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Does Food Insecurity Affect Parental Characteristics and Child Behavior? Testing Mediation Effects

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Abstract

Using two waves of data from the Child Development Supplement in the Panel Study of Income Dynamics, this study investigates whether parental characteristics (parenting stress, parental warmth, psychological distress, and parent's self-esteem) mediate household food insecurity's relations with child behavior problems. Fixed-effects analyses examine data from a low-income sample of 416 children from 249 households. This study finds that parenting stress mediates the effects of food insecurity on child behavior problems. However, two robustness tests produce different results from those of the fixed-effects models. This inconsistency suggests that household food insecurity's relations to the two types of child behavior problems need to be investigated further with a different methodology and other measures.

According to the U.S. Department of Agriculture (USDA), households are food insecure if they have "limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways" (Bickel et al. 2000, 6). The prevalence of food insecurity among households with children in the United States has persisted at nearly 16 percent for the past decade (Nord 2003; Nord, Andrews, and Carlson 2005, 2008). This percentage is even higher for socioeconomically disadvantaged groups: about 30 percent for female-headed households and 20 percent for African American households.

Household food insecurity has negative effects on several aspects of child well-being (Ashiabi and O'Neal 2008; Gundersen and Kreider 2009). Previous studies find that food insecurity is correlated with child behavior problems (Pollitt 1994; Wachs 1995; Martorell 1996; Alaimo, Olson, and Frongillo 2001; Dunifon and Kowaleski-Jones 2003). Kristen Slack and Joan Yoo (2005) further suggest that food insecurity's associations with child behavior problems are mainly mediated by the quality of parenting and the parent's mental health status. This mediation mechanism, consistent with the perspective of the Family Stress Model (FSM; Conger and Donnellan 2007), has important implications for interventions that target child behavior problems. The possibility that parenting factors play a mediating role suggests that the potential effects of food insecurity should be taken into account in constructing such interventions.

The presence of a mediation mechanism in this relationship suggests that food insecurity is a determinant of both parental characteristics and child behavior problems. However, previous empirical studies focus mainly on food insecurity's correlations with parental characteristics and behavior problems using cross-sectional analyses. Therefore, this study further evaluates whether a mediation mechanism exists among food insecurity, parental characteristics, and child behavior problems using longitudinal data.

Background

Food Insecurity and Consequences for Child Well-Being

Despite increases in federal expenditures on food assistance and for several programs that specifically target households with children (including the Special Supplemental Program for Women, Infants, and Children [WIC], the School Breakfast Program, the National School Lunch Program, and the Child and Adult Care Food Program), the food insecurity status of children has not improved consistently in the last decade (Dunifon and Kowaleski-Jones 2003). The percentage of food-insecure households with children declined from 17.4 percent in 1995 to 14.8 percent in 1999, then rebounded to 17.6 percent in 2004 (Nord 2003; Nord et al. 2005). Food insecurity is about twice as prevalent among households with children as among those without children. In 2007, approximately 6 million households with children had food insecurity problems (Nord et al. 2008). Of the 2.2 million low-income households with severe food insecurity in 2005, 38 percent included children, and severe food insecurity was higher in these households than in any type of adult-only households (Nord 2007). Food insecurity seems to be a persistent hardship for households with children; about 50 percent of food-insecure households with children in 1997 were also food insecure in 1999 (Hofferth 2004).

There is considerable evidence that food insecurity is associated with multiple dimensions of child development. Children living with food insecurity may have nutritional deficiencies (Olson 1999; Cook et al. 2004; Ashiabi and O'Neal 2007) and lower nutrition intake than those without food insecurity (Rose 1999). A child's physical health also can be influenced by food insecurity; Katherine Alaimo and colleagues (Alaimo, Olson, and Frongillo 2001; Alaimo, Olson, Frongillo, and Briefel 2001) argue that food-insecure children experience more frequent stomachaches, headaches, and colds than do children in households without food insecurity. Examining children's educational performance, use of mental health services, and social interactions, the same study reports that food insecurity may affect cognitive and psychological development. Children living in food-insecure households are more likely than their food-secure counterparts to experience stressful life events (Weinreb et al. 2002). Additional research finds that low-income children with food insecurity experiences report more behavioral, emotional, and academic problems than do low-income children who lack such experiences (Kleinman et al. 1998).

Food Insecurity and Child's Well-Being: What Mechanism?

To develop effective interventions and improve support for food-insecure households with children, it is important to understand how food insecurity influences child well-being. Previous research proposes several explanations for the link between food insecurity and

child well-being. One of these proposals focuses on food insecurity's connections to a child's physical and mental health. As Cathy Campbell (1991) suggests, food insecurity can be a direct predictor of poor nutritional state. She also notes that it predicts poor physical, social, and mental well-being, as well as overall low quality of life.

Studies by Godwin Ashiabi and Keri O'Neal (2007, 2008) provide empirical support for the mechanism hypothesized by Campbell (1991). In contrast to Campbell's model, however, Ashiabi and O'Neal's study includes measures of the quality of parenting and parents' mental health status. These measures examine the possibility that parental characteristics mediate the relation between food insecurity and child well-being. Ronald Kleinman and his colleagues (1998) argue that parents' emotional distress is an important factor in food insecurity's connection to child behavior problems. The study by Linda Weinreb and colleagues (2002) also finds that the mother's distress is highly statistically significant in models that examine the relations of food insecurity to children's anxiety and to their tendency to internalize problems.

As the discussion notes above, the FSM is consistent with the hypothesis that the effects of food insecurity are mediated by parental characteristics (Haveman and Wolfe 1995; Conger and Donnellan 2007). The FSM is based on the theoretical perspective that economic hardship correlates with family functioning as well as with the negative well-being and behaviors of both parents and children. The FSM proposes that family economic hardship (such as food insecurity) increases the risk of emotional distress and marital conflict between parents. So too, such hardship reduces parents' nurturing and involvement in child development. It consequently has negative effects on child well-being. The FSM posits that hardship's effects on well-being are mediated by parental characteristics.

