Influence of Stress in Parents on Child Obesity and Related Behaviors

WHAT'S KNOWN ON THIS SUBJECT: Stress in parents has been shown to be related to child obesity.

WHAT THIS STUDY ADDS: The presence of multiple parent stressors was related to child obesity, and parent perception of stress was related to child fast-food consumption. Stress in parents may be an important risk factor for child obesity and related behaviors.

abstract

OBJECTIVE: To assess associations of the number of parent stressors and parent-perceived stress with obesity and related behaviors in their children.

METHODS: This cross-sectional analysis used data from the 2006 Southeastern Pennsylvania Household Health Survey in which 2119 parents/caregivers answered questions about themselves and their children (ages 3–17 years). Survey data were used to assess the main exposure variables: the number of stressors (measured using a stressor index) and parent-perceived stress (the response to a general stress question); child covariates (age, race/ethnicity, health quality, and gender); adult covariates (education, BMI, gender, poor sleep quality) and study outcomes (child obesity, fast-food consumption, fruit and vegetable consumption, and physical activity). To account for developmental differences, analyses were also stratified by age group (3–5, 6–8, 9–12, and 13–17 years). Analyses used multiple logistic regression, with results expressed as odds ratios and 95% confidence intervals.

RESULTS: The number of parent stressors was related to child obesity in unadjusted (1.12, 1.03–1.22, $P = .007$) and adjusted models (1.12, 1.03–1.23, $P = .010$). Parent-perceived stress was related to fast-food consumption in unadjusted (1.07, 1.03–1.10, $P < .001$) and adjusted (1.06, 1.02–1.10, $P < .001$) models.

CONCLUSIONS: The number of parent stressors was directly related to child obesity. Parent-perceived stress was directly related to child fast-food consumption, an important behavioral indicator of obesity risk. Clinical care models and future research that address child obesity should explore the potential benefits of addressing parent stressors and parent-perceived stress. *Pediatrics* 2012;130:e1096–e1104

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KEY WORDS

BMI, obesity, fast food, vegetables, fruit, physical activity, psychological stress

ABBREVIATIONS

CHDB—Community Health Database

CI—confidence interval

OR—odds ratio

www.pediatrics.org/cgi/doi/10.1542/peds.2012-0895

doi:10.1542/peds.2012-0895

Accepted for publication Jun 27, 2012

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

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

FUNDING: This research was supported, in part, by the following grants from the National Institutes of Health: 1T32HDHL0789, 3R01HD049701, 3P60MD000209-05S2, and K05CA128805. Funded by the National Institutes of Health (NIH).

Childhood obesity is epidemic, with physical, psychological, and social consequences often persisting into adulthood.^{1–4} Identifying the predictors of parent factors that might increase children's obesity risk may inform preventive strategies. Previous studies found a relationship between stressful events or situations (stressors) resulting in negative physiologic or psychological responses (stress) in parents of obese children.^{5–8} There are several mechanisms for how parent stressors can influence child obesity development.^{5,9,10} Parents experiencing multiple stressors or who perceive that they are under stress may spend less time with their children, use less effective parenting approaches, or both.^{5,7,9,10} This can yield less supervision for children, who may make unhealthy food and activity choices. Adults under stress report decreased fruit and vegetable consumption¹¹ and increased consumption of high-fat/high-sugar foods.¹² Parents under stress may experience more challenges in shopping for and cooking healthy foods, resulting in fewer fruits and vegetables in the home and an increased reliance on fast food. Similarly, stressed parents may be less likely to model and encourage their children to engage in physical activity.

Parent stressors that have been associated with childhood obesity include poor physical and mental health,⁷ financial strain,^{5,7} and single-family households.^{5,7,13} Although multiple stressors can elicit a “stressor pile-up” causing adverse physical health consequences in children,^{5,9} parents' perception of their general stress level may also be important and independent of actual stressors. Moreover, poor sleep quality has been associated with stress, poor diet, and lack of exercise in adults¹⁴; how this affects children has not been explored. The primary goal of this study was to assess the

association between the number of stressors or perceived stress in parents with child obesity, fast-food consumption, fruit and vegetable consumption, and physical activity. The main hypothesis is that children of parents with more stressors and higher levels of perceived stress will be more likely to be obese, consume more fast food but fewer fruits and vegetables, and be less physically active. An exploratory analysis tested the effects of parent sleep quality on these relationships.

