Increased Rates and Severity of Child and Adult Food Insecurity in Households With Adult Smokers

Cynthia Cutler-Triggs, MD; George E. Fryer, PhD; Thomas J. Miyoshi, MSW; Michael Weitzman, MD

Objective: To investigate rates and severity of child and adult food insecurity (the inability to access enough food in a socially acceptable way for every day of the year) in households with and without smokers.

Design: Cross-sectional survey.


Participants: Households with children through age 17 years (n=8817) in the National Health and Nutrition Examination Survey.

Main Exposure: Presence or absence of adult smokers in the household. Covariates included age, sex, and race/ethnicity of the child, and the poverty index ratio.

Main Outcome Measure: Rates and severity of food insecurity were ascertained using the US Department of Agriculture Food Security Survey Module.

Results: Food insecurity was more common and severe in children and adults in households with smokers. Of children in households with smokers, 17.0% were food insecure vs 8.7% in households without smokers (P < .001). Rates of severe child food insecurity were 3.2% vs 0.9% (P < .04), respectively. For adults, 25.7% in households with smokers and 11.6% in households without smokers were food insecure, and rates of severe food insecurity were 11.8% and 3.9%, respectively (P < .003 for each). Food insecurity was higher in low-income compared with higher income homes (P < .01). At multivariate analyses, smoking was independently associated with food insecurity and severe food insecurity in children (adjusted odds ratio, 2.0; 95% confidence interval, 1.5-2.7, and adjusted odds ratio, 3.1; 95% confidence interval, 1.4-6.9, respectively) and adults (adjusted odds ratio, 2.2; 95% confidence interval, 1.6-3.0, and adjusted odds ratio, 2.3; 95% confidence interval, 1.4-3.7, respectively).

Conclusions: Living with adult smokers is an independent risk factor for adult and child food insecurity, associated with an approximate doubling of its rate and tripling of the rate of severe food insecurity.


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APPARENTLY 13 MILLION children in the United States live in food-insecure households,1 experiencing periods during which they skip meals, are hungry, and even have entire days or longer without eating.1 These children, and those who may not experience food insecurity directly but live in households with adults who do, demonstrate measurably negative effects on their physical health,2,6 neuropsychological development,3,7-9 scores on standardized tests of academic achievement,8 and quality of life.10 Objective 19-18 of Healthy People 201011 sets a goal for a national rate of household food insecurity of no more than 6% overall by 2010, but recent data indicate that in 1 year in the United States, 11% of all households experience food insecurity and almost 4% of all households experience severe food insecurity.1

Food security is defined as the access at all times to enough food for an active healthy life.12,13 This includes, at a minimum, the availability of nutritionally adequate and safe foods and the ability to acquire these foods in socially acceptable ways.12,13 In contrast, food insecurity is the inability to access enough food in a socially acceptable way for every day of the year.12 In households with the most severe food insecurity, there are multiple involuntary reductions in food intake and disruptions of usual eating patterns.14,15

Food insecurity is strongly associated with household income.1,16,17 Families with at least 1 smoker spend 2% to 20% of their income on tobacco.18-20 Therefore, household smokers can significantly affect financial resources because most smokers in the United States are poor or near...
poor. To our knowledge, the relationship of household smoking and food insecurity in children and the adults with whom they live has not been previously examined. In this study, we assessed the following questions: Do children and adults living in households with smokers have a greater likelihood of experiencing food insecurity compared with children living in households without smokers? If yes, is adult smoking also associated with severe food insecurity in the children and adults in their households?

METHODS

Data from the National Health and Nutrition Examination Survey (NHANES) from 1999 to 2002 were examined. NHANES is a nationally representative survey that uses a multistage, clustered, stratified sampling design, is conducted annually by the National Center for Health Statistics of the Centers for Disease Control and Prevention, and is reported every 2 years. Before 1999, NHANES assessed food insecurity for the respondent's household as a whole, not allowing for the separate assessment of food insecurity in the children and adults residing together in particular households. Since 1999, NHANES has included the US Department of Agriculture Food Security Survey Module as part of its household questionnaire (see the “Food Security Survey Module” subsection).

