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# Maternal Characteristics and Perception of Temperament Associated With Infant TV Exposure

**WHAT'S KNOWN ON THIS SUBJECT:** The American Academy of Pediatrics recommends that television (TV) exposure should be discouraged among children <2 years; yet, TV exposure is high among infants and toddlers, particularly those with younger, depressed, less educated, or minority mothers.

**WHAT THIS STUDY ADDS:** We found high levels of infant TV exposure, use of devices limiting movement, and feeding in front of the TV. Mothers, especially obese mothers, may use TV to entertain more active or fussier infants.

## abstract

**OBJECTIVE:** This study examines the development of television (TV) behaviors across the first 18 months of life and identifies maternal and infant predictors of infant TV exposure.

**METHODS:** We used longitudinal TV exposure, maternal sociodemographic, and infant temperament data from 217 African-American mother-infant pairs participating in the Infant Care and Risk of Obesity Study. Longitudinal logistic models and ordered regression models with clustering for repeated measures across subjects adjusted for infant gender and visit were used to assess maternal and infant predictors of TV exposure and to test whether infants with both maternal and infant risk factors had higher odds of more detrimental TV exposure.

**RESULTS:** Infants as young as 3 months old were exposed to an average of 2.6 hours of TV and/or videos daily, and nearly 40% of infants were exposed to >3 hours of TV daily by 12 months of age. Maternal TV viewing and maternal obesity and infant activity, fussiness, and crying were associated with greater infant TV exposure, whereas maternal education and infant activity were associated with having the TV on during most meals. Infants perceived as being more active or fussier had higher TV exposure, particularly if their mothers also had risk factors for higher TV exposure.

**CONCLUSIONS:** Understanding the characteristics that shape TV exposure and its biological and behavioral sequelae is critical for early intervention. Maternal perception of infant temperament dimensions is related to TV exposure, suggesting that infant temperament measures should be included in interventions aimed at limiting early TV. *Pediatrics* 2013;131:e390–e397

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### KEY WORDS

television, infancy, temperament, maternal obesity, overweight

### ABBREVIATIONS

AAP—American Academy of Pediatrics

DTL—distress to limitations

ECBQ—Early Childhood Behavior Questionnaire

IBQ-R—Infant Behavior Questionnaire Revised

Drs Thompson, Adair, and Bentley conceptualized the design and interpreted the data; Dr Thompson conducted the statistical analysis and drafted the manuscript; Drs Adair and Bentley designed the Infant Care Study, supervised data collection, and provided critical review of the manuscript; and all authors read and approved the final version of this manuscript.

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Despite the recently renewed American Academy of Pediatrics (AAP) recommendations that television (TV) and media use should be discouraged before the age of 2 years,<sup>1,2</sup> early TV exposure has risen dramatically within the past decade.<sup>3,4</sup> More than 90% of infants and toddlers are regularly exposed to electronic media,<sup>5,6</sup> and 6- to 24-month-olds spend an average of 2 hours watching TV daily.<sup>5</sup> These high levels of early TV exposure are concerning because  $\geq 2$  hours of daily TV viewing is associated with unhealthy diets,<sup>7</sup> overweight,<sup>8</sup> and developmental delays<sup>9,10</sup> in preschool children and because viewing patterns established early in life appear to track through childhood and adolescence.<sup>11,12</sup>

Studies have documented a relationship between maternal characteristics and TV exposure in toddlers and preschool children, with higher exposure associated with younger maternal age, maternal depression, lower levels of education, and racial/ethnic minority status.<sup>13–15</sup> Yet, the impact of child factors such as temperament or TV viewing behaviors beyond the number of hours watched per day remains unexplored in infancy and early childhood.<sup>8,16,17</sup> Consequently, we aimed to (1) describe TV exposure in early infancy and trajectories of TV exposure across the first 18 months of life and (2) identify maternal and infant predictors of TV exposure (daily viewing, placement in front of the TV, and infant feeding with the TV on). Like many maternal behaviors, infant TV exposure reflects a caregiving strategy influenced by both maternal and infant characteristics, so we tested whether characteristics of the maternal-infant dyad affected TV exposure. On the basis of previous literature documenting that obese or depressed mothers are more likely to use the TV as an “electronic” babysitter,<sup>13,15</sup> we hypothesized that obese or depressed mothers of

more active or fussier infants are more likely to use the TV to entertain or soothe these more difficult infants.

