Within-Family Obesity Associations

Evaluation of Parent, Child, and Sibling Relationships

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Background: How parent and sibling obesity status comparatively shape a child's obesity is unknown.

Purpose: To investigate how the obesity status of different children within the same family is related to a parent or sibling's obesity.

Methods: A national sample of adults in 10,244 American households was surveyed during 2011; data were analyzed in 2012–2013. Of these households, 1,948 adults had one or two children; provided sociodemographic information; and reported on adult and child height and weight, physical activity, and food environment. Logistic regression models were estimated in which the outcome of interest was child obesity status, with parent and sibling obesity as key predictors, adjusting for a range of both adult and child social and demographic confounders.

Results: In one-child households, it was 2.2 times more likely (SE=0.5) that the child would be obese if a parent was obese. In households with two children, having an obese younger sibling was more strongly associated with elder-child obesity (OR=5.4, SE=1.9) than parent's obesity status (OR=2.3, SE=0.8). Having an obese elder sibling was associated with younger-child obesity (OR=5.6, SE=1.9), and parent obesity status was no longer significant. Within-family sibling obesity was more strongly patterned between siblings of the same gender than between different genders, and child physical activity was significantly associated with obesity status.

Conclusions: Considering offspring composition and sibling gender may be beneficial in childhood obesity prevention and intervention.

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Introduction

Investigators who examine obesity often observe associations between parent and offspring obesity status. This is the case both when one observes the parent and child contemporaneously, and when a child's obesity is compared with a parent's childhood obesity status. Research has revealed a modest within-family parent–child BMI correlation of between 0.25 and 0.35; there appears to be a stronger relationship between mother and child BMI than between father and child.[1–4] Both parents being overweight or obese increases a child's obesity risk,[5] and adult BMI is independently associated with offspring BMI in both the adult's childhood and adulthood, suggesting multi-generational transfer.[6]

Compared with the parent–child obesity link, documentation of a sibling obesity association has been inconsistent. Some studies[7,8] reveal that obesity is common among offspring, whereas other research finds that having siblings may be protective against obesity[9] and that being a last-born child is a risk factor for later obesity.[10] Understanding how obesity correlates among siblings is important to give context to within-family obesity patterning.

Although shared genetic background may play a role, recent research highlights the importance of the food environment,[11–13] broader social environment,[14] and modifiable health behaviors such as food intake and physical activity (PA) in shaping these correlations.[15,16] From an ecologic perspective, the obesity status and unhealthy behaviors of children are shaped in important ways by the family environment and peer, school, and neighborhood contexts,[17–19] which together may influence sibling health differently than parent health.

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Despite prior research on this subject, little effort has been made to integrate parent and sibling studies to compare a child's obesity status with that of a sibling and parent. Moreover, the contribution of a family's shared social and food environments to obesity prevalence is treated inconsistently. An association is to be expected between parent and child obesity, and also between siblings, but the literature offers little guidance for which association may be stronger contextually. To the authors' knowledge, this study is the first to investigate the comparative associations between sibling and parent obesity with a focal child's obesity status in a way that gives attention to within-family social determinants of health, such as shared food environment and PA behaviors.

Methods

Recruitment

During early December 2011, a total of 14,400 households from the Nielsen/Information Resources Inc. National Consumer Panel (NCP, formerly HomeScan) were contacted to participate in a web-based survey about family-based health habits. The NCP is a stratified, proportionate sample of the contiguous 48 states and District of Columbia designed to gather information on food purchasing behaviors of Americans. The response rate from the NCP survey was 71% (n=10,244 households).

Participants were not paid for responding to the survey beyond the normal incentives Nielsen provides for participation in NCP data collection. The IRB at Massachusetts General Hospital determined that this research does not meet the definition of human subjects research because no personally identifiable information was obtained by the research team in a form associable with the participating individual.

Survey Methods

Participants completed the Family Health Habits Survey (FHHS) via the Internet. Inclusion criteria for the present analyses were that a family had either one or two children aged $<$18 years currently living at home, and that the responding adult reported height and weight for themselves and their child(ren). Of those in the random NCP sample (n=10,244), a total of 7,072 families had previously provided demographic data to Nielsen (highest level of household education, income, race, marital status, and geographic region). This covariate information was matched to new health survey data.

Of the families who provided health survey and demographic data, 6,019 provided self-reported height and weight: 18.9% (n=1,141) were households with a single child and 13.4% (n=807) were households with two children. These sample proportions are similar to tabulations from the 2012 American Community Survey, which show that about 20% of U.S. families have one child and 17% have two children.

The FHHS was designed to examine obesity correlations in families, with information collected on the social context of the food environment. Questions regarding self-reported height and weight, adults' health behaviors, and their children's health were adapted from a variety of validated sources, including the National Health and Nutrition Examination Survey and the Healthy Eating Active Living (HEAL) survey from the Veronica Atkins Center for Weight and Health.[20,21] The instrument was pretested with a focus group of ten colleagues, after which sequence, wording, and content were clarified.

Measures

The primary outcome measure was a child's binary classification as obese or not obese. Rather than using a continuous BMI measure, this dichotomization allows for examination of a discrete high-risk group. The obesity definition was derived from z-scores externally standardized using height, weight, gender, and age, on the basis of CDC 2000 Growth Chart data.[22] Children were classified using z-scores as "obese" or "not obese" with age- and gender-specific BMI cut-offs recommended by the Childhood Obesity Working Group of the International Obesity Taskforce.[23] In the Supplemental Material, additional analyses are robust to the use of alternative cut-points of "overweight/obese" or "not overweight/obese."

A key predictor is the responding parent's obesity status, derived from a BMI calculation of self-reported height and weight (height/weight^2). Adult obesity status was dichotomized into obese (BMI $\geq$30) or not obese (BMI $<$30). Other characteristics included adult socioeconomic and demographic background, health behaviors, and food environment, as well as corresponding child attributes reported by the parent. Adult sociodemographic measures include household income, head of household education, age, marital status, and race/ethnicity, as well as a fixed region effect (Pacific, South, Central, East). A subjective measure of SES asks adults to situate their family on a ladder corresponding to their perceived position in society.[24]

Health behaviors could be mediating factors in the within-family obesity correlations we estimate. Adults report sessions/week of moderate PA, sessions/week of vigorous PA, and perceptions of their fitness relative to peers. To adjust for general perceptions of well-being, two questions were asked about overall health. One is a standard 5-item global self-rated health (SRH) measure; here, the bottom two categories are collapsed into "low" and the top two categories into "high" to yield a 3-level measure (low, moderate, high). The question asked about their self-perception of fitness relative to friends.

A next vector of covariates described the adult's food environment: frequency of alcoholic beverages, fast-food meals, meals in front of the TV/computer, and emotional eating. A set of child-related characteristics included parent-reported child sessions/week of vigorous PA, child extracurricular activity, and fast-food consumption.

Data Analysis

Logistic regression models with robust SEs estimated the odds of a child being obese, adjusting for parent and sibling obesity status as predictors, and a broad set of social, demographic, and behavioral characteristics understood to be risk factors for obesity. The dependent variable represented the odds that a child will be obese,