Several studies examine the role of parental characteristics in food insecurity's effects on children (e.g., Slack and Yoo 2005; Ashiabi and O'Neal 2007). Using data from the Illinois Family Study, Slack and Yoo (2005) measure externalizing and internalizing behavior problems for two different age groups (ages 3–5 and 6–12). They investigate whether parental characteristics (parenting stress, parental warmth, and psychological distress) mediate the influence of food insecurity on child behavior problems. If analyses do not control for parental characteristics (model 1 in Slack and Yoo 2005), food insecurity is estimated to be positively related to both internalizing and externalizing behavior problems in the younger group (ages 3–5) but only to internalizing behavior problems for the older group (ages 6–12). If analyses control for parental characteristics, however (model 2 in Slack and Yoo 2005), neither type of behavior is statistically significantly associated with food insecurity. Among the indicators of parental characteristics, parenting stress is reported to be the strongest predictor of children's behavior problems in that study; it is positively and statistically significantly related to both types of behavior problems in the two age groups. Therefore, the findings by Slack and Yoo suggest that food insecurity is indirectly associated with child behavior problems.

Although not focused on child behavior problems, the study by Ashiabi and O'Neal (2007) also provides evidence for a mediation mechanism. Using structural equation modeling (SEM), Ashiabi and O'Neal (2007) test several potential mediators between food insecurity

and adolescent global health status. Included among these potential mediators is the quality of parenting and parental mental health problems. They find that the best fit is derived in the SEM model with all mediators included. Household food insecurity is negatively and statistically significantly associated with these mediators, and all of the hypothesized mediators have the expected associations with adolescent physical health status.

These empirical studies are likely to be limited by using measures of food insecurity that are less reliable than the standardized 18-item scale designed by the USDA (Bickel et al. 2000). Ashiabi and O'Neal (2007) use a two-item measure for household-level food insecurity; Slack and Yoo (2005) measure child-level food insecurity with a four-item scale. With the child-level measure, it seems more reasonable to expect that food insecurity is directly related to a child's behavior problems than that it is indirectly related to such problems through mediating parental characteristics. More important, the results discussed above only indicate that food insecurity is respectively correlated with parental characteristics and child behavior problems. Neither the difference in coefficients (Slack and Yoo 2005) nor SEM (Ashiabi and O'Neal 2007) is adequate to show that parental characteristics or children's behavior problems are the consequences of food insecurity.

Another limitation of these studies is that they do not fully explore other possible explanations for their findings. The mediation mechanism is one possible explanation supported by the results of the stepwise regression in Slack and Yoo (2005). Alternative interpretations could explain the confoundedness of food insecurity's relations with parental characteristics. These alternatives include the possibility that parental characteristics (i.e., parental distress) may cause both food insecurity and child behavior problems or that there are some underlying factors not discovered behind the associations of food insecurity, parental characteristics, and child behavior problems.

Finally, these studies are limited by their failure to take full advantage of the statistical methods employed. To test a mediation relationship, the hypothesized mediators should be regressed on the main independent variables (food insecurity, in this case; Baron and Kenny 1986; Holmbeck 1997; MacKinnon, Fairchild, and Fritz 2007); however, Slack and Yoo (2005) fail to do this. Also, SEM allows one to fit regression models simultaneously to test mediation, but one major, additional benefit of using an SEM is that it allows one to test the equivalence of different conceptual models. However, Ashiabi and O'Neal (2007) do not test other theoretical interpretations that compete with the proposed mediation mechanism.

This study addresses some of the limitations in previous studies. It also explores the relationships among food insecurity, parental characteristics, and child behavior problems. Using longitudinal data and methods that differ from those in previous studies may provide better insights into household food insecurity's effects on child well-being.

Methods

Data and Sample

This study uses data from two waves (1997 and 2002) of the Child Development Supplement (CDS) to the Panel Study of Income Dynamics (PSID; Hofferth et al. 1999). The PSID is a longitudinal study that collects demographic information and socioeconomic characteristics from a nationally representative sample of individuals and their families. Data were collected annually from 1968 to 1997 and biennially thereafter. In 1997 and 2002, the PSID supplemented its core data collection with additional information on a group of parents and their children in the CDS. The CDS studies a broad array of developmental outcomes of children who are ages 0–12 in 1997, including physical health, emotional well-being, behavior, cognitive and academic achievement, and social relationships with family and peers. Child behavior problems and household food insecurity are also measured in the CDS. The current study links data from the CDS to the PSID family-level data sets in order to obtain information on household characteristics, including household income, the level of education attained by the head of the household, and the household head's employment status.

The study sample includes CDS children who: (1) were included in both 1997 (wave 1) and 2002 (wave 2; $N = 2,907$), (2) live in a household with an income of less than 200 percent of the federal poverty threshold in wave 2 ($N = 1,271$), (3) have parents as their primary caregivers ($N = 1,079$), (4) were age 3 or older in 1997 ($N = 873$), and (5) provided data on the quality of parenting and parent's mental health status in both waves ($N = 439$). The low-income criterion is used to account for factors that may confound the association between food insecurity and household income. The CDS children younger than age 3 in 1997 are not included in the analyses because the behavior problem variable was not collected in wave 1. The CDS children with nonparent caregivers are excluded because parental characteristics cannot be identified for these cases. Due to missing values on the education status of household heads, the multivariate analysis in the study finally includes data on 416 children from 249 households.

Measures

Child behavior problems—The dependent variable is child behavior problems. The 32-item Behavior Problem Index (BPI) is adapted in the CDS from the scale developed by Peterson and Zill (1986). The index asks the primary caregiver whether a set of problem behaviors (e.g., having sudden changes in mood or feeling, being fearful or anxious, bullying, demanding excessive attention) is often, sometimes, or never true of his or her child. The BPI splits into two subscales; one measures externalizing or aggressive behaviors and the other measures internalizing, withdrawn, or sad behaviors. Similar to the study by Slack and Yoo (2005), the current analyses use these two subscales as the outcome variables. Possible scores for the externalizing subscale range from 0 to 17; those for the internalizing subscale range from 0 to 15. A greater value on these scales indicates a higher level of behavior problems.