## METHODS

### Sample

Data were collected from 217 mother and infant pairs participating in the Infant Care and Risk of Obesity Study,<sup>18–20</sup> an observational cohort of low-income African-American mothers and their infants followed in their homes at 3, 6, 9, 12, and 18 months postpartum. First-time mothers, aged 18 to 35 years, were recruited from WIC (Women, Infants, and Children) clinics in central North Carolina. Exclusion criteria included preterm birth ( $< 35$  weeks’ gestation) or an illness or condition that might affect appetite, feeding, or growth. Data were collected from 2003 to 2007. The protocol was approved by the Institutional Review Board of the University of North Carolina at Chapel Hill.

### Infant TV Exposure

At each home visit, mothers described TV time on weekdays and weekends, whether a TV was present in the infant’s bedroom, how often the TV was on, how often the TV was on when the infant was fed, and where the infant was placed when viewing TV. Infant TV exposure was based on maternal response to the question “On average, how many hours does [infant] spend in front of the TV (when it is on) on a typical weekday/weekend?” Responses were recorded as 0 to  $< 1$  hour or whole hours if time was  $\geq 1$  hour. An average daily TV exposure variable was created from the weighted mean of weekday and weekend measures. Average TV exposure was positively skewed and consequently was transformed into 2 categorical variables: (1) a dichotomous variable (any TV) measuring whether, contrary to AAP recommendations, infants were exposed

to any (defined as  $\geq 1$  hour) TV daily and (2) a 3-level variable (TV group) corresponding to tertiles of TV exposure across visits (0 to  $< 1$  hour, 1–3 hours, and  $> 3$  hours). Infant placement during TV exposure was an open-response variable and was coded as “active” if the infant was able to move around (eg, infant walker, jumper, or floor) and “inactive” if movement was restricted (eg, car seat, stroller, or infant swing). Infant placement was modeled as an outcome only after 6 months because constraint is likely protective at younger ages. Infant TV exposure during meals was coded dichotomously as “yes” when mothers reported that the TV was “most often” or “always” on when the infant was fed and “no” if mothers reported that the TV was on “about half the time” or less.

### Infant Temperament

Maternal perception of 2 dimensions of infant temperament, activity and fussiness, was measured by using the activity and distress to limitations (DTL) subscales from the Infant Behavior Questionnaire-Revised (IBQ-R)<sup>21</sup> and the activity subscale from the Early Childhood Behavior Questionnaire (ECBQ).<sup>22</sup> These measures have been previously linked to infant feeding practices<sup>20</sup> and overweight<sup>18</sup> in this sample and show adequate internal consistency at each visit (Cronbach’s  $\alpha > 0.60$ ).<sup>18</sup> The 16-item IBQ-R activity scale, which characterizes maternal perception of infant gross motor activity such as limb movement and squirming, was administered at 3, 6, and 9 months of age. The 12-item toddler ECBQ activity scale, which captures maternal perception of the extent and rate of locomotion, was administered at ages 12 and 18 months. Scores for both scales range from 1 to 7 and higher scores reflect a more active child. The 16-item IBQ-R DTL scale was administered at 3, 6, and 9 months of age and characterizes maternal perception

of infant crying, fussiness, and distress. Scores on this scale also range from 1 to 7, and higher scores indicate an infant who often cries or fusses. A DTL subscale is not available for toddlers in the ECBQ. Consequently, we also assessed maternal reports of average infant daily crying duration, measured in minutes and hours, as a proxy measure of fussiness. Mothers' responses to the questions "In the past week, how much time did [infant] spend crying in the morning [or afternoon/evening/night]?" were converted to hours and summed across the day. Responses ranged from 0 to 10 hours and did not differ significantly across visits.