METHODS

Participants

This secondary data analysis was based on data from the 2006 Southeastern Pennsylvania Household Health Survey/Community Health Database (CHDB), a cross-sectional regional survey by the Philadelphia Health Management Corporation.¹⁵ The CHDB is a population-based household random-digit-dial landline telephone survey conducted biannually to obtain information about local residents' health and social well-being. The survey was administered to 10 186 households (response rate 25%) in Philadelphia and neighboring suburbs between January and May 2006, of which 2119 had a child 3 to 17 years of age meeting study eligibility requirements. The sample was stratified into 3 to 5, 6 to 8, 9 to 12, and 13 to 17 year age groups to account for developmental differences. The adult most knowledgeable about the child's health and well-being (“the parent”) answered questions about themselves and 1 child per household was randomly selected by the Last Birthday Method.¹⁶ Telephone interviews were conducted in English or Spanish. All data are based on parents' responses. Institutional review board approval was obtained from the University of Pennsylvania and The Children's Hospital of Philadelphia.

Measures

Outcome Measures

Dependent variables were child obesity (BMI [weight in kg/height in m²] $\geq$ 95th percentile¹⁷ versus <95th percentile for age and gender), based on parent-reported child weight and height, parent-reported child fast-food and fruit and vegetable consumption, and child physical activity. Child fast-food consumption was assessed with the following question, responses to which were associated with increased BMI in children and adolescents in a previous study¹⁸: “In the past seven days, how many times did (he/she) eat from a fast-food restaurant, such as McDonalds, Pizza Hut or Crown Fried Chicken?” Consistent with previous research,¹⁹ responses were collapsed into 2 categories: ≥ 2 vs <2 times/week. Questions about child fruit and vegetable consumption and physical activity were taken from the US Centers for Disease Control and Prevention Behavioral Risk Factor Surveillance System.^{20,21} Child fruit and vegetable consumption was assessed by the question: “How many servings of fruits and vegetables does (he/she) eat on a typical day? A serving is equal to a medium apple, half a cup of peas, or half a large banana.” Recommended servings for each age category were provided by the Centers for Disease Control and Prevention.²² Categories for meeting these recommendations were collapsed by age: 3 to 5 years ($\geq$ vs <2 cups); 6 to 8 years (≥ 3 vs <3 cups), 9 to 12 years (≥ 3.5 vs <3.5 cups); and 13 to 17 years (≥ 4 vs <4 cups). Child physical activity was assessed with the question: “In the past month, how many times a week did (he/she) get 30 minutes of physical activity such as biking, engaging in sports and games, or participating in physical education class?” Based on current recommendations for children, responses were collapsed into 2

categories: ≥ 14 vs < 14 times/30 min/week (approximating the recommended 60 min/day, 7 days/week).²³

Main Exposure Variables

Number of parent stressors was assessed with a parent stressor index (ordinal scale from 0 to 7) created by using the sum of these 4 domains: physical health (2 questions) (“Would you say your health, in general, is excellent/good or fair/poor?” [fair/poor = 1; excellent/good = 0] and “Do you have a health problem or condition that requires medical treatment or hospitalization on a regular basis?” [yes = 1; no = 0]); mental health (1 question) (“Have you ever been diagnosed with any mental health condition, including clinical depression, anxiety disorder, or bipolar disorder?” [yes = 1; no = 0]); financial strain (3 questions) (parent employment [1 = unemployed; 0 = employed], parent health insurance [1 = no insurance; 0 = insurance], and poverty status [1 = below 200% federal poverty level; 0 = above 200% poverty level]); and family structure (1 question) (single parent [never married, divorced, widowed, or separated] or partnered [married or living with partner] [single parent status = 1, and partnered = 0]), as used in previous research.^{5,9} Parent-perceived stress was measured by a general stress question from the CHDB: “Using a scale from 1 to 10, where 1 means ‘no stress’ and 10 means ‘an extreme amount of stress,’ – how much stress would you say you have experienced in the last year?” Responses were analyzed as a continuous variable.