Household food insecurity—Household food insecurity, the main independent variable, is measured with an 18-item scale used by the USDA.¹ This scale asks survey respondents about food-related experiences and behaviors in the 12 months prior to the interview (e.g., “We worried whether our food would run out before we got money to buy more”). From responses, a continuous food insecurity score is computed for each household. Possible scores for the scale range from 0 to 13, with higher values indicating more severe levels of food insecurity.² For robustness tests, the continuous measure is redefined into a categorical variable. According to the USDA’s guide (Bickel et al. 2000), it is acceptable to create a categorical food insecurity measure (food secure vs. food insecure) based on the continuous score.

The current study’s main analysis uses the continuous household food insecurity score. The continuous measure is recommended for regression and correlation analysis by the USDA’s guide for measuring household food insecurity (Bickel et al. 2000). Food insecurity is a theoretically complex, multidimensional phenomenon that varies along a continuum. The continuous score captures the full range of food insecurity severity and can produce greater within-variation in repeated measures than can the categorical measure. This advantage is important for the study’s main fixed-effects models, which may be subject to bias if the estimation uses rarely changing variables (Beck 2001; see the Analytical Strategies section below). The household food insecurity scale was included in wave 1 of the CDS but not in wave 2. Therefore, this study draws the household food insecurity scale for wave 2 from the 2001 PSID main file.

Parental characteristics—The hypothesized mediator, parental characteristics, is examined with variables that assess the quality of parenting and parent’s mental health status. All parental characteristics are collected from the child’s primary caregiver. Two indicators used to measure the quality of parenting are parenting stress and parental warmth. Parenting stress is measured by a seven-item index that indicates the primary caregivers’ feelings and perceptions about caring for the child (e.g., “There are some things that [child] does that really bother me a lot”). The six-item parental warmth scale measures the warmth of the relationship between the child and parent in the month prior to the interview. Questions in this scale investigate the frequency with which the primary caregiver shows physical affection, emotional support, and appreciation, as well as the frequency with which the parent plays with the child or participates in the child’s favorite activities. Both of these scales were developed by Child Trends, Inc. (Hofferth et al. 1999). Possible responses on the scales range from 1 to 5; higher scores indicate a higher degree of the measured constructs (stress and warmth).

This study also includes two measures of parents’ mental health status: psychological distress and parents’ self-esteem. The six-item psychological distress scale was developed by Ronald Kessler and colleagues (2002) to monitor general psychological distress. Possible scores range from 1 to 24. A Rosenberg scale is used to measure a global level of self-esteem in the CDS data, and possible responses range from 1 to 4. Higher values on these two scales indicate higher levels of the measured phenomenon (psychological distress or self-esteem). Details on the construction and psychometric properties of these measures can be found in a supplement to the CDS user guide (Hofferth et al. 1999).

Other control variables—Control variables for this study are selected following Slack and Yoo's model specification.³ This study has three groups of control variables: household head's characteristics, household characteristics, and child's characteristics.⁴ Household head's characteristics and the household characteristics are measured in the 1997 and 2001 PSID family files, while the child's characteristics are measured in two CDS waves. The measured characteristics of the household head include age, gender (male = 1, female = 0), schooling years, employment status (employed = 1, others = 0), and marital status (married = 1, others = 0). The measured household characteristics include household size, number of children under age 18, log-transformed household income, and food stamp participation (participants = 1, others = 0). Measured child characteristics include age and disability status. A child's disability status is measured by whether a child is reported by the primary caregiver to have any physical or mental condition that limits childhood activities, school attendance, or schoolwork (yes = 1, no = 0). Household income is used as an indicator of socioeconomic status, and food stamp participation is used as an indicator of food consumption (Slack and Yoo 2005). Previous studies consistently find that low-income children and those in welfare programs have a high prevalence of behavior problems (e.g., McLoyd 1998; Hofferth et al. 2000). The analyses control for these factors in order to examine food insecurity's unique relations with behavior problems.

Analytical Strategies

The study's main analyses are three fixed-effects models applied on two waves of CDS data (see table 3). The findings of the fixed-effects models are tested for robustness using a lagged-dependent-variable model and propensity score analyses. Taking advantage of longitudinal data, a fixed-effects model allows an estimation of unobservable individual-specific effect, controls for all stable characteristics of the individuals in the study, and, therefore, eliminates potential omitted variable bias (Hsiao 2003). As discussed above, the confoundedness of food insecurity's relations with parental characteristics may be explained by other unmeasured variables. A fixed-effects estimator provides one possible way to control for these unmeasured characteristics if they do not change over time. The current study's approach allows analyses to account reasonably for unobserved time-invariant effects in the fixed-effects model and to more accurately estimate the correlates of food insecurity.

In fixed-effects model 1, the dependent variables (the externalizing and internalizing subscales of child behavior problems) are regressed on food insecurity, the control variables, and a dummy indicator of CDS data waves (wave 1 = 0; wave 2 = 1). Parental characteristics (parenting stress, parental warmth, psychological distress, and parent's self-esteem) are added into the regression in fixed-effects model 2. Different from the model specification using cross-sectional data in the study by Slack and Yoo (2005), the first two models employ two waves of information and a fixed-effects estimator.

Finally, parenting stress and parental warmth, two indicators for the quality of parenting, are regressed on food insecurity and control variables in fixed-effects model 3. These three models are employed to test the mediation mechanism using regression (Baron and Kenny 1986; Holmbeck 1997). The results obtained by including parental characteristics in model 2

of the Slack and Yoo (2005) analyses show that food insecurity's associations with child behavior problems may be spurious. Slack and Yoo (2005) explain the effects of food insecurity by proposing a mediation mechanism, and they conclude that parental characteristics mediate food insecurity's relations with behavior problems. This theory-driven interpretation does not rule out other potential explanations for the confoundedness in food insecurity's relations with parental characteristics. The nature of the relations and confounding factors need to be examined further. Therefore, this study uses fixed-effects model 3 to examine food insecurity's respective associations with parenting stress and parental warmth.