### Anthropometric Measurements

Maternal anthropometric measurements were collected by trained study personnel by using standard techniques at the 3-, 12-, and 18-month visits. Height was measured to the nearest 0.1 cm by using a stadiometer (Harpenden, Holtain Ltd, Crymych, United Kingdom) and weight was measured on a digital scale (Seca 761, Hanover, MD) to the nearest 0.1 kg. All anthropometric variables were measured in triplicate, and the mean of these measures was used in analysis. Maternal BMI was calculated as weight (kg)/height (m<sup>2</sup>). Maternal obesity was defined as a BMI >30.

### Maternal Characteristics

Maternal and household characteristics previously associated with TV exposure (maternal age, education, depressive symptoms [using the Center for Epidemiologic Studies Depression Scale<sup>23</sup>] and marital status) were assessed through questionnaires administered at each home visit.

### Statistical Methods

Descriptive statistics were used to assess TV exposure patterns at baseline. We used longitudinal mixed models

(linear and logistic) to test for visit differences in TV behaviors, controlling for repeated measures by subject. Individual mixed logistic regression models for dichotomous outcomes (any TV, inactive placement during TV viewing, and TV on during feeding) and ordered logistic regression for the 3-level TV group outcome (adjusted for clustering by individual) were used to test maternal and infant predictors of TV exposure. Maternal and infant characteristics were modeled individually to (1) identify significant risk factors for infant TV exposure and (2) avoid collinearity due to correlation between independent variables such as maternal TV viewing and unemployment or infant activity and fussiness scores. All models were adjusted for infant gender and visit to account for changes in TV exposure across visits. Interaction terms between the maternal or infant predictors and visit were not significant and were not included in final models.

To identify whether characteristics of the mother-infant dyad influenced the risk of detrimental TV exposure, we grouped the sample on the basis of the presence of maternal and infant risk factors and compared the odds of TV exposure between dyads with  $\geq 1$  maternal and infant risk factors with those dyads with no risk factors. Continuous infant temperament measures were dichotomized at the median, and 4 indicator variables were created: (1) low-risk mother, low-risk infant; (2) high-risk mother, low-risk infant; (3) low-risk mother, high-risk infant; and (4) high-risk mother, high-risk infant. These mother-infant interaction variables were used as main effects in mixed logistic and ordered regression models, controlling for infant gender, visit, maternal TV viewing time, and repeated measures across subjects. We limited our testing of maternal-infant interactions to the risk factors that were associated with TV exposure

at  $P < .10$  in main-effects models to focus on the most notable and potentially clinically relevant risk factors. All analyses were conducted by using Stata 11 (StataCorp, College Station, TX). Statistical significance was set at  $P < .05$ .

### RESULTS

Mothers in this sample were young (mean  $\pm$  SD: 22.7  $\pm$  3.8 years). Most were unmarried (89%), 44% were obese, and 29% had Center for Epidemiologic Studies Depression Scale scores indicative of depression at baseline (Table 1). All participating mothers owned a TV.

The proportion of infants exposed to <1 hour or 1 to 3 hours of TV did not significantly differ across visits, but the proportion of infants exposed to >3 hours of TV daily was significantly higher at ages 6, 9, and 12 months than at age 3 months ( $P < .05$ ; Fig 1). The proportion of households with TVs in infants' rooms was significantly higher at ages 12 and 18 months than at age 3 months (Table 2). The proportion of infants placed in a seat or a device limiting movement while in front of the TV decreased from 96.1% at age 3 months to 34.3% at age 18 months.

Maternal and infant characteristics were associated with infant TV exposure (Table 3). Maternal TV viewing and infant crying duration were associated with higher odds of infants being exposed to some TV daily. Maternal TV viewing, maternal obesity, infant activity, and crying duration predicted having a higher level of TV exposure compared with lower levels. Longer crying duration was associated with higher odds of inactive placement in front of the TV. Higher maternal education (high school diploma or postsecondary education) and having a TV in the infant's bedroom were associated with lower odds and infant activity with higher odds of having the TV on during meals.