Covariates

Several additional variables were included as covariates a priori in the analyses for potential associations with parent stress and our outcome variables. Child-specific covariates included: age (years), gender, race/ethnicity (non-

Hispanic-white [white], non-Hispanic black [black], or Hispanic), and health quality (excellent or poor). Parent covariates included: gender, education level ($\leq$ high school versus $\geq$ college), and BMI. Sleep quality was added as an exploratory variable and was assessed by responses to the question: “In general, how would you rate the quality of your sleep in the past week on a scale from 1 to 5 with 1 being restless and 5 being restful?” from the Sleep Heart Healthy Morning survey.²⁴

Statistical Analysis

Child and parent characteristics are presented as means (SD) for continuous variables and percentages for categorical variables. For each dependent variable (child obesity, fast-food consumption, fruit and vegetable consumption, and physical activity), 3 logistic regression models were fit for the number of parent stressors and one was fit for parent-perceived stress. Model 1 contained the number of parent stressors or parent-perceived stress as the only independent variable. Model 2 was fit with the number of parent stressors or parent-perceived stress adjusted for the a priori covariates described previously. Model 3 was fit by using the number of parent stressors and the covariates listed above plus parent-perceived stress. To account for differences in child development and the nature of parent influence by child age, child age $\times$ number of parent stressors and child age $\times$ parent-perceived stress interactions were tested. In addition, a priori stratified analyses were conducted by age group (years): preschool (3–5), school (6–8), preteen (9–12), and teen (13–17) for all models. In post hoc analyses, a model was fit containing the 4 individual stressors included in the stressor index. Statistical significance was determined at $\alpha = .05$. Analyses were conducted by the use of Stata 11.0 (StataCorp, College Station, TX).

RESULTS

Descriptive characteristics for the sample appear in Table 1. Among the 2119 children, 25% were obese. The mean number of parent stressors was 1.4 ± 1.5 , and the mean for parent-perceived stress was 5.8 ± 2.8 (Table 1).

Child Age

There was no difference by age category for number of stressors or parent-perceived stress with child obesity, fruit and vegetable consumption, or physical activity. Child age was a significant interaction factor in the association of number of parent stressors with child fast-food consumption ($P = .03$). The stratum with the largest odds ratio (OR) for consuming fast food was ages 3 to 5 (Table 2). There were no other statistically significant associations of number of parent stressors and fast-food consumption with age. Child age was not a significant interaction factor in the relationship of parent-perceived stress with any outcome variable.

Number of Parent Stressors

As shown in Table 2, the number of parent stressors was directly associated with child obesity unadjusted (model 1) and covariate-adjusted (model 2). As shown in Table 3, this association remained significant, although somewhat attenuated, in the model that included parent-perceived stress with other covariates (model 3). Poor child health quality, black or Hispanic child race/ethnicity, parent with a high school education or less, and elevated parental BMI were predictive of child obesity (Table 3). Parent-perceived stress was not predictive of the child's obesity in this model.

Number of parent stressors was associated with child fast-food consumption in the unadjusted (Table 2) but not covariate-adjusted analysis (Table 3). Children of black and Hispanic

TABLE 1 Characteristics of the 2119 Children and Adult Respondents

Variables	% or mean (SD)
Child variables	
Race/ethnicity, %	
Non-Hispanic white	56
Non-Hispanic black	24
Hispanic	17
Male, %	52
Child age category, %	
Preschool (3–5)	18
School (6–8)	16
Preteen (9–12)	24
Teen (13–17)	40
Met recommended servings of fruits and vegetables for age, %	42.3
Preschool (3–5)	86
School (6–8)	58
Preteen (9–12)	28
Teen (13–17)	26
Met physical activity requirements of 60 min/d 7 times/wk, %	19
Preschool (3–5)	24
School (6–8)	23
Preteen (9–12)	20
Teen (13–17)	15
Consumed fast food ≥ 2 times/wk, %	34
Preschool (3–5)	23
School (6–8)	29
Preteen (9–12)	29
Teen (13–17)	43
BMI ≥ 95 th percentile, %	25
BMI z score	0.53 (1.2)
	Range –4.5 to 4.9
Parent variables^a	
No. of parent stressors	1.4 (1.54)
	Range 0–7
Perception of stress	5.8 (2.6)
	Range 1–10
Relationship to the child, %	
Mother	72
Father	22
Grandparent/other relative/ legal guardian	3/2/1
Race/ethnicity,%	
Non-Hispanic white	58
Non-Hispanic black	24
Hispanic	17
Male, %	28
Age, y	41 (8.7)
	Range 18–59
Education $\leq$ high school, %	39
BMI (kg/m ²)	32 (7.5)
	Range 23.6–73.6
Current smoker, %	23
Federal poverty level <200 , %	33
Unemployed, %	25
No health insurance,%	7.5
Poor health quality, %	16
Has a chronic health condition, %	20
Has a mental health diagnosis, %	15
Poor sleep quality,%	20