SAMPLE

*Children* were defined by the legal definition of a minor, that is, age 17 years or younger, and all such individuals with relevant data were included. All variables used were obtained from either the sample person files (the individual files for the person aged ≤17 years) or the family demographic data, which were linked to the specific sample person. All aspects of NHANES were approved by the Institutional Review Board of the National Center for Health Statistics, and informed consent was obtained from all participants.

VARIABLES

Covariates included were limited to child and household variables. In the NHANES data set, once the child was selected, only household data could be linked to the child. Parental demographic data were not linkable to the sample child in the data set and were not included in the analysis. Therefore, independent variables included child age, sex, and race/ethnicity; household poverty index ratio (PIR); and reported residence in a home with at least 1 adult smoker. Each of these variables was analyzed for comparisons between households in which children reside with and without smokers and for their associations with child and adult food security status in these households.

The PIR is the total household income divided by the federal poverty threshold for that particular household of specified size. A PIR of 1 indicates a household income at the poverty level; a PIR of 2 indicates a household income at twice the poverty level; and so on. Children living in households with a PIR less than 1.85 were categorized as living in low-income households because this is the general income level below which a household is eligible for 2 of the 3 largest US Department of Agriculture food and nutrition services from the federal food assistance programs: the Special Supplemental Nutrition Program for Women, Infants, and Children and the National School Lunch Program. The third program is the Food Stamp Program, which has a lower income threshold (PIR of ≤1.3), and so was included in the households with a PIR less than 1.85.

Researchers have determined that families living in households with a PIR of 2 or less are considered low-income families. Therefore, a PIR of 1.85 encompasses low-income families who are eligible for federal food assistance programs.

Households were characterized as smoking households if the survey respondent answered affirmatively to the question, “Does anyone who lives here smoke cigarettes anywhere inside this home?” and as nonsmoking households if this question was answered negatively.

FOOD SECURITY SURVEY MODULE

Food security, insecurity, and severe insecurity were assessed using the US Department of Agriculture Food Security Survey Module. This module was developed to assess the presence and severity of food deprivation resulting from inadequate household resources during the preceding 12 months and has been used by the federal government and researchers in numerous previous studies and reports. Food security status was assessed separately for children and adults in the home on the basis of scores on the adult and child modules of the Food Security Survey Module, as recommended.

Scoring of the Food Security Survey Module uses an 18-point scale (Table 1) based on 18 questions, 10 of which pertain to adults in the home and the remaining 8 to those aged 17 years or younger who live in the home with the adults. The survey is scored on a continuous scale but typically is reported in terms of specific categories on the basis of ranges of scores. For an adult to be considered food insecure, an affirmative answer to at least 3 questions is needed. On the child food security scale, an affirmative answer to any 2 questions indicates food insecurity.

Table 1. US Food Security Survey Module

<table>
<thead>
<tr>
<th>10 Items Pertaining to Adults in Household</th>
<th>8 Items Pertaining to Children in Household</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worried food would run out before we got money to buy more</td>
<td>Relied on a few kinds of low-cost food to feed children because ran out of money to buy food</td>
</tr>
<tr>
<td>Food bought didn’t last, and didn’t have money to get more</td>
<td>Couldn’t feed children balanced meals because couldn’t afford</td>
</tr>
<tr>
<td>Could not afford to eat balanced meals</td>
<td>Children not eating enough because couldn’t afford</td>
</tr>
<tr>
<td>Cut the size of meals or skipped meals because there wasn’t enough money for food</td>
<td>Cut the size of children’s meals because there wasn’t enough money for food</td>
</tr>
<tr>
<td>Ate less than should because there wasn’t enough money to buy food</td>
<td>Children skipped meals because there wasn’t enough money for food</td>
</tr>
<tr>
<td>Hungry but didn’t eat because couldn’t afford enough food</td>
<td>Children skipped meals in 3 or more months over last 12 months</td>
</tr>
<tr>
<td>Lost weight because didn’t have enough money for food</td>
<td>Children hungry but couldn’t afford more food</td>
</tr>
<tr>
<td>Did not eat for a whole day because there wasn’t enough money for food</td>
<td>Children did not eat for a whole day because there wasn’t enough money for food</td>
</tr>
</tbody>
</table>

