped, after which the food was removed and the next food presented. After each food, a research assistant briefly interviewed the mother and child about their opinions of the food. Mothers were aware that they were being videotaped; no prompts were given regarding whether a mobile device could or could not be used; and there were no signs instructing participants not to use devices (i.e., as occur in some medical settings).

Coding of Mobile Device Use

Through an iterative process in which coding staff examined a subset of videotapes and related their specific observations to the investigators (JSR and JCL), we developed a mobile device use coding scheme comprising 3 apparent modes of use: (1) no device visibly present, (2) negligible use (i.e., placed on table; checked quickly for the time or to read an incoming text but then turned off), or (3) actively used (e.g., talked on the phone whether or not the call was placed or received, replied to a text, swiping or typing motions made with fingers). Coding staff then applied this 3-category variable to the remainder of the videos; inter-rater reliability for the 14% of videos that were double-coded was high (Cohen's kappa = 0.97).

Based on our prior study's suggestion that high caregiver engagement with devices – rather than fleeting – may be most disruptive to caregiver-child interaction,[18] we collapsed the no device present category with the negligible use category, and compared these mothers to those who actively used their device. This dichotomization was supported by bivariate analyses showing no consistent sociodemographic differences between mothers in the no device present and negligible use categories (data not shown).

Coding of Mother-Child Interaction

A coding scheme based on the BATMAN (Bob and Tom's Method of Assessing Nutrition),[23,24] which is one of the most commonly used coding schemes for observed mother-child interaction around eating and has been used in prior work by the investigators,[25,26] was applied to videotapes of the eating interaction protocol. The scheme counts number of verbal encouragements (e.g., mother says, “Try a bite”), physical encouragements (e.g., mother moves food in the child's direction, hands the child a piece of food, or gives the child a bite), verbal discouragements (e.g., mother says, “That doesn't look so good”), and physical discouragements (e.g., mother pushes plate away from child). For the 20% of videotapes coded by two coders, inter-rater reliability was high, with intraclass correlation coefficients ranging from 0.81 to 1.00 for all codes.

From these coded behaviors, we created two types of interaction variables, based either on the type of interactions (verbal or nonverbal) or the content of the interactions (encouragement or discouragement) initiated by the mother. We combined verbal encouragements and discouragements into a Verbal Interaction variable, physical encouragements and discouragements into a Nonverbal Interaction variable, verbal and physical encouragements into a Total Encouragement variable, and verbal and physical discouragements into a Total Discouragement variable. As our primary outcomes, we collapsed these frequencies across all 4 foods. In order to examine whether associations between mobile device use and eating interactions varied by the type of food or familiarity of food – as introduction of unfamiliar foods is usually more stressful for children[27] – we also examined these interactions for individual foods, and for familiar foods (green beans and cupcakes) and unfamiliar foods (artichoke hearts and halva).

Parenting Style

To examine whether mobile device use behaviors were associated with general parenting style, we used as a secondary outcome self-reported scores on The Parenting Scale,[28] a validated measure of parenting style. This scale generates subscales for parenting laxness and overreactivity, both of which had good internal reliability (Cronbach's alpha laxness = .81, overreactivity alpha = .71) and which we modeled as continuous outcomes.

Covariates

Mothers reported their birth date, race/ethnicity (categorized for this analysis as non-Hispanic white vs. Hispanic/non-white), educational attainment (categorized for this analysis as ≤ high school diploma or equivalent vs. > high school diploma), single parent status, number of children in the household, and the child's sex. Most mothers (n = 204) reported their household income, from which we calculated household income-to-needs ratio by dividing the annual household income by the federal poverty line for the given year for a family of a specific size. Mothers completed the Center for Epidemiologic Studies – Depression (CES-D) scale, a valid, reliable 20-item questionnaire used widely to measure depression symptoms in the general population.[29] We used the accepted cutoff of ≥ 16 to classify mothers with clinically significant depression symptoms. Mothers also completed the Chaos, Hubbub, and Order Scale (CHAOS), a 15-item validated measure reflecting level of chaos in the home (Cronbach's alpha = .79).[30]

Analysis

We used chi square tests and one-way analysis of variance to analyze bivariate relationships between maternal mobile device use and maternal, child, and household characteristics.

We performed multiple Poisson regressions adjusting for overdispersion to examine associations of maternal device use with total number of maternal verbal and nonverbal interactions as well as maternal encouragements and discouragements directed to the child. Total number of maternal interactions is a count variable and Poisson regression is suited for this type of outcome. These models were repeated for each food individually, and for unfamiliar foods and familiar foods separately. Our secondary outcomes, the laxness and overreactivity subscales of The Parenting Scale, were normally distributed, so we used linear regression to examine associations of device use with these outcomes.