^a Parent is the adult respondent; survey response rate was 25%.

The number of parent stressors was not associated with meeting fruit and vegetable serving recommendations or physical activity recommendations in any model (Tables 2 and 3). Older children (age = continuous) were less likely to meet the fruit and vegetable and physical activity recommendations. Black children were more likely to meet physical activity recommendations. Girls and children with poor health quality were less likely to meet physical activity recommendations (Table 3).

Post Hoc Analyses of Individual Stressors

Of the measured stressors, single-parent households (family structure) had the strongest relationship with child obesity (OR = 1.60 95% confidence interval [CI] (1.24–2.07), $P = .007$), and financial stress the strongest relationship for a child not being physically active (OR = 0.74, 95% CI (0.58–0.95), $P = .019$). There was no significant difference with any of the parent stressors and child fast-food or fruit and vegetable consumption.

Parent-Perceived Stress

Parent-perceived stress was related to obesity in unadjusted analysis only (Tables 2, 3, and 4). Covariates associated with child obesity were the same as for number of parent stressors (Tables 3 and 4). Parent-perceived stress was associated with child fast-food consumption in all models. For every unit increase in parent-perceived stress level, the odds of child fast-food consumption ≥ 2 times/week increased by 7% (Table 2), and was essentially unchanged by adding important covariates (Table 3). Covariate associations with child fast-food intake were similar to those observed in the model on number of parent stressors, with the exception that, in this model, poor parent sleep quality was also predictive of greater child fast-food consumption.

race/ethnicity, of older age, parent with high school education or less, and parent with high levels of perceived stress

were more likely to consume fast food. Girls were less likely than boys to consume fast food (Table 3).

TABLE 2 Results of Logistic Regression Analyses of the Number of Parent Stressors and Parent-Perceived Stress with Child Obesity, Fast-Food Consumption, Fruit and Vegetable Consumption, and Physical Activity ($n = 2119$), Overall and by Child Age Group

	Obesity(BMI $\geq$ 95th percentile)	Fast-Food Consumption (≥ 2 or < 2 times/wk)	Fruit & Vegetable Intake(Meets Recommended Daily Servings for Age)	Exercise(Meets Recommended 60 min/d/wk)
No. of parent stressors (0–7) (unadjusted) ^a	1.26 (1.18–1.35)*	1.13 (1.07–1.19)*	1.02 (0.96–1.08)	1.05 (0.98–1.12)
No. of parent stressors $\times$ child age group (years) ^b	$P = .2$	$P = .03^*$	$P = .2$	$P = .5$
Interaction term				
Stratified				
Ages 3–5	1.05 (0.84–1.31)	1.23 (0.98–1.53)	0.93 (0.7–1.22)	1.01 (0.80–1.27)
Ages 6–8	1.27 (1.04–1.57)*	0.99 (0.81–1.21)	1.10 (0.91–1.33)	1.21 (0.99–1.49)
Ages 9–12	1.05 (0.89–1.24)	1.00 (0.86–1.16)	1.09 (0.94–1.27)	0.98 (0.83–1.15)
Ages 13–17	1.13 (0.98–1.31)	1.01 (0.91–1.13)	1.04 (0.92–1.17)	0.90 (0.78–1.04)
Parent perceived stress level (unadjusted) ^c	1.07 (1.03–1.11)*	1.07 (1.03–1.10)*	0.99 (0.96–1.02)	1.04 (1.00–1.08)*
Parent perceived stress $\times$ child age group (years) ^b	$P = .5$	$P = .3$	$P = .06$	$P = .5$
Interaction term				
Stratified:				
Ages 3–5	1.05 (0.95–1.17)	1.11 (0.99–1.23)	0.92 (0.8–1.04)	1.05 (0.95–1.15)
Ages 6–8	1.01 (0.91–1.12)	1.09 (0.99–1.20)	0.98 (0.9–1.07)	1.02 (0.92–1.13)
Ages 9–12	1.03 (0.94–1.03)	1.08 (1.00–1.16)*	0.96 (0.9–1.03)	1.06 (0.98–1.16)
Ages 13–17	1.13 (0.98–1.31)	1.01 (0.91–1.13)	1.04 (0.92–1.17)	0.90 (0.78–1.04)

