RESEARCH
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Dietary Research to Reduce Children's Oral Health Disparities: An Exploratory Cross-Sectional Analysis of Socioeconomic Status, Food Insecurity, and Fast-Food Consumption

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ABSTRACT

Background Tooth decay is the most common childhood disease and it disproportionately affects low-income children. The dietary risk factors associated with socioeconomic status (SES), such as food insecurity and fast-food consumption, are poorly understood.

Objective To better understand how upstream social factors are related to dietary behaviors by testing the hypothesis that food insecurity mediates the SES–fast-food consumption relationship.

Design A 36-item survey was administered to caregivers of children younger than age 18 years (n=212). The predictor variable was SES, measured by whether the child was insured by Medicaid (no/yes). Food insecurity, the potential dietary mediator, was measured using the six-item US Department of Agriculture Household Food Security Survey (food secure/food insecure without hunger/food insecure with hunger). The outcome variable was whether the household reported eating at a fast-food restaurant ≥2 times a week (no/yes). We used logistic structural equation and mediation models to test our hypothesis.

Results About 63% of children were classified as low SES. Thirty percent of caregivers reported food insecurity (with or without hunger) and 18.6% of households consumed fast food ≥2 times per week. Lower SES was significantly associated with food insecurity (odds ratio [OR] 3.03, 95% CI 1.51 to 6.04; P=0.002), but SES was not related to fast-food consumption (OR 1.94, 95% CI 0.86 to 4.36; P=0.11). Food insecurity was not associated with fast-food consumption (OR 1.76, 95% CI 0.86 to 3.62; P=0.12). The mediation analyses suggest food insecurity does not mediate the relationship between SES and fast-food consumption. However, there are important potential differences in fast-food consumption by SES and food insecurity status.

Conclusions Future dietary research focusing on tooth decay prevention in vulnerable children may need to account for the differential effects of SES on food insecurity and dietary behaviors like fast-food consumption. Studies are needed to further elucidate the mechanisms linking SES, dietary behaviors, and tooth decay in children.
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TOOTH DECAY (DENTAL CARIES) IS THE MOST COMmon childhood disease in the United States and it disproportionately affects low-income children.[1-5] Untreated tooth decay can lead to pain, infection, school absences, poor academic performance, low oral health quality of life, hospitalizations, and in rare cases death.[6-9] In addition, the potential associations between poor oral health and systemic diseases such as hypertension, cardiovascular disease, peripheral arterial disease, stroke, and obesity that manifest throughout the life course have underscored the importance of identifying strategies to prevent oral diseases.[10-14] Identifying and understanding the social and behavioral determinants of oral disease are likely to be critical in eliminating oral health disparities among socioeconomically vulnerable children.[15,16]

Food insecurity, a social determinant of health, is defined as inadequate access to food that results in food shortages, disrupted eating patterns, and hunger.[17] Many low-income children live in households that encounter food insecurity, which is associated with tooth decay and other adverse childhood conditions.[18-21] A potential mechanism linking food insecurity and tooth decay is dietary behaviors, including the quantity and frequency of carbohydrate consumption.[22,23]

Dietary sources of cariogenic (ie, tooth decay-causing) carbohydrates include candies and sweets, fruit juices,

sugar-sweetened beverages, crackers, and chips, and to a lesser extent breads, rice, and pasta.[24-26] In the presence of cariogenic bacteria, the consumption of fermentable carbohydrates can lead to acid production with the potential for demineralization.[27] Cavities result when the demineralization process proceeds uncontrolled. Topical fluorides found in fluoridated toothpaste, mouthwash, and drinking water as well as fluoride gels, foams, and varnishes applied to the teeth during preventive dental or medical care visits may help reverse the demineralization process.

Numerous studies have shown that fast foods are a source of dietary carbohydrates, including added sugars and sugar-sweetened beverages, and studies suggest a relationship between fast-food consumption (FFC) and tooth decay in children.[28-31] Whereas low socioeconomic status (SES) may be associated with food insecurity and food insecurity, in turn, is related to tooth decay in children, the potential link between food insecurity and FFC has not yet been examined.[30,32] As a result, there is a critical gap in the scientific literature regarding potential mechanisms linking upstream social factors, dietary behaviors, and child oral health outcomes. Our study goal was to start to address this research gap by testing the hypothesis that food insecurity mediates the relationship between SES and FFC.