*All items refer to status during the previous 12 months.
From Nord et al.*

References 1, 2, 4-6, 9, 10, 13, 14, 17, 27-32.
Table 2. Characteristics of Children and Their Households

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td></td>
</tr>
<tr>
<td>&lt;1</td>
<td>10.5</td>
</tr>
<tr>
<td>2-5</td>
<td>21.5</td>
</tr>
<tr>
<td>6-12</td>
<td>40.0</td>
</tr>
<tr>
<td>13-17</td>
<td>28.0</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>51.0</td>
</tr>
<tr>
<td>Female</td>
<td>49.0</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>58.6</td>
</tr>
<tr>
<td>Black</td>
<td>14.5</td>
</tr>
<tr>
<td>Hispanic</td>
<td>20.6</td>
</tr>
<tr>
<td>Other</td>
<td>6.3</td>
</tr>
<tr>
<td>Poverty index ratio</td>
<td></td>
</tr>
<tr>
<td>&lt;1.85</td>
<td>48.8</td>
</tr>
<tr>
<td>&gt;1.85</td>
<td>51.2</td>
</tr>
<tr>
<td>Smoking in household</td>
<td></td>
</tr>
<tr>
<td>Present</td>
<td>22.8</td>
</tr>
<tr>
<td>Not present</td>
<td>77.2</td>
</tr>
<tr>
<td>Adult food security</td>
<td></td>
</tr>
<tr>
<td>Food secure</td>
<td>85.0</td>
</tr>
<tr>
<td>Secure</td>
<td>-75.3</td>
</tr>
<tr>
<td>Marginally secure</td>
<td>9.7</td>
</tr>
<tr>
<td>Food insecure</td>
<td>15.0</td>
</tr>
<tr>
<td>Low security</td>
<td>9.3</td>
</tr>
<tr>
<td>Very low security (severe food insecurity)</td>
<td>5.7</td>
</tr>
<tr>
<td>Child food security</td>
<td></td>
</tr>
<tr>
<td>Food secure</td>
<td>89.2</td>
</tr>
<tr>
<td>Secure</td>
<td>83.2</td>
</tr>
<tr>
<td>Marginally secure</td>
<td>6.0</td>
</tr>
<tr>
<td>Food insecure</td>
<td>10.9</td>
</tr>
<tr>
<td>Low security</td>
<td>9.5</td>
</tr>
<tr>
<td>Very low security (severe food insecurity)</td>
<td>1.4</td>
</tr>
</tbody>
</table>


Adults may be categorized as highly food secure (0 affirmative answers), marginally food secure (1-2 affirmative answers, indicating anxiety about food sufficiency but no changes in intake), low food secure (3-5 affirmative answers, indicating reduced quality, variety, or desirability of diet), or very low food security (6-10 affirmative answers, indicating decreased food intake and disrupted eating patterns). Children may be categorized as highly food secure (0 affirmative answers), marginally food secure (1 affirmative answer), low food secure (2-4 affirmative answers), or very low food secure (5-8 affirmative answers). The US Department of Agriculture accepts combining the categories for adults and children into 2 categories for each group—food secure and food insecure. This study combines highly food secure and marginally food secure as food secure, and uses 2 categories of food insecurity: food insecure, which includes low food secure and very low food secure, and severely food insecure, which is the classically used term for those adults and children who meet the criteria for very low food secure.