**TABLE 1** Sample Characteristics at the 3-Month Baseline Visit by Daily TV Exposure

Sample Characteristic	Total Sample (n = 217)	TV Viewing Level <sup>a</sup>		
		<1 h TV (n = 44)	1–3 h TV (n = 108)	>3 h TV (n = 55)
Maternal age, y	22.7 ± 3.8	22.8 ± 4.4	22.5 ± 3.8	22.8 ± 3.3
Maternal education, high school graduate, % (n)	42.7(90)	50.0 (22)	41.1 (44)	39.3 (22)
Marital status, % single (n)	88.8 (190)	86.4 (38)	88.2 (97)	91.1 (51)
Currently working, % (n)	53.7 (115)	61.4 (27)	50.9 (56)	50.0 (28)
Maternal obesity, BMI >30, % (n)	44.2 (96)	36.4 (16)	40.5 (45)	55.4 (31) <sup>b</sup>
Depression, % (n) <sup>c</sup>	29.1 (62)	29.6 (13)	24.1 (26)	38.2 (21)
Infant gender, % male (n)	46.5 (101)	45.5 (20)	40.5 (45)	55.4 (31)
Infant overweight, % (n) <sup>d</sup>	29.5 (64)	25.0 (11)	33.3 (37)	26.8 (15)
Infant temperament score				
Activity <sup>e</sup>	4.1 ± 0.82	3.9 ± 0.85	4.1 ± 0.84	4.3 ± 0.75 <sup>f</sup>
DTL <sup>g</sup>	3.5 ± 0.74	3.3 ± 0.65	3.5 ± 0.75	3.6 ± 0.78
Crying duration, h	1.58 ± 2.09	1.19 ± 1.95	1.69 ± 2.05	1.79 ± 2.32
Any breastfeeding, % (n) <sup>h</sup>	22.6 (49)	29.6 (13)	25.2 (28)	14.3 (8)

Data are presented as means ± SD unless otherwise indicated.

<sup>a</sup> Differences between groups tested with nonparametric tests of trend for dichotomous variables and 1-way analysis of variance for continuous variables.

<sup>b</sup>  $P < .05$ .

<sup>c</sup> Score  $\geq 16$  on the Center for Epidemiologic Studies Depression Scale.

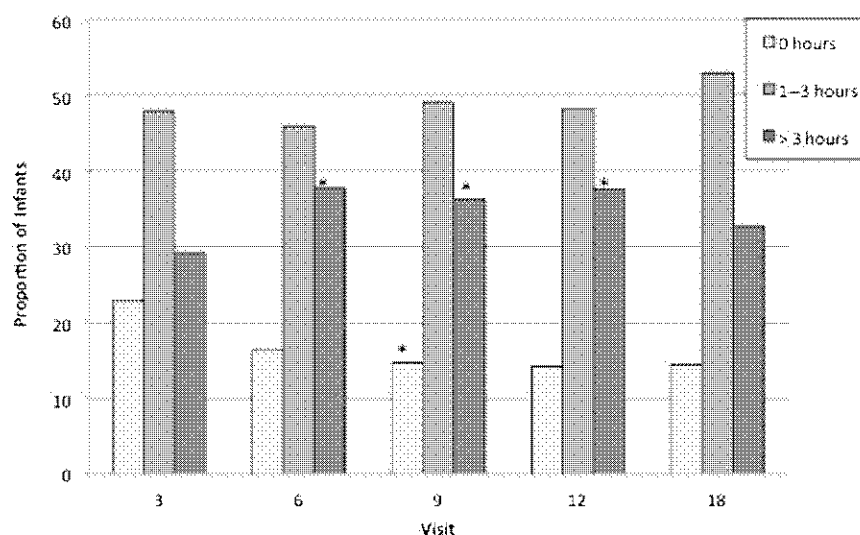
<sup>d</sup> Greater than the 90th percentile for weight-for-height of the 2000 Centers for Disease Control and Prevention National Center for Health Statistics growth charts.

<sup>e</sup> Score from the activity subscale of the IBQ-R.<sup>21</sup>

<sup>f</sup>  $P < .05$  for <1 h TV compared with >3 h of TV.

<sup>g</sup> Score from the DTL scale of the IBQ-R.<sup>21</sup>

<sup>h</sup> Any breastfeeding in 24-h recalls.