Among the four tested parental characteristics in fixed-effects model 2, only parenting stress and parental warmth are included as dependent variables in fixed-effects model 3. Indicators of parents' mental health status, such as psychological distress and self-esteem, are not used as dependent variables in fixed-effects model 3; an alternative explanation to the proposed mediation mechanism suggests that parents' mental health status could be the cause of food insecurity and child behavior problems.

Two strategies are used to test the robustness of the results from the fixed-effects models. First, a lagged-dependent-variable model is used to regress the dependent variables in wave 2 on a group of variables measured in wave 1. The wave 1 variables include child behavior problems (previous dependent variable), mediators of parental characteristics, other control variables, and food insecurity. This test (see table 4) examines the influence of food insecurity in the first wave on behavior problems in the second wave; the analysis controls for prior behavior problems and parental characteristics. If wave 1 food insecurity is truly a determinant of behavior problems in wave 2 and has long-lasting effects, the estimates should identify a statistically significant regression coefficient on food insecurity in wave 1.

Second, a propensity score variable of dichotomous food insecurity measured in wave 2 is estimated in a logit model by using information from wave 1. This variable, as the predicted value of this logit model, indicates individuals' estimated probability of having food insecurity in wave 2 based on previous information. Child behavior problems in wave 2 then are regressed on the dichotomous variable for food insecurity, its propensity score, and other variables (see table 5).⁵ Briefly, the propensity score analysis restricts comparisons of child behavior problems to children with and without food insecurity in wave 2, given the fact that they actually have similar likelihood to encounter food insecurity in wave 2. Mediators of parental characteristics in wave 1 are used to create the propensity score of food insecurity in wave 2. This score helps to explain the confounding influences in food insecurity's relations with parental characteristics.

Results and Discussion

Descriptive Statistics

Table 1 presents sample characteristics. Because the variables were measured twice for the study sample, these descriptive statistics are shown by wave. The table also shows descriptive statistics for the full sample used in the main analyses of the fixed-effects models. In the sample, about 45 percent of the children are male, and 30 percent are African

American. The reported scale scores for both externalizing and internalizing child behavior problems increase between the two waves. A high proportion of sampled children reportedly live in female-headed households (about 47 percent); these household heads are in their thirties and report, on average, less than 12 years of schooling. Nearly one-quarter of all household heads claim to be unemployed, and slightly more than half are reportedly married. In the same way that child behavior problems increase from wave 1 to wave 2, three indicators of parental characteristics (parenting stress, parental warmth, and psychological distress) are estimated to worsen between the two waves; parents' self-esteem is estimated to remain nearly the same. The measure of food insecurity indicates that the children and their households have lower levels of food insecurity in wave 2; the proportion of households with food insecurity decreases from 26 percent in wave 1 to 23 percent in wave 2. Nonetheless, reports of household income remain low, around \$24,000, in both waves. If adjusted for inflation, the average household income in the second wave is even lower than that of the first. However, the rate of participation in food stamp programs reportedly drops from 42 percent to 26 percent between the two waves.⁶

Bivariate Correlations

Table 2 presents correlations between the dependent variables and major independent variables. All correlation coefficients are in the expected directions. Each type of child behavior problem (externalizing and internalizing) is estimated to be positively and statistically significantly related to food insecurity, parenting stress, and parental psychological distress. Each type is found also to be negatively and statistically significantly related to parental warmth and self-esteem. The magnitudes of the estimated coefficients for food insecurity's correlations with the behavior problems (.15 for the externalizing subscale; .08 for the internalizing subscale) are much smaller than those for the correlations of parenting stress with the behavior problems (.47 for externalizing; .36 for internalizing). Among the four measured parental characteristics, parenting stress has the strongest correlation with the two types of child behavior problems.

Results of Fixed-Effects Models

The second and third columns in table 3 display the results of model 1. As hypothesized about the mediation mechanism, the results of analyses that do not control for parental characteristics suggest that food insecurity is positively and statistically significantly related to both externalizing and internalizing behavior problems. The marginal effect of food insecurity is relatively small (.15 for externalizing; .13 for internalizing). On average, the children with the highest 10 percent of scores on the food insecurity scale have a predicted externalizing problem score of 5.8; those with the lowest 10 percent of scores have a predicted externalizing problem score of 5.4; that is, only a .4 difference. In general, the results on food insecurity are consistent with those reported in Slack and Yoo (2005). The estimated regression coefficients of food insecurity here are smaller than their estimations for children ages 3–5, and greater than those for children ages 6–12. These findings suggest that food insecurity's relations with behavior problems may differ by child's age and developmental trajectory, because the average child age in the sample is greater than 3 years but less than 12. Other results from model 1 bolster this point; as table 3 shows, coefficients for three age-related variables (CDS wave indicator, child's age, and household head's age)

are estimated to be statistically significant in the model. Older children and children living with older parents are found to be less likely to have behavior problems if the analyses control for all other variables. The household head's employment is estimated to have a negative effect on child behavior problems in this low-income sample. Unemployment and the resulting income shortage may impose substantial stress and may disrupt parenting behavior (McLoyd et al. 1994; Elder et al. 1995). In addition, household size is estimated to be positively and statistically significantly related to children's internalizing problems.

Consistent with Slack and Yoo's (2005) findings, the estimates in model 2 suggest that household food insecurity's relations with both externalizing and internalizing behavior problems fall short of statistical significance if the analyses control for parental characteristics. The regression coefficients for food insecurity in model 2 are about 50 percent smaller than those in model 1. This suggests that parental characteristics confound much of food insecurity's association with each type of behavior problem. The associations for all parental characteristics variables are in the expected direction; however, only parenting stress is statistically significantly associated with both dependent variables. Parents' self-esteem is negatively related to children's internalizing problems at the .1 significance level.