STATISTICAL ANALYSES

All statistical analyses were performed using commercially available software (SUDAAN version 9.0.1; RTI International, Research Triangle Park, North Carolina) to accommodate sample design complexities such as oversampling certain segments of the population. The appropriate statistical weights were applied to produce national estimates.

Bivariate analyses were conducted to assess the associations of adult and child food insecurity with household and individual factors. All comparisons were made using the chi-square test to determine statistical significance set at P < .05. The association of adult smoking in the household with adult and child food insecurity was determined for the entire sample and stratified by child age, sex, and race/ethnicity; household smoking; and PIR.

Multiple logistic regression analyses were performed to investigate possible independent associations of adult household smokers and increased prevalence and severity of food insecurity in children and adults in these homes. Separate regression analyses were performed for adults and children, both to explore food insecurity overall and to explore whether severe food insecurity, which includes severe disruptions and decrease in food intake, is independently associated with the presence of adult household smokers. The regression models included all 8817 households who answered the Food Security Survey Module. The first model included all households with outcomes dichotomized into food-secure and food-insecure groups. The second model also included all households with outcomes dichotomized into severe food insecurity and all other food security groups. All multivariable models included as covariates child age, sex, and race/ethnicity, and household PIR.

A total of 8817 households with children and adolescents were included in the analyses. Table 2 gives the characteristics of these children and their households. Almost one-fourth of the households had an annual income below the poverty level, and almost half were classified as low-income families (18.5% of the poverty level). Approximately 23% of households with children included at least 1 adult smoker, and 32% of children in low-income households lived with a smoker compared with 15% of those in more affluent households (P < .001). Overall, 15% of adults and 11% of children experienced some degree of food insecurity during the previous 12 months, with 6% of adults and 1% of children experiencing severe food insecurity (very low food security) (P = .02 and P < .001, respectively).

Table 3 gives the rates of child food insecurity overall and severe child food insecurity (very low security) by child and household characteristics. Rates of childhood food insecurity in those living in households with smokers were approximately double (17% vs 9%; P < .001), and rates of children experiencing severe food insecurity were more than triple (3% vs 0.9%; P = .04) compared with those in nonsmoking households.

Black and Hispanic families had higher rates of child food insecurity in both smoking and nonsmoking households compared with white and other families. The highest rates of food insecurity were in children living in low-income households with smokers (25% vs 17% for those in low-income homes with and without smokers, respectively; P = .01). While not statistically significant for households with a PIR at or above 1.85, the trend was for children in household with smokers to have higher rates of food insecurity compared with those in similar economic circumstances in households without smokers.

RESULTS
Table 4 gives factors associated with rates of adult food insecurity. While rates are higher for adults than for the children they live with, the associations with living in households with smokers are similar to those found for children. Overall, 26% of adults living in households with children and smokers were food insecure compared with 12% of adults living in households with children but with no smokers ($P<.001$). Low-income households with smokers had the highest rates of adult food insecurity, similar to the finding for children. Household smoking was associated with triple the rate of severe food insecurity in adults compared with households without smokers (12% vs 4%; $P<.003$). Rates of severe food insecurity were also highest in adults in low-income households with smokers, with 17% of adults in such households experiencing severe food insecurity compared with 8% who lived in low-income homes without smokers ($P=.01$).

The independent associations of child food insecurity and severe food insecurity, and adult food insecurity and severe food insecurity with each characteristic investigated is given in Table 5. When adjusting for child
This study confirms how common food insecurity, exposure to secondhand smoke are for children living in US households with low income. Never before demonstrated, to our knowledge, these data indicate that living with adult smokers is an independent risk factor for children’s food insecurity, associated with an approximate doubling of its rate and a tripling of the rate of severe food insecurity, even after controlling for household income. In low-income households, 1 in 3 children live with a smoker, and in such households, 1 of 4 children and 1 of 3 adults experience some degree of food insecurity. One of 20 children and 1 of 6 adults in low-income homes with smokers have severely compromised diets.