**FIGURE 1**

Trends in infant television exposure from age 3 to 18 months. The proportion of infants in each of the television exposure groups at each visit is presented. \*Significantly different from the 3-month baseline visit ( $P < .05$ ) in mixed logistic model testing for effect of visit, controlling for repeated measures across subjects.

TV exposure group and having the TV on during meals were significantly predicted by both maternal and infant characteristics (Table 3). On the basis of these results, we tested the interaction of maternal obesity and 3 infant risk factors (activity, DTL, and crying) on TV exposure and the interaction of maternal education and

infant activity and DTL on TV exposure during meals. Overall, infants in the high-risk dyads were exposed to higher levels of TV daily and had higher odds of more detrimental TV outcomes than infants in dyads with no or 1 risk factor, independently of maternal TV viewing (Table 4). The combination of maternal obesity with any of the infant risk fac-

tors (fussiness, higher activity, and crying) was associated with higher levels of TV exposure compared with low-risk infants of nonobese mothers. Households in which infants were perceived as active and whose mothers did not have a high school diploma were more likely to have the TV on during meals.

**TABLE 2** Trends in TV Exposure From 3 to 18 Months of Age

	Visit				
	3 (n = 214)	6 (n = 167)	9 (n = 161)	12 (n = 145)	18 (n = 110)
Number of TV sets in household, mean ± SD	3.0 ± 1.2	2.9 ± 1.1 <sup>a</sup>	2.9 ± 1.2	2.8 ± 1.3	2.8 ± 1.2
Households with TV in infant's room, %	14.0	15.6	16.9	26.2 <sup>b</sup>	28.6 <sup>b</sup>
TV on most of the time or always, %	48.8	46.1	48.5	45.6	50.5
TV on most of the time or always when infant is fed, %	42.9	37.1	34.2 <sup>b</sup>	34.0 <sup>b</sup>	30.3 <sup>b</sup>
Hours infant spends in front of TV per day, mean ± SD	2.6 ± 3.1	3.0 ± 3.0	3.0 ± 2.9	2.8 ± 2.5	2.6 ± 2.4
Infants placed in device/seat limiting movement while in front of the TV, %	96.1	61.5 <sup>b</sup>	28.7 <sup>b</sup>	26.9 <sup>b</sup>	34.3 <sup>b</sup>

<sup>a</sup> Significantly different ( $P < .05$ ) from 3-mo visit in longitudinal regression model testing for an effect of visit, controlling for repeated measures across subjects.

<sup>b</sup> Significantly different ( $P < .05$ ) from 3-mo visit in longitudinal logistic model testing for an effect of visit, controlling for repeated measures across subjects.

**TABLE 3** Bivariate Models of Maternal and Infant Predictors of TV Viewing Across the 3- to 18-Month Visits

	Any TV <sup>a</sup>	TV Group <sup>b</sup>	Inactive TV Placement <sup>c</sup>	TV on During Meals <sup>d</sup>
<b>Maternal characteristics</b>				
Education, high school graduate or greater	1.31 (0.58, 2.99)	0.95 (0.59, 1.52)	0.97 (0.63, 1.49)	0.35 (0.16, 0.75)
Single	1.12 (0.36, 3.50)	0.91 (0.46, 1.80)	0.87 (0.48, 1.58)	1.97 (0.67, 5.68)
Obese	1.30 (0.61, 2.75)	1.52 (1.02, 2.29)	1.11 (0.77, 1.62)	1.22 (0.62, 2.39)
Has depressive symptoms	0.64 (0.36, 1.22)	0.96 (0.66, 1.39)	1.18 (0.76, 1.84)	1.14 (0.68, 1.94)
Currently working	0.70 (0.43, 1.46)	1.08 (0.76, 1.54)	1.07 (0.72, 1.59)	1.05 (0.65, 1.69)
Daily TV viewing (hours)	1.27 (1.12, 1.44)	1.24 (1.14, 1.35)	1.01 (0.49, 1.07)	1.19 (1.09, 1.29)
<b>Infant characteristics</b>				
TV in infant's bedroom	1.00 (0.45, 2.24)	1.30 (0.80, 2.11)	0.91 (0.54, 1.53)	0.57 (0.33, 0.99)
Currently breastfeeding	0.87 (0.37, 2.04)	0.66 (0.41, 1.06)	0.73 (0.37, 1.42)	0.78 (0.42, 1.33)
Activity	1.42 (0.97, 2.09)	1.42 (1.12, 1.79)	0.85 (0.65, 1.10)	1.35 (1.06, 1.72)
Fussiness <sup>e</sup>	1.27 (0.79, 2.03)	1.29 (0.99, 1.69)	1.07 (0.77, 1.51)	1.28 (0.98, 1.65)
Daily crying duration (hours)	1.23 (1.02, 1.47)	1.10 (1.01, 1.19)	1.14 (1.00, 1.30)	0.98 (0.86, 1.12)

