Symposium: Food Assistance and the Well-Being of Low-Income Families

Child Food Insecurity Increases Risks Posed by Household Food Insecurity to Young Children's Health[1,2]

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ABSTRACT The US Food Security Scale (USFSS) measures household and child food insecurity (CFI) separately. Our goal was to determine whether CFI increases risks posed by household food insecurity (HFI) to child health and whether the Food Stamp Program (FSP) modifies these effects. From 1998 to 2004, 17,158 caregivers of children ages 36 mo were interviewed in six urban medical centers. Interviews included demographics, the USFSS, child health status, and hospitalization history. Ten percent reported HFI, 12% HFI and CFI (H&CFI). Compared with food-secure children, those with HFI had significantly greater adjusted odds of fair/poor health and being hospitalized since birth, and those with H&CFI had even greater adverse effects. Participation in the FSP modified the effects of FI on child health status and hospitalizations, reducing, but not eliminating, them. Children in FSP-participating households that were HFI had lower adjusted odds of fair/poor health [1.37 (95% CI, 1.06–1.77)] than children in similar non-FSP households [1.61 (95% CI, 1.31–1.98)]. Children in FSP-participating households that were H&CFI also had lower adjusted odds of fair/poor health [1.72 (95% CI, 1.34–2.21)] than in similar non-FSP households [2.14 (95% CI, 1.81–2.54)]. HFI is positively associated with fair/poor health and hospitalizations in young children. With H&CFI, odds of fair/poor health and hospitalizations are even greater. Participation in FSP reduces, but does not eliminate, effects of FI on fair/poor health. J. Nutr. 136: 1073–1076, 2006.

KEY WORDS: • *household food security* • *child food security* • *child health* • *food stamps*

Household food insecurity (HFI)[4] is a serious concern with numerous implications for nutrition and health. Food insecurity (FI) has been associated with inadequate intake of several important nutrients (1,2), cognitive developmental deficits (3–5), behavioral and psychosocial dysfunction in children and adults (6,7), and poor health in children and adults (8–11). Inability to purchase enough nutritious food and the resultant emotional or psychological stresses can contribute to adverse health effects or exacerbate poor health caused by other factors (12–15).

Young, low-income children in households using urban medical centers are a sentinel population at high risk of adverse health outcomes and may exhibit health effects of FI at levels of clinical severity or prevalence rates not noted among children

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[4] Abbreviations used: AOR, adjusted odds ratio; CFI, child food insecurity; CFS, child food seccurity; C-SNAP, children's sentinel nutrition assessment; ED, emergency department; FI, food insecurity; FS, food secure; FSP, food stamp program; HFI, household food insecurity; H&CFI, household and child food insecurity; SSI, supplemental secuirty income; TANF, temporary assistance to needy families; USFSS, U.S. food security scale; WIC, special supplemental nutrition program for women, infants, and children.

in the general population (16). This study evaluates whether, in inner city settings, children 36 mo of age or younger in households exposed to FI have significantly different odds of negative health outcomes than similar children in food-secure (FS) households and whether the additional burden of identifiable child food insecurity (CFI) is associated with even greater odds of adverse outcomes.

The US Food Security Scale (USFSS) consists of 18 questions; three about conditions and experiences of the household as a whole, seven about experiences, behaviors, and conditions of adult members of the household, and eight specifically about experiences and conditions of children in the household as a group. The eight child-referenced questions have been used to construct a CFS scale that identifies a larger proportion of households as having severe FI, including hunger, among children than the 18-item scale (17). In households with children, it is thus possible to identify mutually exclusive categories of households as *1*) FS on the 18-item household scale; *2*) food insecure on the household scale, but not food insecure on the child scale; and *3*) food insecure on the household scale and the child scale.

MATERIALS AND METHODS

Setting and instruments. The Children's Sentinel Nutrition Assessment Program (C-SNAP) conducted household-level surveys and medical record audits from August 1998 to June 2004 at central city medical centers in Baltimore, Boston, Little Rock, Los Angeles, Minneapolis, and Washington, DC. A sentinel sample of adult caregivers accompanying 17,130 children ages ≤36 mo at acute- and primary-care clinics and hospital emergency departments (EDs) was interviewed in private settings by trained interviewers scheduled during peak patient flow times. Children are especially vulnerable during this period of critical cognitive and physiological development, but may be protected from adverse affects of FI when it is possible for their caregivers to do so. At three sites (Boston, Little Rock, and Los Angeles, $n = 10{,}505$), interviews were conducted in hospital EDs. Caregivers of critically ill or injured children at any site were not approached. Potential respondents were excluded if they did not speak English, Spanish, or Somali (Minneapolis only), were not knowledgeable about the child's household, the child's caregiver had been interviewed within the previous 6 mo, or they refused consent for any reason.

The survey instrument included questions on household characteristics, food security, federal assistance program participation, changes in benefits, and the child's health status and hospitalization history. Household and child food security status were derived from responses to the USFSS in accordance with established procedures (17). The survey instrument and interview protocols were pilot tested at Boston Medical Center on several hundred subjects from 1996 to 1997. These instruments have undergone slight modifications since 1998 to improve skip patterns or to clarify aspects of a few questions.