In model 3, the analyses hypothesize that household economic hardships affect parental involvement in child development and thus have a negative influence on the interactions between parent and child. The model therefore uses food insecurity to predict parenting stress and parental warmth. Psychological distress and parents' self-esteem are not used as dependent variables (see the discussion in the Analytical Strategies section). As table 3 shows, the other three parental characteristics (parenting warmth, parental psychological distress, and parent's self-esteem) are associated with parenting stress in the expected directions, but only parental warmth is statistically significantly correlated with parenting stress. A more important finding supports the mediation hypothesis; food insecurity is estimated to increase parenting stress (conditional on other control variables in the model). That is, a one-point increase in the food insecurity scale is estimated to be associated with a .04-unit increase in parenting stress. Results (not shown) of the calculation using Michael Sobel's (1982) test suggest that food insecurity indirectly affects externalizing (.07, $p = .055$) and internalizing problems (.04, $p = .061$) through parenting stress.

In summary, the findings of models 1 and 2 are similar to those in the estimates by Slack and Yoo (2005); both sets of results confirm the confoundedness of food insecurity and parental characteristics. Model 3 estimates that food insecurity has a statistically significant influence on parenting stress. This finding supports the proposed mediation mechanism.

Robustness Tests

Two sets of tests are conducted to evaluate the robustness of the findings. First, the lagged-dependent-variable models are employed by regressing externalizing and internalizing behaviors measured in wave 2 on the continuous food insecurity score in wave 1. These regressions control for the corresponding behavior problems measured in wave 1 (see cols. 1 and 3 in table 4). This model specification may provide some insights into the true relationship between food insecurity and each type of behavior problem without

decomposing the confoundedness between food insecurity and parental characteristic. Results of this model suggest that food insecurity in wave 1 has little effect on behavior problems in wave 2. One possible reason may be the nature of the CDS data; the time interval between the two waves may be longer than the duration of food insecurity effects.

To account for the possibility that the effects of food insecurity are short term, the lagged-dependent-variable model is rerun using food insecurity from wave 2 instead of wave 1 (see cols. 2 and 4 in table 4). In the lagged models that use food insecurity in wave 2, the regression coefficients of food insecurity increase substantially, and food insecurity is estimated to be statistically significantly associated with externalizing behavior problems.

The second set of robustness tests (see table 5) adds a food insecurity propensity score variable in estimating the influence of food insecurity on behavior problems. Rather than the continuous variable used in the main fixed-effects models, a dichotomous measure of food insecurity in wave 2 is used. The propensity score of food insecurity in wave 2 is predicted by wave 1 variables, including mediators of parental characteristics (parenting stress, parental warmth, psychological distress, and self-esteem). The results suggest that the dichotomous measure of food insecurity in wave 2 is not statistically significantly associated with either externalizing or internalizing behavior problems; that is, for children with the same predicted probability of having food insecurity, the experience of food insecurity does not seem to lead to behavior problems. The inconsistency between this study's main analyses and the robustness tests warrants further examination of food insecurity's relations with child behavior problems.

Conclusion

This study contributes to the literature on material hardship and child well-being. It focuses on the relationships among food insecurity, parental characteristics, and child behavior problems. Consistent with findings from previous studies, results from the main analyses of fixed-effects models provide support for the hypothesis that the relations of these three constructs are subject to a mediation mechanism. Household food insecurity is found to be a determinant of parental characteristics and child behavior problems. However, the robustness tests present different stories and seem to favor alternatives to the proposed mediation mechanism. The disparities in the findings imply that food insecurity's relations with child behavior problems are more complicated than previous research recognizes, and further examination is needed.

First, the results from the fixed-effects models with a continuous measure of food insecurity provide support for the proposed mediation mechanism. The estimated effects of food insecurity are similar to but smaller in magnitude than those found by Slack and Yoo (2005). This is not surprising because the fixed-effects estimator controls for unobserved time-invariant factors. Results in the fixed-effects models suggest that the food insecurity's relations with both types of behavior problems are mainly mediated through parenting stress.

Second, the results from the lagged-dependent-variable models raise the question as to whether the relationship between food insecurity and each type of behavior problem is

consistent over the long term. Household food insecurity in wave 1 is not estimated to be associated with behavior problems in wave 2; however, food insecurity in wave 2 is found to be statistically significantly associated with externalizing behavior in wave 2 (table 4). One possible explanation for the difference in these findings is that food insecurity may not have a long-term effect. It indicates that interventions for behavior problems of children with food insecurity need to consider other characteristics of food insecurity, not only severity of food insecurity.

Third, the results of the second robustness test suggest that, with the same levels of parental characteristics as in wave 1, food insecurity is not related to behavior problems. Contrary to the proposed explanation of a mediation mechanism, these results seem to favor an alternative explanation; long-term family background and parental characteristics, not short-term food insecurity, are the major factors contributing to child behavior problems. If the mediation mechanism explanation were correct, food insecurity in wave 2 should be statistically significantly related to both parental characteristics and child behavior problems, even if analyses control for parental characteristics measured earlier.

Several limitations of this study should be noted. First, it uses panel data from only two waves; this limits the study's ability to examine child development trajectories in relation to time-varying household food insecurity. Longitudinal data with more waves of observations are needed to better understand the influence of food insecurity on child well-being. Second, the time interval between the two measures is quite long. Many factors could affect family background, food insecurity, parental characteristics, and child behavior problems between the two time points. Third, in fixed-effects models, the estimation of variables that slowly change over time (such as demographic variables) may be inefficient or even biased (Beck 2001). Finally, the study does not fully explore counterfactual models against the proposed mediation mechanism. For example, Kleinman and colleagues (1998) and Weinreb and associates (2002) imply that parental characteristics, such as psychological distress, may be the cause of both household food insecurity and child behavior problems. Depressed parents may be less involved than other parents in food preparation and child development. In addition, parenting stress, which is here and elsewhere found to be the strongest predictor of children's behavior problems (Slack and Yoo 2005; Ashiabi and O'Neal 2007), may actually have simultaneous or reciprocal effects on child behavior problems. That is, child behavior problems may increase parenting stress. The misspecification of the relationship between parenting stress and child behavior problems may cause estimation bias.

