

Food Insecurity and Links to Obesity in a Sample of Infants

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Background

Food insecurity is defined as “limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire food in socially acceptable ways” (Bickel, Nord, Price et al., 2000, page 6). Food insecurity is a multidimensional phenomenon that has successive stages as categorized by the USDA: food secure, food insecure, food insecure with moderate hunger, and food insecure with severe hunger. As households become more food insecure, there is a decrease in the frequency and quantity of children’s food intake (Nord, Jemison, & Bickel, 1999; Hamilton, Cook, Thompson et al., 1997). This deprivation of food can be a precursor to nutritional, health and developmental problems for infants and toddlers.

While the discussion of food insecurity often focuses on insufficient consumption, obesity is an important and growing public health concern that disproportionately affects low-income U.S. children, and the reasons why food insecurity may be related to obesity in some segments of the population are not well understood. Some studies indicate that children from food insecure households are at an increased likelihood of being overweight, while others show no association or an association with being underweight (Alaimo, Olson, & Frongillo, 2001a; Casey, Simpson, Gossett et al., 2005). One study using the NHANES III data found that children ages 2 to 7 from food insufficient households were *less* likely to be overweight than children from food sufficient households. In contrast, among children ages 8 to 16, non-Hispanic white girls from food insufficient households were *more* likely to be overweight than non-Hispanic white girls who were from food sufficient households (Alaimo, Olson, & Frongillo, 2001a). In addition, one study using the ECLS-K found that food insecurity was related to an increase in weight gain for school age children (Jyoti, Frongillo, & Jones, 2005), while another using a small community based sample found food insecurity to be related to being underweight (Matheson, Varady, Varady & Killen, 2002). Still other studies have found no relationship between food insecurity and obesity (Bhattachurrie et al., 2005; Rose & Bodor, 2006).

The U.S. government has stated its commitment to achieving food security through Healthy People 2010 (U.S. Department of Health and Human Services, 2000). The social, health, and financial consequences of the obesity epidemic are staggering, as overweight children are not only at increased risk for becoming overweight adults, but they are also concurrently at increased risk of developing a host of other health problems (DHHS, 2001). These concerns have led health professionals and policymakers to recognize childhood overweight as both a critical health problem of the 21st century (DHHS, 2001), and a Leading Health Indicator in Healthy People 2010 (DHHS, 2000).

Research Questions:

Our project addresses the following key research questions:

- Is there an association between food insecurity and infant obesity, and if so, what are the pathways through which food insecurity influences this outcome for infants?
- How do the associations and pathways through which food insecurity works to influence infant obesity differ based on characteristics of children and their families (i.e., by birth weight, income and parental nativity)?

Hypotheses:

We hypothesize that:

H1: Persistent food insecurity with moderate and severe hunger will be associated with obesity.

H2: Dietary behaviors (the quality, quantity and frequency of food intake) will represent an indirect path through which food insecurity influences obesity. Food insecurity (especially extreme forms involving hunger) may lead to concern that food will not be steadily available, resulting in excessive feeding of children when food is available, or concern about hunger resulting in reliance on food that is filling and high in calories, but low in nutrition.

H3: Food insecurity will lead to higher levels of aggravation in parenting and higher parental anxiety/depression, which will lead to poor dietary behaviors and, consequently, obesity.

H4: Food insecurity involving moderate and severe hunger will have more negative effects on children in households where the availability of time or material resources are constrained. More severe levels of food insecurity (i.e., moderate and severe hunger) will be more common among low-income families. Because low-income households have less economic stability and higher levels of stress associated with parenting, we

hypothesize that food insecurity will have more of a negative effect on obesity outcomes for children in these households. The combination of food insecurity and low-income will create a cumulative stress burden that will impair parenting (e.g., aggravation in parenting and parent anxiety/depression) resulting in higher levels of obesity for infants.

H5: Food insecurity with moderate and severe hunger will have a more negative effect on obesity for children in single-parent than two-parent families. Single parents face cumulative stress from diminished income, time and other resources. Food insecurity will be more likely to result in high levels of parental aggravation and parental anxiety/depression in these contexts, and these in turn are hypothesized to have a particularly negative influence on childhood obesity.

H6: We hypothesize that more severe levels of food insecurity (i.e., moderate and severe hunger) will be more problematic for children in households with larger family sizes (3 or more children) compared to smaller family sizes. Because larger families are likely to have higher levels of stress associated with aggravation in parenting and parental anxiety/depression, we hypothesize that food insecurity will have more of a negative effect on obesity outcomes for children in these households.

Data

Analyses will use the 9 and 24-month data from the Early Childhood Longitudinal Study- Birth Cohort (ECLS-B). The ECLS-B is the first longitudinal study in the U.S. to track a nationally representative sample of children from infancy to the time they enter school. It includes over-samples of important populations such as Asians and American Indians, low to moderately low-birth weight infants, and twins. Data collection is occurring in five waves: at approximately nine months after birth, 24 months, 48 months, entrance to kindergarten, and at first grade. The primary modes of data collection are in-person interviews and direct child assessments that occur during home visits. Information on children was also drawn from birth certificates.