Data are presented as odds ratios (95% confidence interval).

<sup>a</sup> Represents odds of having  $\geq 1$  h of TV exposure in longitudinal logistic models, adjusted for infant gender and visit.

<sup>b</sup> Represents effect of a 1-unit increase in predictor on the odds of higher TV exposure group (0–<1 h of TV, 1–3 h of TV, or >3 h of TV per day) in ordinal regression models, adjusted for infant gender and visit. SEs were adjusted to control for clustering by subject.

<sup>c</sup> Inactive TV placement modeled after 6 mo only. Represents odds of being placed in a device limiting movement controlling for infant gender and visit.

<sup>d</sup> Represents odds of having >half of meals with the TV on (vs. half or fewer meals) in longitudinal logistic models, adjusted for infant gender and visit.

<sup>e</sup> Fussiness measured only at ages 3–9 mo.

## DISCUSSION

Contrary to AAP recommendations, the low-income, African-American infants and young children in our sample were exposed to an average of 2.6 hours of TV and/or videos daily as early as 3 months of age, and nearly 40% were exposed to >3 hours of TV daily by age 12 months. Unlike previous cross-sectional studies of maternal correlates of child TV exposure, our longitudinal in-home assessments of a wide range of maternal and infant characteristics permitted us to explore other TV-viewing behaviors and the interaction between maternal and infant characteristics in shaping TV behaviors across infancy. We found that many infants were placed in seats or in infant devices limiting movement

and were fed most or all of their meals while in front of the TV and that TV exposure differs by maternal obesity and education and dimensions of perceived infant temperament. These maternal and infant predictors of TV exposure did not differ across visits, suggesting that patterns of TV use begin early and persist.

Levels of TV exposure were high (>77% of 3-month-olds were exposed daily) and showed little significant change over the first 18 months of life. Although high, these levels are consistent with recent studies, which revealed that >70% of 0- to 2-year-olds<sup>17</sup> and as many as 96% of 6-month-old low-income infants did not meet the AAP guidelines.<sup>5</sup> Infants in our sample had higher average daily TV exposure (2.6

hours) than did other studies in infants and children younger than 2 years, which found average daily TV exposure of 1<sup>6</sup> to 2 hours.<sup>5</sup> Our higher levels of TV may reflect the confluence of characteristics associated with higher TV exposure, including nonwhite maternal race,<sup>6,8,14–16</sup> low-income,<sup>8</sup> single motherhood,<sup>8,14</sup> lower educational levels,<sup>8,13–15</sup> and maternal depression.<sup>8,13,15</sup>

Unlike a previous study that found little association between sociodemographic factors and TV exposure in infants and a stronger effect of the local media environment,<sup>17</sup> we found that both maternal factors (obesity and education) and characteristics of the local media environment (maternal TV viewing) shaped TV use. Higher maternal TV viewing and maternal obesity were associated