The findings of this study illustrate the complications of poverty, material hardship, and family well-being. For low-income families, multiple factors may be related to children's outcomes. Such factors may include material hardships (e.g., food insecurity), family background, and parental characteristics. These issues are intertwined in the lives of the families struggling with them. A single intervention or interventions focusing on one issue might not improve the well-being of low-income children experiencing material hardships. In working with families that struggle with food insecurity, service providers should remain aware that children in this vulnerable population are at high risk for behavior problems, and providers should address this issue as needed for the family.

In conclusion, this study builds on previous literature (Slack and Yoo 2005; Ashiabi and O'Neal 2007) by further investigating the links among food insecurity, parental characteristics, and child outcomes. It sheds light on the mechanisms by providing empirical evidence. The findings suggest that the dynamic relationships among food insecurity, parental characteristics, and child behavior problems cannot be captured in a simple way. These relationships should be further investigated with well-designed data and diverse methodologies.

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1. This scale has 18 items for households with children and 10 for households without children (Bickel et al. 2000). Because this study's sample is drawn from households with children, the study uses the 18-item scale.
2. According to the measurement guide for this scale (Bickel et al. 2000), households affirming none of 18 items are considered fully food secure and are not identified in the scale scores. In the current study, households affirming no items are instead coded as 0.
3. Due to the nature of the fixed-effects estimator, the current study's models do not control for several time-invariant demographic variables (such as children's gender and race). Some other variables rarely change, or change slowly over time, and are also excluded from the model. For instance, only 96 children changed their schooling status between the two waves, and that change is highly related to age change. Therefore, the model does not include children's schooling status.
4. In the study sample, the household head is one parent of the CDS child but can be a person different from the child's primary caregiver.
5. After estimating propensity score, matching, weighting, or subclassification can be used for data analysis. For the purpose of robustness tests, we simply control for the propensity score in the regression model.
6. The difference in the food stamp participation rate might be a result of welfare reform. Previous studies find that, after welfare reform, welfare recipients also exit the Food Stamp Program when they leave welfare, even though exiting food stamps is not required by the policy. The food stamp participation rate in wave 1 of CDS was reported before or around the 1996 Personal Responsibility and Work Opportunity Reconciliation Act (U.S. Public Law 104-193); the participation rate in wave 2 reflects participation after the welfare reform.

References

- Alaimo, Katherine; Olson, Christine M.; Frongillo, Edward A., Jr. Food Insufficiency and American School-Aged Children's Cognitive, Academic, and Psychosocial Development. *Pediatrics*. 2001; 108(1):44–53. [PubMed: 11433053]
- Alaimo, Katherine; Olson, Christine M.; Frongillo, Edward A., Jr.; Briefel, Ronette R. Food Insufficiency, Family Income, and Health in US Preschool and School-Aged Children. *American Journal of Public Health*. 2001; 91(5):781–86. [PubMed: 11344887]
- Ashiabi, Godwin S.; O'Neal, Keri K. Is Household Food Insecurity Predictive of Health Status in Early Adolescence? A Structural Analysis Using the 2002 NSAF Data Set. *Californian Journal of Health Promotion*. 2007; 5(4):76–91.
- Ashiabi, Godwin S.; O'Neal, Keri K. A Framework for Understanding the Association between Food Insecurity and Children's Developmental Outcomes. *Child Development Perspectives*. 2008; 2(2): 71–77.