The ECLS-B has several advantages for examining the proposed research questions. First, this study is one of the first of its kind to collect detailed information on food insecurity, hunger and child well-being while also collecting detailed data on parenting, parent-child relationships, and information on parental nativity allowing for an identification of children of immigrants. This survey is one of few studies that includes the new Household Food Security Scale (Bickel et al., 2000). The study includes data on food insecurity collected at two points in time covering most of the first two years of the child's life. The first wave – 9 months – includes data for the first 9 months of the child's life as well as 3 months prenatal, since the food insecurity scale covers a full year before the survey. The second point in time – 24 months – covers the entire second year of the child's life. Second, the ECLS-B also tracks parenting, parent-child relationships and child development across two points in time, allowing analyses of differences that are present at birth (or shortly thereafter) to be distinguished from those at a later point in time. Third, these data are recent and nationally representative and provide large samples that facilitate subgroup analyses. Fourth, these data include an over-sample of low birth weight children.

Sample for Proposed Analyses. At 9 months, 10,688 parent interviews and 10,221 child assessments were completed, and at 24 months, 9,831 parent interviews were completed, and 9,260 child assessments were completed (West, 2005). Estimates for the 24-month data are still preliminary. Data from the 9 and 24-month waves (including retrospective data from the previous calendar year) will be used to categorize children in households according to their levels of food insecurity. Data from the 9-month study will also be used as mediators to examine the pathways through which food insecurity influences obesity, because it is expected that food insecurity would influence concurrent feeding practices and parenting processes.

Complex Survey Design. All analyses will be conducted using sample weights and standard errors will be adjusted using a SUDAAN correction for the effects of the stratified clustered sample design of the ECLS-B.

Analytic Plan

Our first set of analyses will identify direct and indirect effects of food insecurity on obesity by examining the role of mediators in helping explain the relationship between food insecurity and obesity. We will examine whether the influence of food insecurity has a direct effect on obesity or whether it operates in part through combinations of infant feeding practices and/or parenting processes.

Univariate & Bivariate Methods. Initially we will conduct univariate analyses for key variables. We will first examine and report levels of food insecurity (i.e., the proportions that are food secure, food insecure, food insecure with moderate hunger, and food insecure with severe hunger), our mediating variables (i.e., infant feeding practices, parenting processes), sub-population variables (income level, birth weight and immigration status) and obesity in both the 9 and 24-month waves of data.

Appropriate sampling weights will be used for all analyses so that results will be representative of the U.S population. Analyses will be conducted using sample weights to correct for the different probabilities of sample selection resulting from over-sampling in the ECLS-B. Standard errors will be adjusted using a SUDAAN correction in SAS for the effects of the stratified clustered sample design of the ECLS-B. We will then conduct bivariate analyses to examine the associations between food insecurity and obesity. Bivariate analyses will also be conducted between our food insecurity variable and our sub-group variables to determine the proportions in our key subgroups (income, birth weight categories and immigration status categories) that are food secure, food insecure, food insecure with moderate hunger, or food insecure with severe hunger. We will compare percentages and means of variables for each category of food insecurity, examine chi-squares for categorical variables, and use bivariate Generalized Linear Models (GLM). Standard errors will be adjusted using a SUDAAN correction in SAS for the effects of the stratified clustered sample design of the ECLS-B.

Multivariate Methods. This stage of analysis will test structural equation models (SEM). With SEM, interrelations among factors relating food insecurity and obesity, both direct and indirect, can be tested. While the answers to our questions could be tested using Ordinary Least Squares regression models, SEM is the optimal statistical technique for performing the proposed analyses of mediators. SEM refers to a set of techniques for estimating a causal model such as the one shown in **Figure 1** on page 16 (Bollen, 1989). SEM allows researchers to examine relationships among systems of interrelated variables. These techniques permit (a) unbiased estimation of causal effects within a system of equations, (b) estimating the magnitudes of both direct and indirect effects of the independent variables on the dependent variables in the model, (c) inclusion of variables that are both directly-measured and scaled, (d) calculation of goodness-of-fit measures for the overall model, (e) using modification indexes to test for, and include, correlated errors across equations so as to improve model fit, and (f) full information maximum likelihood estimation to take account of missing data values.

Analytical Approach. The initial models will test the relationship between food insecurity (with moderate and severe hunger) and each of the process variables (e.g., infant feeding practices, parenting processes), individually. These tests will allow us to answer how food insecurity at different levels relates to infant feeding practices and parenting processes. We will then examine the link between these processes and obesity. An SEM model estimates direct effects of food insecurity on obesity. It also estimates the indirect effect through parenting processes and infant feeding practices, as well as child health and nutritional status on children's outcomes. Taken together, this set of models will tell us how food insecurity relates to infant feeding practices and parenting processes, and in turn, obesity.

For all of our models using SEM, we will assess model fit using the Comparative Fit Index (CFI), the Root Mean Square Error of Approximation (RMSEA), and the Standardized Root Mean Square Residual (SRMR). The cut-off of .06 for the RMSEA, of .95 for the CFI, and .09 for the SRMR (Hu & Bentler, 1999) will be used to assess whether models have an acceptable fit. These tests have been found to provide reliable assessments of the degree to which models fit data that are not overly sensitive to sample size. Several different sets of software now exist to implement these techniques, and our analyses will be conducted using AMOS (Arbuckle & Wothke, 2005), and M-Plus software (Muthen & Muthen, 2005).

Sub-Group Differences. To test differences using cross group comparison models in SEM, we will estimate models separately for the two groups and tested whether constraining a given pathway to be equal for the groups makes for a significantly worse-fitting model. If there is no indication that this constraint worsens the model fit, then there is no difference in that path for the two groups. For the sub-group models, we will assess model fit using the CFI, the RMSEA, and the SRMR.

Preliminary Findings

Not yet available, but will be for the conference.