MATERIALS AND METHODS

This was a cross-sectional observational study. We approached, recruited, and verbally consented a purposive sample of caregivers with children younger than age 18 years seeking dental care. Bias was minimized by including all caregivers wishing to participate. Participants were recruited from a university-based pediatric dentistry clinic in Seattle, WA, from December 2011 to January 2012 (n=212). After obtaining verbal consent, which was requested by the institutional review board to prevent potential disclosure of study participants' identities in this minimal risk study, we administered a 36-item survey to caregivers. The English-language survey included questions on parent demographics (eg, age, sex, race, ethnicity, education, employment, and marital status), child characteristics (eg, dental insurance), and household demographics (eg, income, food insecurity, and FFC). The study was approved by the University of Washington Institutional Review Board.

A preliminary conceptual model is presented based on previous work that examined SES, food insecurity, and tooth decay in children (see the Figure). In our study, a proxy for SES was whether the child was insured by Medicaid (no/yes). The proposed mediator—food insecurity—was measured using the six-item US Department of Agriculture Household Food Security Survey.[33] Based on the number of affirmative responses to the six questions, we assigned each participant to one of three categories: food secure (0 or 1 affirmative responses), food insecure without hunger (2 to 4 affirmative responses), or food insecure with hunger (5 or 6 affirmative responses). To measure FFC, the outcome measure, we asked participants, "How many times per week do you and your family eat from a fast-food restaurant?" The possible choices ranged from 0 to $\geq$10. Based on a previous operationalization of FFC, we classified those who reported eating at a fast-food restaurant $\geq$2 times a week as "yes" and remaining participants as "no."[34]

After generating descriptive statistics, we fit a series of logistic structural equation models (structural equation modeling) using maximum likelihood estimation.[35] These models resulted in ORs and 95% CIs (α=.05). We evaluated the bivariate relationships between SES and food insecurity, SES and FFC, and food insecurity and FFC.[36] Statistically significant bivariate relationships between predictor (ie, SES) and outcome (ie, FFC) as well as mediator (ie, food insecurity) and outcome (ie, FFC) are typically necessary conditions before testing for mediation. However, estimated effect sizes and statistical power (β) based on the ORs from the logistic structural equation modeling indicated that our analyses were not adequately powered to detect large effect sizes (β=.33 and β=.35, respectively).[37] Thus, we conducted descriptive mediation analyses to test our hypothesis without regard to the statistical significance of the bivariate relationships.[38] In the mediation model, we bootstrapped the standard errors and estimated the total, direct, and indirect effects. We estimated indirect effects using odds.[35,39] Consistent with our a priori conceptual model, there were no hypothesized confounders.[18] All statistical analyses were conducted using Mplus version 7 for Windows (1998, Muthén & Muthén).

RESULTS

There were 212 caregivers included in the analyses. The mean age of caregivers was 39.7±9.7 years (see the Table). Nearly 77% of surveyed caregivers were women and 58.5% were white. Most caregivers had completed at least some college, 17.9% had lost a job during the past 12 months, and 56.1%

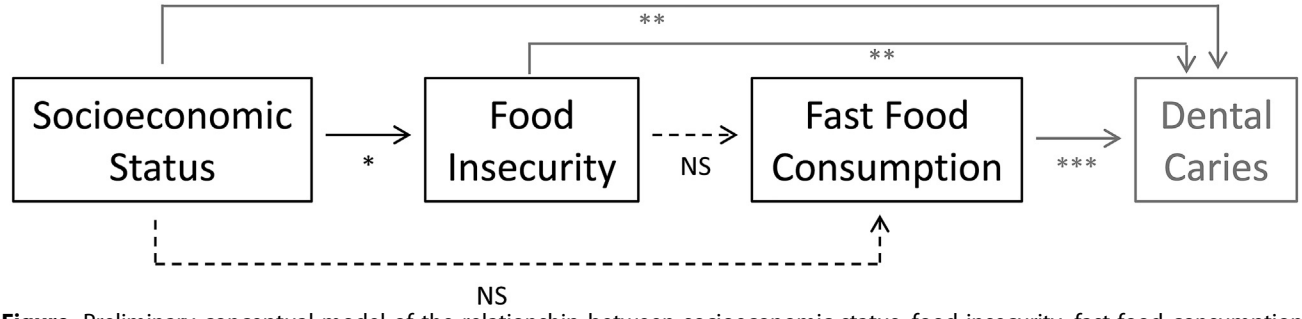

Figure. Preliminary conceptual model of the relationship between socioeconomic status, food insecurity, fast-food consumption, and dental caries in children. Light gray boxes and arrows indicate portions of model not tested in our study. Hatched arrows indicate a nonstatistically significant (NS) relationship. *Statistically significant (current study). **Statistically significant in reference 18. ***Statistically significant in reference 31.