- Baron, Reuben M.; Kenny, David A. The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations. *Journal of Personality and Social Psychology*. 1986; 51(6):1173–82. [PubMed: 3806354]
- Beck, Nathaniel. Time-Series-Cross-Section Data: What Have We Learned in the Past Few Years? *Annual Review of Political Science*. 2001; 4:271–93.
- Bickel, Gary; Nord, Mark; Price, Cristofer; Hamilton, William; Cook, John. Guide to Measuring Household Food Security: Revised 2000. U.S. Department of Agriculture, Food and Nutrition Service, Office of Analysis, Nutrition, and Evaluation; Washington, DC: 2000. Measuring Food Security in the United States: Reports of the Federal Interagency Food Security Measurement Project, no. 6
- Campbell, Cathy C. Food Insecurity: A Nutritional Outcome or a Predictor Variable? *Journal of Nutrition*. 1991; 121(3):408–15. [PubMed: 2002411]
- Conger, Rand D.; Brent Donnellan, M. An Interactionist Perspective on the Socioeconomic Context of Human Development. *Annual Review of Psychology*. 2007; 58:175–99.
- Cook, John T.; Frank, Deborah A.; Berkowitz, Carol; Black, Maureen M.; Casey, Patrick H.; Cutts, Diana B.; Meyers, Alan F.; Zaldívar, Nieves; Skalicky, Anne; Levenson, Suzette; Heeren, Tim; Nord, Mark. Food Insecurity Is Associated with Adverse Health Outcomes among Human Infants and Toddlers. *Journal of Nutrition*. 2004; 134(6):1432–38. [PubMed: 15173408]
- Dunifon, Rachel E.; Kowaleski-Jones, Lori. The Influences of Participation in the National School Lunch Program and Food Insecurity on Child Well-Being. *Social Service Review*. 2003; 77(1):72–92.
- Elder, Glen H., Jr.; Eccles, Jacquelynne S.; Ardel, Monica; Lord, Sarah. Inner-City Parents under Economic Pressure: Perspectives on the Strategies of Parenting. *Journal of Marriage and the Family*. 1995; 57(3):771–84.
- Gundersen, Craig; Kreider, Brent. Bounding the Effects of Food Insecurity on Children's Health Outcomes. *Journal of Health Economics*. 2009; 28(5):971–83. [PubMed: 19631399]
- Haveman, Robert; Wolfe, Barbara. The Determinants of Children's Attainments: A Review of Methods and Findings. *Journal of Economic Literature*. 1995; 33(4):1829–78.
- Hofferth, Sandra L. Persistence and Change in the Food Security of Families with Children, 1997-99. 2004.
- U.S. Department of Agriculture, Economic Research Service; Washington, DC: Mar. Food Assistance and Nutrition Research Report no. EFAN04001
- Hofferth, Sandra L.; Davis-Kean, Pamela E.; Davis, Jean; Finkelstein, Jonathan. The Child Development Supplement to the Panel Study of Income Dynamics: 1997 User Guide. University of Michigan, Survey Research Center; Ann Arbor: 1999.
- Hofferth, Sandra L.; Smith, Julia; McLoyd, Vonnie C.; Finkelstein, Jonathan. Achievement and Behavior among Children of Welfare Recipients, Welfare Leavers, and Low-Income Single Mothers. *Journal of Social Issues*. 2000; 56(4):747–74.
- Holmbeck, Grayson N. Toward Terminological, Conceptual, and Statistical Clarity in the Study of Mediators and Moderators: Examples from the Child-Clinical and Pediatric Psychology Literatures. *Journal of Consulting and Clinical Psychology*. 1997; 65(4):599–610. [PubMed: 9256561]
- Hsiao, Cheng. Analysis of Panel Data. 2nd ed. Cambridge University Press; New York: 2003.
- Kessler RC, Andrews G, Colpe LJ, Hiripi E, Mroczek DK, Normand SLT, Walters EE, Zaslavsky AM. Short Screening Scales to Monitor Population Prevalences and Trends in Non-specific Psychological Distress. *Psychological Medicine*. 2002; 32(6):959–76. [PubMed: 12214795]
- Kleinman, Ronald E.; Michael Murphy, J.; Little, Michelle; Pagano, Maria; Wehler, Cheryl A.; Regal, Kenneth; Jellinek, Michael S. Hunger in Children in the United States: Potential Behavioral and Emotional Correlates. *Pediatrics*. 1998; 101(1):e3. [PubMed: 9417167]
- MacKinnon, David P.; Fairchild, Amanda J.; Fritz, Matthew S. Mediation Analysis. *Annual Review of Psychology*. 2007; 58:593–614.
- Martorell, Reynaldo. The Role of Nutrition in Economic Development. *Nutrition Reviews*. 1996; 54(4):S66–S71. [PubMed: 8700455]

- McLoyd, Vonnie C. Socioeconomic Disadvantage and Child Development. *American Psychologist*. 1998; 53(2):185–204. [PubMed: 9491747]
- McLoyd, Vonnie C.; Jayaratne, Toby Epstein; Ceballo, Rosario; Borquez, Julio. Unemployment and Work Interruption among African American Single Mothers: Effects on Parenting and Adolescent Socioemotional Development. *Child Development*. 1994; 65(2):562–89. [PubMed: 8013240]
- Nord, Mark. Food Insecurity in Households with Children. U.S. Department of Agriculture, Economic Research Service; Washington, DC: Jul. 2003 Food Assistance and Nutrition Research Report no. FANRR34-13
- Nord, Mark. Characteristics of Low-Income Households with Very Low Food Security: An Analysis of the USDA GPRA Food Security Indicator. U.S. Department of Agriculture, Economic Research Service; Washington, DC: May. 2007 Economic Information Bulletin no. EIB-25
- Nord, Mark; Andrews, Margaret; Carlson, Steven. Household Food Security in the United States, 2004. U.S. Department of Agriculture, Economic Research Service; Washington, DC: Oct. 2005 Economic Research Report no. ERR-11
- Nord, Mark; Andrews, Margaret; Carlson, Steven. Household Food Security in the United States, 2007. U.S. Department of Agriculture, Economic Research Service; Washington, DC: Nov. 2008 Economic Research Report no. ERR-66
- Olson, Christine M. Nutrition and Health Outcomes Associated with Food Insecurity and Hunger. *Journal of Nutrition*. 1999; 129(2 (Suppl.)):521S–524S. [PubMed: 10064322]
- Peterson, James L.; Zill, Nicholas. Marital Disruption, Parent-Child Relationships, and Behavior Problems in Children. *Journal of Marriage and the Family*. 1986; 48(2):295–307.
- Pollitt, Ernesto. Poverty and Child Development: Relevance of Research in Developing Countries to the United States. *Child Development*. 1994; 65(2):283–95. [PubMed: 7516848]
- Rose, Donald. Economic Determinants and Dietary Consequences of Food Insecurity in the United States. *Journal of Nutrition*. 1999; 129(2 (Suppl.)):517S–520S. [PubMed: 10064321]
- Slack, Kristen S.; Yoo, Joan. Food Hardship and Child Behavior Problems among Low-Income Children. *Social Service Review*. 2005; 79(3):511–36.
- Sobel, Michael E. Asymptotic Confidence Intervals for Indirect Effects in Structural Equation Models. *Sociological Methodology*. 1982; 13:290–312.
- Wachs, Theodore D. Relation of Mild-to-Moderate Malnutrition to Human Development: Correlational Studies. *Journal of Nutrition*. 1995; 125(8 (Suppl.)):S2245–S2254.
- Weinreb, Linda; Wehler, Cheryl A.; Perloff, Jennifer; Scott, Richard; Hosmer, David; Sagor, Linda; Gundersen, Craig. Hunger: Its Impact on Children's Health and Mental Health. *Pediatrics*. 2002; 110(4):e41. [PubMed: 12359814]

Table 1

SAMPLE CHARACTERISTICS (Weighted, Number of Children = 416)