We built multivariate models by first examining bivariate associations between predictors, outcomes, and all covariates listed above, and only included in adjusted models those covariates with p value ≤ 0.20 for both predictors and outcomes (i.e., maternal age, race/ethnicity, and single parent status). We performed all analyses using SAS software version 9.3 (SAS Institute Inc., Cary, NC).

Results

In the analysis sample, 71.8% of mothers were of non-Hispanic white race, with a mean age of 31.3 (SD 7.1) years (Table 2). During the structured eating protocol, 52 (23.1%) mothers used a mobile device at least once, while 23 (10.2%) quickly checked it or had it on the table, and 150 (66.7%) had no device visible. No maternal, child, or household characteristics were significantly associated with maternal mobile device use in bivariate analyses; there was more mobile device use among younger, Hispanic or non-white mothers, and those who were single parents, but none of these differences reached statistical significance (Table 2).

Mothers with mobile device use had significantly fewer verbal (11.1 vs. 14.1, $p = 0.03$) interactions with their children than mothers who had no or negligible use during the eating protocol, particularly during presentation of halva (2.3 vs 3.7, $p = 0.03$), the most unfamiliar of the foods presented. In addition, mothers with mobile device use made significantly fewer total encouragements (8.8 vs. 12.3, $p = 0.03$) and fewer encouragements regarding unfamiliar foods (5.0 vs. 7.7, $p = 0.02$) and halva (1.9 vs. 3.5, $p = 0.02$) with their children (Table 3).

After multivariate adjustment, we found that maternal use of mobile devices was associated with 20% (95% CI: -3%, 37%) fewer verbal and 39% (95% CI: 4%, 61%) fewer nonverbal interactions during the eating protocol (Table 4). This relationship was strongest during presentation of unfamiliar foods; mothers actively using mobile devices initiated 26% (95% CI: 2%, 43%) fewer verbal interactions and 48% (95% CI: 4%, 72%) fewer nonverbal interactions regarding unfamiliar foods. These results appeared to be driven by differences in interaction frequency during the most unfamiliar food, halva, during which there were

33% (95% CI: 7%, 52%) fewer verbal and 58% (95% CI: 11%, 80%) fewer nonverbal interactions in mothers with device use.

Device use was also associated with 28% (95% CI: 5%, 46%) fewer encouragements during all foods, with more marked decreases in encouragement frequency during unfamiliar foods (35% [95% CI: 10%, 52%]) and halva (72% [95% CI: 18%, 96%]). Device use was not related to the frequency of eating discouragements (Table 4).

Maternal mobile device use was not associated with self-reported parenting style, with effect estimates of -0.04 (95% CI: -0.34, 0.27) for the laxness subscale and -0.04 (-0.27, 0.18) for the overreactivity subscale.

Discussion

In this analysis of videotaped mother-child eating interactions, we demonstrated that mobile device use is common and occurs in mothers with varying characteristics. We also showed that maternal mobile device use is associated with fewer verbal, nonverbal, and encouragement interactions directed to their young children regarding eating. As mobile device ownership and use becomes nearly universal,[9,10] these results may have important implications regarding how parents balance attention between devices and interactions with their children during daily life and during meals in particular, which are an important protective routine in pediatric health.[13]

This study is the first to quantitatively examine associations between parental mobile device use and parent-child interactions, supporting observations in our prior qualitative work[18] that higher degrees of caregiver absorption with mobile devices during meals co-occurred with fewer interactions or more negative interaction patterns with children. Our results are consistent with prior investigations of traditional media showing that when the TV is on in a room with parents and children, they have fewer and lower-quality interactions.[7] One recent publication demonstrated that parents who report lower relationship quality with their adolescents also report more adolescent use of mobile devices during meals,[17] but no other studies have examined this issue in families with young children.

Although the frequencies of verbal and nonverbal interactions in our study may appear low, these estimates are similar to published work,[23,25] and it should be noted that this eating interaction comprised only 16 minutes. If interactions continue in this manner over multiple meals, days, months, and years, the accumulated exposure may be substantial. Moreover, the effect size (Cohen's d) for differences in interaction frequency between device-using and non-using mothers were in the moderate range (0.30-0.40). We theorize that mobile device use was associated with a decreased number of maternal verbal and nonverbal interactions through decreased awareness of the child's social cues while the mother's gaze and/or attention was directed at a device. Nonverbal interactions are a primary mode through which emotional content is communicated between parents and children, so its frequent displacement could represent a significant decrease in emotional connection.