Values presented are ORs (95% CI).

^a Measured by a 4-item parent stressor index.

^b Adjusted for the following child covariates: race/ethnicity, gender, health quality and adult covariates: adult gender, $\leq$ high school education, BMI, poor sleep quality.

^c Continuous 10-point scale.

* Significance = CIs do not contain 1 or $P < .05$.

Parent-perceived stress was not associated with meeting recommendations for child fruit and vegetable servings or physical activity in any model (Tables 2 and 4). Girls were less likely to consume fast food in the model with parent-perceived stress. Furthermore, black and Hispanic children were more likely to consume fast food. Covariate associations for physical activity paralleled those for parent-perceived stress.

DISCUSSION

The associations of food, stress, hormonal changes, and adiposity are complex and evolving.²⁵ Our results expand previous knowledge about parental stress and childhood obesity^{5,7–9,13}

by examining how multiple parent stressors and parent perceptions of stress relate to child obesity, fast-food consumption, fruit and vegetable consumption, and physical activity. We examined the number of parent stressors by using a stressor index and parent-perceived stress by using a general stress question in children, accounting for age effects. The number of parent stressors was directly related to child obesity, and parent-perceived stress was directly related to child fast-food consumption. However, neither parent stressors nor parent-perceived stress was associated with child fruit and vegetable consumption or physical activity. Black/Hispanic children, children from single-parent households, and children

from families with reduced finances are particularly at risk.^{13,26}

This study confirms that parent stressors are associated with childhood obesity in an ethnically and socioeconomically diverse population, an advancement over previous studies with more homogenous samples^{7,8,13} or those focused only on low-income families.^{5,9} The 2 approaches to measuring parent stress variables (number of stressors and perceived stress) yielded distinct findings, suggesting that they reflect different pathways of how stress exerts effects on factors related to child obesity.

To our knowledge, this is the first study to examine the association of parent-perceived stress with child fast-food

TABLE 3 Results of Logistic Regression Analyses of the Number of Parent Stressors and Covariates on Parent-Perceived Obesity, Fast-Food Consumption, and Physical Activity in Their Children ages 3 to 17 (*n* = 2119), with Parent-Perceived Stress in the Model

	Obesity (BMI ≥95th Percentile)	Fast-Food Consumption (≥2 or <2 times/wk)	Fruit & Vegetable Intake (Meets Recommended Daily Servings for Age)	Physical Activity (Meets Recommended 60 min/d/wk)
No. of parent stressors ^a	1.11 (1.02–1.21) ^b	1.00 (0.93–1.08)	1.06 (0.98–1.15)	1.01 (0.92–1.10)
Covariates				
Child age, y (continuous)	0.86 (0.83–0.88)	1.10 (1.08–1.13) ^b	0.80 (0.78–0.82)	0.96 (0.94–0.99)
Child race/ethnicity ^c				
Black	1.93 (1.46–2.56) ^b	1.60 (1.26–2.04) ^b	0.77 (0.60–1.00)	1.42 (1.07–1.88) ^b
Hispanic	1.75 (1.27–2.43)	1.48 (1.12–1.97)	0.75 (0.56–1.01)	0.98 (0.69–1.38)
Child gender ^d	1.02 (0.81–1.27)	0.73 (0.61–0.89)	1.33 (1.10–1.61) ^b	0.66 (0.52–0.82)
Child health quality ^e	2.42 (1.60–3.68) ^b	1.36 (0.94–1.97)	1.19 (0.80–1.77)	0.58 (0.35–0.97)
Adult gender ^d	0.81 (0.62–1.05)	0.94 (0.75–1.18)	1.35 (1.07–1.70) ^b	0.96 (0.74–1.25)
Adult education, ≤high school	1.37 (1.06–1.75) ^b	1.29 (1.04–1.58) ^b	0.84 (0.67–1.05)	1.20 (0.94–1.54)
Adult BMI	1.02 (1.01–1.04) ^b	1.00 (0.99–1.02)	1.00 (0.99–1.02)	1.00 (0.98–1.01)
Sleep quality ^f	1.04 (0.78–1.38)	1.22 (0.96–1.55)	1.02 (0.80–1.32)	1.19 (0.90–1.57)
Parent-perceived stress ^g	1.03 (0.98–1.08)	1.07 (1.03–1.12) ^b	0.99 (0.95–1.03)	1.03 (0.98–1.07)