**TABLE 4** Infant TV Exposure by Maternal and Infant Temperament Risk Factors

Maternal/Infant Risk Factor Groups	n <sup>b</sup> (% of sample)	Median TV Exposure, h <sup>a</sup>	Percentage Exposed to >3 h of TV <sup>a</sup>	Percentage Households With TVs on During Most Meals <sup>a</sup>	OR (95% CI)
<b>Maternal obesity and perceived infant activity</b>					
1. Nonobese mother; low-active infant	52 (25)	1.5	13.5	—	Referent
2. Obese mother; low-active infant	46 (23)	1.5	26.1	—	1.10 (0.67, 1.82) <sup>b</sup>
3. Nonobese mother; high-active infant	61 (31)	1.7	27.9	—	1.27 (0.85, 1.90) <sup>b</sup>
4. Obese mother; high-active infant	43 (21)	3	44.2	—	2.18 (1.35, 3.51) <sup>b</sup>
<b>Maternal obesity and perceived infant fussiness<sup>c</sup></b>					
1. Nonobese mother; low-DTL infant	63 (31)	1.5	19.4	—	Referent
2. Obese mother; low-DTL infant	40 (19)	2	32.5	—	1.45 (0.84, 2.52) <sup>b</sup>
3. Nonobese mother; high-DTL infant	52 (25)	1.7	23.5	—	1.60 (0.96, 2.66) <sup>b</sup>
4. Obese mother; high-DTL infant	51 (25)	2.7	36.7	—	1.96 (1.11, 3.43) <sup>b</sup>
<b>Maternal obesity and infant crying duration</b>					
1. Nonobese mother; low-crying infant	60 (29)	1.4	22.0	—	Referent
2. Obese mother; low-crying infant	45 (21)	2	29.6	—	1.49 (0.88, 2.52) <sup>b</sup>
3. Nonobese mother; high-crying infant	58 (28)	1.7	19.3	—	1.47 (0.97, 2.21) <sup>b</sup>
4. Obese mother; high-crying infant	47 (22)	2.3	37.0	—	1.78 (1.02, 3.09) <sup>b</sup>
<b>Maternal education and perceived infant activity</b>					
1. High school graduate mother; low-active infant	75 (37)	2	—	37.8	Referent
2. Non-high school graduate mother; low-active infant	22 (11)	1	—	45.5	1.61 (0.66, 3.91) <sup>d</sup>
3. High school graduate mother; high-active infant	74 (37)	2	—	41.1	1.24 (0.73, 2.12) <sup>d</sup>
4. Non-high school graduate mother; high-active infant	31 (15)	3	—	61.3	3.25 (1.35, 7.81) <sup>d</sup>
<b>Maternal education and perceived infant fussiness<sup>c</sup></b>					
1. High school graduate mother; low-DTL infant	78 (39)	2	—	36.4	Referent
2. Non-high school graduate mother; low-DTL infant	23 (11)	1	—	52.2	1.62 (0.58, 4.56) <sup>d</sup>
3. High school graduate mother; high-DTL infant	71 (35)	2	—	42.9	1.55 (0.84, 2.87) <sup>d</sup>
4. Non-high school graduate mother; high-DTL infant	30 (15)	2.7	—	56.7	2.16 (0.85, 5.52) <sup>d</sup>

CI, confidence interval; OR, odds ratio.

<sup>a</sup> From 3-mo baseline visit.

<sup>b</sup> Represents effect of risk group on odds of higher TV exposure (no TV, 1–3 h of TV per day, >3 h of TV per day) in ordered logistic regression, adjusted for infant gender, visit, maternal TV viewing, and clustering by subject.

<sup>c</sup> Fussiness measured only at 3- to 9-mo visits.

<sup>d</sup> Represents effect of risk group on odds of a positive outcome in longitudinal logistic models, adjusted for infant gender, visit, maternal TV viewing, and repeated measures across subjects.

with higher daily infant TV exposure, whereas higher maternal education was associated with lower odds of having the TV on during meals. Contrary to previous research among preschool children,<sup>13,15</sup> maternal depression was not associated with infant TV exposure in our sample. A large national study also failed to find a significant association between maternal depression and infant TV exposure, suggesting that this association may differ by child developmental stage.<sup>14</sup> Similarly to a recent review,<sup>11</sup> but unlike other studies in toddlers and preschool children,<sup>16,17</sup> we did not find a significant association of TV in the infant's bedroom with hours of daily TV exposure. This may stem from the limited opportunity for our younger sample to be involved in independent activities<sup>11</sup>

or the relatively low prevalence of TVs in infants' rooms (14%–17%) before age 12 months. Having a TV in the infant's room was unexpectedly associated with lower odds of the infant being fed in front of the TV, suggesting that TV exposure during meals may be related to the distribution of TVs in the household.