Our results suggest that mother-child interactions were most disrupted when unfamiliar foods were presented, particularly halva, which 99.5% of children had not eaten before. This

is notable, as it may represent a lesser degree of maternal engagement in helping the child negotiate a novel experience during which more parental support or role modeling is needed. It is unclear why a novel stimulus prompted less interaction in device-using mothers, but it is possible that mothers withdrew from the stimulus or from a negative affective response in the child. Existing literature suggests that parental encouragement is important in children trying new things, both food-related[31,32] and in the children's broader experience,[33] so displacement of this encouraging parental presence may have negative consequences.

However, we cannot draw causal conclusions from this study and several limitations are worthy of mention. Mobile device use was coded as any active use during the entire 16-minute videotape, not whether it preceded or co-occurred with any observed interactions. Device use may therefore be a marker of some other maternal trait (e.g., an unmeasured personality characteristic, stress level) that itself is associated with decreased engagement with the child. While it might be assumed that mobile device use around children is simply a facet of parenting style, maternal mobile device use was not associated with self-reported parenting style in this study; this may be because device use habits evolve independently of parenting style, or because of the biases inherent in self-report.

It may be questioned whether device use in a research setting reflects how mothers actually use their devices in real-life eating encounters. Videotaped behavior in laboratory settings can be a valid indicator of behavior in more naturalistic contexts,[34] but some device use behavior may have been inhibited by knowledge of the fact that they were being videotaped or participating in a research study. Nonetheless, our approach allowed the assessment of spontaneous usage patterns, which enabled us to objectively and reliably examine whether device use predicted differences in eating interactions within a controlled situation in a relatively large study sample. Future studies should examine more detailed ways in which device use might affect interpersonal dynamics or affective co-regulation in naturalistic contexts.

Conclusions

By using previously recorded videos of a structured parent-child interaction task, we found that maternal spontaneous mobile device use was relatively common, but not predicted by characteristics of the mother or child. As we observed in prior naturalistic work,[18] mobile device use during eating encounters has become a cultural norm that, like TV,[16] may interrupt the positive family communication thought to make such family routines protective in child health and development.[13,35] Media has become pervasive in the American child's daily environment and experience, often replacing the interactions with adults that serve as the foundation for learning healthy behaviors and emotion regulation strategies. Because secure parent-child relationships are one of the strongest buffers against psychosocial stress,[3] guidance is needed for how caregivers can use the rapidly evolving technologies in their homes in the healthiest ways possible.

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Abbreviations

BMI	Body mass index
CES-D	Center for Epidemiologic Studies Depression Scale
CHAOS	Chaos, Hubbub, and Order Scale
CI	confidence interval
RR	Relative Rate
SD	standard deviation
TV	television

What's New

When parents spontaneously used a mobile device during a parent-child interaction task, they showed fewer verbal and nonverbal interactions with their children regarding eating, particularly during more unfamiliar segments of the protocol.

Table 1
Familiarity of foods presented in the structured eating protocol

Food		n (%) of children who had eaten it before	n (%) of mothers who had eaten it before
Vegetable	Green beans	216 (98.2%)	218 (99.1%)
	Artichokes	28 (13.0%)	87 (39.9%)
Dessert	Cupcake	210 (95.0%)	217 (97.8%)
	Halva	1 (0.5%)	13 (5.8%)

Table 2
Participant characteristics and bivariate associations with mobile device use

	Total cohort Mean (SD) or n (%)	No device/Negligible Use Mean (SD) or n (%)	Mobile device use Mean (SD) or n (%)	*p*
	n=225	**173 (76.9)**	**52 (23.1)**	
Maternal race/ethnicity				
Non-Hispanic white	162 (72.0)	129 (79.6)	33 (20.4)	0.12
Hispanic or not white	63 (28.0)	44 (69.8)	19 (30.2)	
Maternal age (years)	31.3 (7.1)	31.6 (7.1)	30.1 (7.1)	0.20
Maternal education				
≤ High school diploma or equivalent	106 (47.1)	78 (73.6)	28 (26.4)	0.27
> High school diploma	119 (52.9)	95 (79.8)	24 (20.2)	
Single parent				
No	129 (57.3)	104 (80.6)	25 (19.4)	0.12
Yes	96 (42.7)	69 (71.9)	27 (28.1)	
CES-D Score				
< 16	149 (66.2)	117 (78.5)	32 (21.5)	0.42
≥ 16	76 (33.8)	56 (73.7)	20 (26.3)	
Income-to-needs ratio	0.12 (0.08)	0.12 (0.07)	0.11 (0.08)	0.37
Child sex				
Male	108 (48.0)	83 (76.9)	25 (23.2)	0.99
Female	117 (52.0)	90 (76.9)	27 (23.1)	
Child age (months)	70.8 (8.5)	70.5 (8.4)	72.0 (8.8)	0.24
Number of children in household	4.08 (3.15)	2.77 (1.25)	2.85 (1.38)	0.72
CHAOS score	4.08 (3.15)	4.17 (3.15)	3.87 (3.24)	0.54