Values presented are ORs (95% CI).

^a Measured by a 4-item parent stressor index, the sum of financial, physical, mental, and family structure stress factors.

^b Significance = CIs that do not contain 1.

^c Non-Hispanic whites.

^d Males.

^e Good health.

^f Good sleep.

^g Continuous 10-point scale.

consumption. Although there may be unmeasured confounding factors, the association is supported by evidence that adult perception of stress is associated with increased consumption of high-fat/high-sugar foods and haphazard meal planning.¹² Parents experiencing stress may purchase more fast food for their families to save time or reduce the demands of meal preparation. If confirmed, this association has several implications. Fast-food consumption is associated with obesity²⁷ and increases salt and saturated fat intake, risk factors for hypertension and dyslipidemia.²⁸ Fast-food consumption often includes sugar-sweetened beverages,²⁹ which are linked to obesity, type 2 diabetes, and metabolic syndrome in children.³⁰ Furthermore, fast-food consumption is associated with

decreased milk, vegetable and fruit intake, which can yield suboptimal intakes of nutrients (eg, vitamin D, folate).³⁰ Additionally, fast-food consumption is significantly higher among black and Hispanic children, who are at substantially higher than average risk for obesity.^{18,31} Reducing parental stress in families of black and Hispanic children may be particularly desirable for obesity prevention.

Contrary to expectation, neither parent stressors nor parent-perceived stress was related to decreased fruit and vegetable consumption. A previous study in 4- to 12-year-olds found an association between parental stress and children not meeting vegetable consumption guidelines, although this did not apply to fruit consumption.³² In

this study, fruit and vegetable consumption were combined, masking possible independent effects. Additionally, fruit and vegetable availability in the home was unmeasured and could have influenced this relationship.³³

There have been mixed results from studies of stress in adults and physical activity.^{34,35} Stress in children has not been associated with decreased physical activity.³⁶ Most children in this sample did not meet physical activity recommendations. Lack of physical education in school, limited recess, neighborhood safety, and affordable physical activity options may be stronger influences than either parent stressors or parent-perceived stress.²⁶ Parent sleep quality was predictive of child fast-food consumption. Poor sleep

TABLE 4 Results of Logistic Regression Analyses of Parent Perception of Stress Level and Covariates on Obesity, Fast-Food Consumption, Fruit and Vegetable Intake, and Physical Activity in Their Children Ages 3 to 17 (*n* = 2119)