Additional information was obtained from medical record audits of all children whose caregivers were interviewed. These data include height and weight and, for the subsample of children interviewed at EDs, whether the child was admitted to the hospital on the day of the ED visit. Institutional Review Board (IRB) approval was obtained at each of the six C-SNAP sites through application to the parent institution's IRB.

Sample characteristics. The analytic cohort was composed of 17,130 children whose adult caregivers were interviewed at the six C-SNAP sites. These children were identified from a larger pool of potential participants approached at the six study sites. Of the larger pool, 7% of those approached refused the interview, and an additional 15% were ineligible due to language, not having knowledge of the child's household, or having been interviewed previously.

Exposure variable. The exposure variable is a three-category food security variable constructed from each child's household and child food security status as described above. Household and child food security status were categorized separately on the basis of caregivers' responses to questions in the 18-item USFSS using established methods (17). Food security status was based on conditions occurring in households during the 12 mo preceding the interview. Both household and child food security status were dichotomized to "food secure versus food insecure" by collapsing the two food-insecure categories (with and without hunger) into one category. In the case of child food security status, we collapsed the child hunger category and a less severe category characterized elsewhere as "reduced dietary quality and variety of children's diet" to form a dichotomous child food security status variable (17).

Outcome variables. Each caregiver was asked, "In general, would you say [the child's] health is excellent, good, fair, or poor?" Responses were collapsed into two categories (fair/poor versus good/excellent). Two hospitalization variables were available. For all children in the analytic cohort, caregivers indicated the number of times the child had been hospitalized since discharge after birth. This information was used to create a dichotomous variable indicating whether the child had been hospitalized at all since birth (excluding the day of the interview).

In three study sites, caregivers were interviewed in conjunction with ED visits. Overall, 10,505 (61%) of the 17,130 interviews in the analytic cohort were obtained from three ED sites: Boston (5,096, 48%), Little Rock (3,616, 34%), and Los Angeles (1,793, 17%). Separate analyses were conducted using data from the ED subsample, with hospital admission on the day of the visit as the outcome. A dichotomous growth-risk outcome variable was created with the affirmative category indicating that the child's weight-for-age Z-score was less than the fifth percentile or weight-for-height Z-score was less than the tenth percentile based on Center for Disease Control age-sex specific growth standards.

Potential confounding variables. Potential confounding variables were included in the regression models. These include study site, child's age in months, race/ethnicity, health insurance status, and day-care attendance, whether the child's mother was born in the US (99% of all children were born in the US), caregiver's age, employment, marital and education status, whether the household received Supplemental Security Income (SSI), Special Supplemental Nutrition Program for Women, Infants and Children (WIC), Food Stamp Program (FSP), or Temporary Assistance for Needy Families (TANF). Further description of the form of these variables is described elsewhere (18).

Analytic approach. Separate logistic regression models were specified to model differences in the odds of fair/poor health status, lifetime hospitalization, same-day hospitalization (for the ED subsample only), and being at risk for growth problems between children exposed to HFI, household and child food insecurity (H&CFI), and those not exposed to FI, controlling for likely confounding factors. Chi-squared tests were used for all categorical bivariate comparisons, and *t* tests for continuous bivariate comparisons. Because FSP and TANF receipt were correlated in this population, we reported results from two sets of multiple logistic regression models controlling for participation (currently, previously, never) in these two programs separately. To test whether participation in the FSP modifies the effects of FI as defined in this study, we estimated a separate set of models with FSP participation by food security status interaction terms. All hypothesis tests used a significance level of $\alpha = 0.05$. Data management, manipulation, and analyses were conducted using the Statistical Analysis System (19).

RESULTS

H&CFI and child health outcomes. Overall, 22% of all households in the C-SNAP sample were food insecure, with 10% of households classified as HFI and 12% as H&CFI. In models controlling for TANF (**Table 1**), children living in HFI households had significantly greater adjusted odds of fair/poor health and hospitalization since birth [1.51 (95% CI, 1.29–1.78)] compared with similar children in FS households [1.19 (95% CI, 1.04–1.37)]. The magnitude of these odds was greater if the children lived in H&CFI households [1.99 (95% CI, 1.73–2.29) and 1.23 (95% CI, 1.08–1.40)], for FSP-participating households and non-FSP–participating households, respec-

TABLE 1

Child health outcomes by exposure to differences in household food security status, 1998–2002[1–4]