Table 3

Bivariate associations between mobile device use and mother-child interactions during the structured eating protocol

	No device/Negligible Use Mean (SD)	Mobile device use Mean (SD)	*p*
Verbal interactions	14.1 (9.8)	11.1 (9.3)	0.05
Nonverbal interactions	1.4 (2.6)	0.83 (1.2)	0.11
Total encouragements	12.3 (10.5)	8.8 (8.3)	0.03
Total discouragements	3.3 (4.5)	3.1 (4.2)	0.84
Verbal interactions			
Familiar	6.2 (5.1)	5.2 (4.8)	0.22
Unfamiliar	8.0 (6.8)	5.9 (5.4)	0.04
Nonverbal interactions			
Familiar	0.50 (1.3)	0.37 (0.74)	0.47
Unfamiliar	0.92 (2.1)	0.46 (0.90)	0.12
Total encouragements			
Familiar	4.6 (4.8)	3.8 (3.9)	0.24
Unfamiliar	7.7 (8.0)	5.0 (5.2)	0.02
Total discouragements			
Familiar	2.0 (3.3)	1.8 (2.7)	0.57
Unfamiliar	1.2 (2.4)	1.4 (2.2)	0.70
Verbal interactions			
Green Beans	3.1 (3.6)	2.8 (3.7)	0.72
Artichokes	4.3 (4.1)	3.5 (3.8)	0.24
Cupcakes	3.1 (3.0)	2.4 (2.8)	0.10
Halva	3.7 (4.3)	2.3 (2.6)	0.03
Nonverbal interactions			
Green Beans	0.27 (1.1)	0.17 (0.55)	0.57
Artichokes	0.52 (1.2)	0.31 (0.83)	0.25
Cupcakes	0.24 (0.69)	0.19 (0.56)	0.67
Halva	0.40 (1.2)	0.15 (0.36)	0.15
Total encouragements			
Green Beans	3.0 (4.2)	2.8 (3.8)	0.71
Artichokes	4.1 (4.6)	3.0 (3.8)	0.13
Cupcakes	1.7 (2.2)	1.1 (1.5)	0.08
Halva	3.5 (5.0)	1.9 (2.2)	0.02
Total discouragements			
Green Beans	0.32 (1.26)	0.27 (0.84)	0.77
Artichokes	0.68 (1.65)	0.79 (1.58)	0.67
Cupcakes	1.7 (2.6)	1.5 (2.4)	0.57

	No device/Negligible Use Mean (SD)	Mobile device use Mean (SD)	*p*
Halva	0.54 (1.6)	0.58 (1.2)	0.89
Parenting Scale: Laxness	2.58 (0.96)	2.65 (0.90)	0.67
Parenting Scale: Overreactivity	2.37 (0.78)	2.39 (0.79)	0.86

Table 4

Multivariate* associations of maternal mobile device use with maternal-child eating interactions summed across all 4 foods presented, stratified by familiarity of foods, and for each individual food

	Verbal Interactions RR† (95% CI)	Nonverbal interactions RR (95% CI)	Encouragements RR (95% CI)	Discouragements RR (95% CI)
All four foods	0.80 (0.63, 1.03)	0.61 (0.39, 0.96)	0.72 (0.54, 0.95)	1.04 (0.68, 1.60)
Familiar foods(green beans and cupcakes)	0.87 (0.66, 1.15)	0.74 (0.38, 1.48)	0.81 (0.59, 1.12)	0.97 (0.59, 1.57)
Unfamiliar foods (artichokes and halva)	0.74 (0.57, 0.98)	0.52 (0.28, 0.96)	0.65 (0.48, 0.90)	1.16 (0.68, 1.97)
Green beans	0.94 (0.63, 1.40)	0.63 (0.21, 1.86)	0.91 (0.59, 1.40)	0.91 (0.30, 2.80)
Artichokes	0.80 (0.58, 1.11)	0.58 (0.27, 1.28)	0.72 (0.49, 1.03)	1.21 (0.64, 0.83)
Cupcakes	0.79 (0.55, 1.15)	0.88 (0.36, 2.18)	0.65 (0.42, 1.005)	0.97 (0.59, 1.60)
Halva	0.67 (0.48, 0.93)	0.42 (0.20, 0.89)	0.28 (0.04, 0.82)	1.09 (0.63, 2.29)

*Adjusted model includes maternal race/ethnicity, age, and single parent status

†Relative Rate.