	Obesity (BMI ≥95th percentile)	Fast-Food Consumption (≥2 or <2 times/wk)	Fruit & Vegetable Intake (Meets Recommended Daily Servings for Age)	Physical Activity (Meets Recommended 60 min/d/wk)
Parent-perceived stress level (adjusted) ^a	1.04 (0.99–1.09)	1.06 (1.02–1.10) ^b	0.99 (0.95–1.03)	1.03 (0.99–1.08)
Covariates (main effects) ^c				
Child age (continuous)	0.86 (0.83–0.88)	1.10 (1.08–1.12)	0.80 (0.78–0.82) ^b	0.95 (0.93–0.97)
Child race ^d				
Black	2.12 (1.64–2.75) ^b	1.69 (1.36–2.12) ^b	0.76 (0.60–0.97)	1.35 (1.04–1.75) ^b
Hispanic	1.96 (1.45–2.64)	1.55 (1.20–2.01) ^b	0.71 (0.54–0.93)	1.03 (0.76–1.39)
Child gender ^e	1.03 (0.84–1.28)	0.76 (0.63–0.91)	1.33 (1.10–1.60) ^b	0.69 (0.56–0.85)
Child health quality ^f	2.45 (1.65–3.63) ^b	1.27 (0.90–1.80)	1.20 (0.83–1.74)	0.59 (0.37–0.95)
Adult gender ^e	0.85 (0.66–1.08)	0.95 (0.77–1.17)	1.34 (1.08–1.66) ^b	0.99 (0.78–1.26)
Adult education, ≤high school	1.50 (1.21–1.92) ^b	1.27 (1.01–1.59) ^b	0.91 (0.74–1.12)	1.26 (1.00–1.58) ^b
Adult BMI	1.03 (1.00–1.04) ^b	1.00 (0.99–1.02)	1.01 (0.99–1.02)	1.00 (0.98–1.01)
Parent sleep quality ^g	1.27 (0.79–1.34)	1.27 (1.01–1.59) ^b	1.05 (0.83–1.33)	1.25 (0.97–1.62)

Values presented are ORs (95% CI).

^a Parent refers to the adult survey respondent providing information about the child.

^b Significance = CIs that do not contain 1.

^c 1 is lowest level of stress reference groups.

^d Non-Hispanic whites.

^e Males.

^f Good health.

^g Good sleep household.

quality is associated with obesity in adults and children^{14,37–39} and is related to stress.^{14,40} Furthermore, poor sleep quality in adults is associated with obesity, decreased physical activity, lower fruit and vegetable consumption, and increased fast-food consumption.^{18,20} The lack of association of parent sleep quality with child obesity, fruits and vegetable consumption, and physical activity was surprising. The reported effects of poor parent sleep on obesity in adults and children are physiologic, whereas fast-food consumption may be behavioral. Other influences on physical activity and fruit and vegetable consumption may exceed the effects of parent sleep. Strengths of this study include the large sample size, a socioeconomically, racially, and ethnically diverse sample, measurement of parent sleep quality, and the ability to link key lifestyle

behaviors of parents with child outcomes. This study also has several limitations. The overall survey response rate resulting in 10 186 households was low (25%), possibly related to the increased use of cell phones versus land lines. Use of cell phones and other technology is evolving, although there is evidence that families with children are more likely to maintain landlines than rely on cell phones.⁴¹ The low response rate may limit study generalizability and introduce bias if the associations examined here are different between responders and nonresponders.

The use of self-report measures overall and, specifically, the use of a single-item stress question is also a limitation.⁴² Only 4 types of stressors (mental, physical, financial, and family structure) were tested,⁵ raising the possibility that a more comprehensive stressor index should be used. Simi-

larly, obese individuals and parents of obese children tend to underreport the intake of high-fat and high-sugar foods^{43–45} and would make our results for child fast-food consumption conservative. The effect of parent-report measures on meeting fruit and vegetable and activity guidelines, however, is unknown. Additionally, parent-reported heights and weights were used and have been shown to be accurate in estimating BMI in children >13 years, even though adolescents themselves underestimate BMI.^{46–48} Parents, however, overestimate the prevalence of overweight and underestimate obesity prevalence in preschool-aged children and school-children.^{46,47} To account for potential overestimation of the overweight category, we dichotomized our outcome to ≥95th percentile or ≤95th percentile. Thus, although some truly obese

children may have been in the non-obese category, those in the obese category were likely truly obese.

Additionally, other potentially important covariates such as parent fast-food consumption, parent feeding behaviors, child feeding behaviors, food availability, and neighborhood factors were unavailable and therefore not included in our analyses. Finally, the cross-sectional design precludes inferences about

temporality. Future longitudinal studies are needed to further explore these associations.

CONCLUSIONS

Child obesity was related to a number of parent stressors. Parent-perceived stress was related to child fast-food consumption, which is an important risk indicator for obesity and child

health. These results have public health and clinical implications. Clinical care, research, and other programs addressing child obesity should consider the potential benefits of developing supportive strategies to reduce parent stressors. Additionally, decreasing perceived stress by teaching alternative coping strategies may be beneficial, particularly in high-risk minority populations.

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