Infants who were perceived as more active or fussier were exposed to higher levels of TV daily and were more likely to be fed while the TV was on. Lengthier daily crying duration was associated with higher odds of increased TV exposure across visits and placement in devices limiting movement while in front of the TV after 6 months of age. We are not aware of other studies examining how dimensions of infant

temperament relate to TV exposure; however, more difficult infant temperaments have been identified as risk factors for higher weight gain in the first 2 months of life,<sup>24</sup> greater gains in weight-for-length from age 6 to 12 months,<sup>25</sup> and overweight and obesity at age 6 years.<sup>26</sup>

Previous studies on infant temperament and overweight<sup>24,26</sup> have proposed that more difficult infant behavior elicits caregiving strategies that influence infant energy balance. Within our sample, higher levels of infant fussiness and activity at age 3 months have been previously associated with earlier solid food introduction<sup>20</sup> and higher fussiness with increased adiposity and weight-for-length z-score in later infancy.<sup>18</sup> Our current analysis

provides another potential mechanism linking perceived infant temperament to the development of an obesogenic early environment: more active or fussier infants are exposed to higher levels of TV because mothers use the TV to soothe and/or entertain them. This use of TV as an “electronic babysitter” was more likely among obese mothers, who may be more sedentary or who watch TV more often.<sup>15</sup> High levels of daily TV exposure accompanied by the use of devices limiting movement can reduce physical activity, a risk factor for overweight in children as young as 3 to 5 years.<sup>8</sup> Feeding with the TV on, a practice seen among less educated mothers with more active infants, can also influence dietary patterns, interfering with the development of internal satiety cues<sup>27</sup> or influencing the types of foods being consumed.<sup>7,12,27</sup>

Although this study provides a unique opportunity to examine the development of TV behaviors among low-income African-American infants, TV exposure is high among this sample, and results may not be generalizable to other samples with lower levels of TV exposure.<sup>8</sup> An important limitation is our use of a single pair of questions asking mothers to recall the amount of

time infants are “placed in front of the television when it is on” on the usual weekday and weekend day to estimate infant TV exposure. Although common in the literature,<sup>6,8,13,14,17</sup> these questions rely on maternal recall and do not distinguish between time spent watching versus not watching television or the types of programming viewed. Studies comparing maternal recall to daily logs and direct observation suggest that maternal reports slightly overestimate TV exposure time,<sup>28,29</sup> although a recent study found consistency between recalls and 24-hour TV diaries.<sup>28</sup> Because we do not know how mothers define “watching TV” for infants and toddlers,<sup>14</sup> our definition of TV exposure as “time spent in front of the television when it is on” potentially provides a more complete measure of total exposure to infant- and adult-directed TV.<sup>5</sup> Previous research suggests that 6-month-old infants will attend to TV half the time it is on but watch continuously for only short periods of time.<sup>30</sup> Nonetheless, with the high levels of TV exposure in this sample, infants are spending a large proportion of their waking hours in front of the TV, often in devices limiting movement and while they are being

fed. Although our longitudinal analysis captures developmental changes in TV exposure across infancy, the high levels of TV exposure seen at the 3-month baseline visit limit our ability to distinguish directionality in the association between infant TV exposure and dimensions of temperament. Further research may help distinguish whether infant temperament is a cause or consequence of higher TV exposure.

## CONCLUSIONS

Contrary to AAP recommendations, even young infants are exposed to high levels of TV daily, indicating that interventions limiting TV must begin early. Our results suggest that mothers, especially those who are obese or have not completed high school, use TV to entertain infants whom they perceive as more active or fussier. TV exposure may be an important factor influencing energy balance and the development of an obesogenic early environment. Future interventions should focus on encouraging more responsive parenting strategies for dealing with active and fussy infants to reduce early-life TV exposure.

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## Maternal Characteristics and Perception of Temperament Associated With Infant TV Exposure

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