Outcome variables	Food Secure (*n* = 13,379, 78.1%)	Food Insecure	
		HFI (*n* = 1,675, 9.8%)	H&CFI (*n* = 2,076, 12.1%)
Child health fair/poor:			
% Unadjusted	11%	16%	21%
AOR[5] (95% CI), TANF controlled	1.00	1.51 (1.29, 1.78)	1.99 (1.73, 2.29)
AOR (95% CI), FSP controlled	1.00	1.51 (1.29, 1.78)	2.00 (1.74, 2.30)
Lifetime hospitalizations:			
% Unadjusted	22%	23%	25%
AOR (95% CI), TANF controlled	1.00	1.19 (1.04, 1.37)	1.23 (1.08, 1.40)
AOR (95% CI), FSP controlled	1.00	1.19 (1.04, 1.37)	1.24 (1.09, 1.41)
Admit on ED visit (n = 10,505):			
% Unadjusted	13%	12%	10%
AOR (95% CI), TANF controlled	1.00	0.96 (0.75, 1.21)	0.85 (0.67, 1.09)
AOR (95% CI), FSP controlled	1.00	0.95 (0.75, 1.20)	0.84 (0.66, 1.07)
At risk for growth problems:			
% Unadjusted	15%	15%	14%
AOR (95% CI), TANF controlled	1.00	1.09 (0.93, 1.28)	1.02 (0.88, 1.19)
AOR (95% CI), FSP controlled	1.00	1.10 (0.94, 1.30)	1.02 (0.87, 1.19)

[1] Multivariate odds ratios are adjusted for study site, race/ethnicity of child, child's health insurance status, whether mother born in the US, caregiver's age, caregiver's employment status, caregiver's marital status, caregiver's education, whether child in day care, household on SSI, whether child's family receives WIC, whether child's household received FSP, and whether the household received TANF.
[2] The reference category for all odds ratios is "food secure."
[3] Subsample from three ED sites only: Boston, Little Rock, and Los Angeles.
[4] Child considered at risk for growth problems if weight-for-age Z-score < fifth percentile or weight-for-height Z-score < tenth percentile.
[5] AOR, Adjusted odds ratio.

tively. There were no statistically significant associations between HFI or H&CFI and admission to the hospital on the day of an ED visit or the growth-risk variable.

FSP as a modifier of FI effects. In separate models with FSP participation by food security status interaction terms, we found significant effect modification by FSP participation. Currently participating in the FSP reduced, but did not eliminate, the positive associations of both HFI and H&CFI with caregivers' reports of children's health as fair/poor. In analyses of subgroups stratified on FSP participation, after controlling for potential confounders, children in households receiving FSP benefits that were HFI had lower adjusted odds of fair/poor health [1.37 (95% CI, 1.06–1.77)] than children in similar households not participating in the FSP [1.61 (95% CI, 1.31–1.98)]. Likewise, children in FSP-participating households that were also H&CFI had lower odds of fair/poor health [1.72 (95% CI, 1.34–2.21)] than children in similar households not participating in the FSP [2.14 (95% CI, 1.81–2.54)]. Participation in FSP reduced the odds of fair/poor health by 24% and 42% in HFI and H&CFI households, respectively.

DISCUSSION

This is the first research of which we are aware to examine relations between HFI with and without measurable CFI and direct measures of health outcomes among infants and toddlers. The significantly higher odds of having health reported fair/poor and of being hospitalized since birth for children in households that are food insecure without measurable CFI are consistent with other results showing that FI at relatively low severity levels is associated with adverse health outcomes in young children, even when it does not involve measurable hunger. The results reported here go a step further, indicating that HFI without measurable CFI at any severity level is associated with adverse child health outcomes. This could reflect responses to overall family stress manifesting in other ways that have an impact on child health or indicate that low-severity FI that has an impact on the quality or variety of adult caregivers' food intake can affect child health adversely, even in the absence of measurable CFI.

In an earlier study using a smaller C-SNAP sample recruited between 1998 and 2001, FSP participation was found to moderate the association of FI with higher odds of fair/poor child health status, but not completely eliminate it (20). In this study, we also found significant interaction between FSP participation and the three-category food security variable. Participation in FSP significantly reduced the odds of children in both HFI and H&CFI households having their health reported as fair/poor, but did not eliminate associations between FI and fair/poor health. This result may indicate that the amount of FSP benefits received was inadequate to completely eliminate FI in affected households.

Limitations. The C-SNAP sample is a cross-sectional sentinel surveillance sample of young high-risk low-income children. Data were obtained over a 5-y period in six geographically, ethnically, and economically diverse sites, broadly reflecting several major geographic regions and types of welfare policies. However, the sample is neither random nor nationally representative and the extent to which these findings can be generalized is therefore limited.

Lack of specified a priori temporal sequencing of events, longitudinal data, and random assignment of children to different categories preclude drawing inferences about causal rela-

tions. Although effects of many relevant confounders were statistically controlled in analyses, other unmeasured confounders may have influenced the outcomes. Exclusion of the most severely ill or injured cases from the ED subsample may have biased the results of that analysis and contributed to the failure to find significant associations between FI and same-day hospital admission. However, comparison of characteristics of the ED subsample with the remainder of the C-SNAP sample did not reveal notable differences.

Conclusions. Exposure of infants and toddlers ages ≤36 mo to HFI, with and without measurable CFI, is associated with greater odds of fair/poor health status and experiencing health problems requiring hospitalization in these data, after adjusting for relevant confounders. A statistically significant increment was added to the odds of caregivers in food-insecure households reporting their children's health fair/poor (as opposed to excellent/good) when CFI was also present. A similar, although not significant trend, was observed for lifetime hospitalization. FSP participation moderated these adverse effects, but did not eliminate them.

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