In the United States in 2005, an estimated $82 billion was spent to purchase cigarettes, with the average price of a pack of cigarettes being more than $4. Families with low income, in general, are more likely to experience food insecurity, and spend less on food, and spend a larger percentage of available money on tobacco compared with more affluent families. In developing countries such as Bangladesh, China, and Bulgaria, tobacco expenditures crowd out expenditures for food, health care, and education. While the available data do not enable us to examine whether this is the mechanism behind the findings presented herein, it seems plausible.

Although the effect of poverty on food insecurity cannot be overstated, inasmuch as it was the greatest independent predictor, it does not explain all food insecurity. Smoking was a significant independent predictor of food insecurity even after controlling for household income level. Possible mechanisms beyond the economic effect of tobacco may include behavioral or psychosocial differences in smoking households compared with nonsmoking households in terms of dietary behavior and food acquisition. Smokers have different dietary attitudes and behaviors than those of nonsmokers, and this may extend to feeding practices of their children as well. This relationship cannot be tested with the current data set, and further research is needed to assess these characteristics.

Race/ethnicity also has a strong role in food insecurity: black and Hispanic families experience higher rates of food insecurity even after controlling for household income level. Possible mechanisms beyond the economic effect of tobacco may include behavioral or psychosocial differences in smoking households compared with nonsmoking households in terms of dietary behavior and food acquisition. Smokers have different dietary attitudes and behaviors than those of nonsmokers, and this may extend to feeding practices of their children as well. This relationship cannot be tested with the current data set, and further research is needed to assess these characteristics.

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Children who experience food insecurity are at higher risk for cognitive and psychosocial disability, 3,9 poorer quality of life, 10 and higher rates of suicidal ideation. 7 They have lower scores on standardized academic tests, miss more days of school, and have more difficulty getting along with others. 8 They also have poorer overall health, higher lead levels, increased rates of iron deficiency, and more emergency department use and hospitalizations. 2,6 Moreover, related literature indicates that even food-secure children experience deleterious effects from living with food-insecure adults. 9,10

Child sex differences were noted in this study. Although sex was not a significant predictor of food insecurity, male sex was independently associated with severe child food insecurity. Sex differences related to nutrition have been reported as recent studies in developed countries have shown that boys may consume more carbohydrates than girls do, 46-47 and that girls may have a stronger preference for nutritious foods. 48,49 If boys and girls are consuming different types of foods, this may have an effect on sex on food consumption. Additional research including a detailed dietary history is needed to further assess this theory.

There are limitations to this study. These data are cross-sectional, limiting our ability to draw causal inferences. The potential of unmeasured confounders introducing unrecognized biases is a possibility in an observational study such as this. Findings related to severe food insecurity were not robust across all subgroups in the analysis. For example, across racial/ethnic groups, smoking was significantly associated with severe food insecurity only for white families; this may be because of the low number of subjects included in these subgroups. Additional covariates likely related to food insecurity include parental demographic data, for example, immigration status, and nonincome financial support, such as participation in the Special Supplemental Nutrition Program for Women, Infants, and Children, which would have strengthened our findings. However, these additional covariates were either unreported in the data or were not linkable to the sampled cases.

Other limitations are that measures used were based on adult report, and it is possible that the wording of the question about the presence of adult smokers in the household may have led some respondents to answer no if there were adult smokers living in the home who smoked only outside the home. If this were the case, however, it would falsely diminish rather than falsely inflate the independent risk of food insecurity associated with adult household smokers. An additional limitation is that we could not ascertain whether more household smokers was associated with higher rates and severity of food insecurity.

To our knowledge, this is the first study to show a relationship between adult smoking and child and adult food insecurity in the United States. These data also demonstrate how pervasive this combination of child health risks is in low-income families. The burden of food insecurity is a previously unrecognized danger of adult tobacco use to be added to the ever growing list of negative effects of adult tobacco use on children in the United States.

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Children need models more than they need critics.
—Joseph Joubert