VARIABLE	FULL SAMPLE Mean or %	SAMPLE BY WAVE	
		Wave 1 Mean or %	Wave 2 Mean or %
Children demographic characteristics:			
Gender: male (%)	45.31	45.31	45.31
Race: African American (%)	29.89	29.89	29.89
Age (years)	9.53 (3.55)	7.46 (2.87)	11.65 (2.87)
Disability status (%)***	86.99	80.06	94.10
Children's behavior problems:			
Externalizing scale**	5.49 (4.06)	5.22 (3.52)	5.77 (4.53)
Internalizing scale***	2.97 (3.02)	2.40 (2.43)	3.55 (3.45)
Household heads' characteristics:			
Gender: female (%)	43.24	43.24	43.24
Age (years)	36.94 (7.39)	34.91 (7.05)	39.01 (7.15)
Education: schooling years	11.13 (2.92)	11.03 (2.94)	11.22 (2.89)
Employment: employed (%)*	74.73	72.46	77.06
Marital status: married (%)	52.54	55.76	49.21
Parental characteristics:			
Parenting stress***	2.15 (.76)	1.95 (.64)	2.36 (.82)
Parental warmth***	4.08 (.72)	4.37 (.60)	3.78 (.72)
Psychological distress**	4.66 (4.10)	4.33 (4.05)	4.99 (4.13)
Parent's self-esteem	3.31 (.46)	3.32 (.47)	3.30 (.44)
Household characteristics:			
Food insecurity status:			
Continuous score (household level)	1.59 (2.32)	1.66 (2.48)	1.51 (2.16)
Dichotomous measure (% , house- hold level)	24.77	26.05	23.47
Household income (\$, thousands)	24.48 (14.67)	24.26 (16.71)	24.70 (12.23)
Household size	4.54 (1.44)	4.54 (1.42)	4.55 (1.45)
Number of children	2.79 (1.24)	2.81 (1.24)	2.77 (1.22)
Food stamp participation (%)***	33.87	41.55	25.98

NOTE.—Asterisks in table indicate statistically significant difference between two waves. Standard deviation is listed in parentheses.

*
 $p < 0.10$.**
 $p < 0.05$.***
 $p < 0.01$.

Table 2

CORRELATIONS OF DEPENDENT VARIABLES AND MAJOR INDEPENDENT VARIABLES (Weighted)

	2	3	4	5	6	7
1. Externalizing behaviors	.62	.15	.43	-.11	.26	-.17
2. Internalizing behaviors		.08	.36	-.17	.32	-.27
3. Food insecurity scale			.16	-.05	.16	.27
4. Parenting stress				-.25	.36	-.32
5. Parental warmth					-.10	.18
6. Parental psychological distress						-.47
7. Parent's self-esteem						

NOTE.—Coefficients for all correlations except the one between food insecurity and parental warmth are statistically significant at the .001 level.

Table 3
RESULTS OF FIXED-EFFECTS MODELS: BEHAVIOR PROBLEMS, FOOD INSECURITY, AND PARENTAL CHARACTERISTICS (Weighted)

VARIABLE	Model 1		Model 2		Model 3	
	Externalizing	Internalizing	Externalizing	Internalizing	Externalizing	Internalizing
Food insecurity	.15* (.08)	.13** (.06)	.07 (.08)	.07 (.06)	.04* (.02)	.01 (.01)
Parenting stress			1.80*** (.26)	1.06*** (.20)		-.09* (.05)
Parental warmth			-.37 (.30)	.24 (.22)	-.12* (.07)	
Psychological distress			.06	.04 (.03)	.03*** (.01)	-.00 (.01)
Parent's self-esteem			-.13 (.39)	-.58* (.31)	-.21** (.09)	-.04 (.07)
Control variables:						
Child's age	-1.13** (.48)	-.89** (.42)	-.78* (.46)	-.63 (.41)	-.11 (.09)	.01 (.07)
Child's disability status	.36 (.60)	.28 (.56)	-.06 (.56)	-.02 (.53)	.20* (.11)	.05
Head's gender (female)	-.24 (1.06)	-.02 (.78)	-.47 (.94)	-.44 (.72)	.25 (.19)	.53*** (.17)
Head's age	-.20*** (.08)	-.05 (.07)	-.17*** (.06)	-.04 (.06)	.00 (.01)	.01 (.01)
Head's employment (yes)	-.75* (.40)	-.59* (.33)	-.74* (.40)	-.60* (.32)	.08 (.09)	-.00 (.06)
Head's education	.05 (.16)	-.02 (.19)	.02 (.18)	-.04 (.20)	.01 (.04)	-.00 (.04)
Head's marital status	.57 (.97)	.06 (.69)	.56 (.88)	-.10 (.64)	.12 (.16)	.34** (.13)
Log-household income	-.00 (.11)	-.05 (.10)	.02 (.08)	-.06 (.10)	-.00 (.02)	.04* (.02)
Household size	.24 (.36)	.52** (.24)	.17 (.34)	.46* (.24)	-.01 (.06)	.04 (.05)
Number of children	-.08 (.37)	-.10 (.27)	-.01 (.35)	-.02 (.27)	-.01 (.07)	-.09 (.06)

VARIABLE	MODEL 1		MODEL 2		MODEL 3	
	Externalizing	Internalizing	Externalizing	Internalizing	Externalizing	Internalizing
Food stamp participation	-.46 (.41)	-.10 (.35)	-.22 (.39)	.10 (.34)	-.06 (.08)	-.03 (.06)
CDS wave (wave 2 = 1)	5.94*** (2.07)	4.77*** (1.79)	3.50* (2.00)	3.46** (1.75)	.72* (.38)	-.68** (.32)
Number of children	416	416	416	416	416	416
R ²	.07	.11	.21	.20	.25	.45

NOTE.—Head = household head; CDS = Child Development Supplement to the Panel Study of Income Dynamics. Robust standard errors are in parentheses.

*
p < 0.10.
**
p < 0.05.

p < 0.01.

Table 4

ROBUSTNESS TEST: LAGGED-DEPENDENT-VARIABLE MODELS

	DEPENDENT VARIABLES IN WAVE 2			
	Externalizing (1)	Externalizing (2)	Internalizing (3)	Internalizing (4)
Independent variables:				
Food insecurity in wave 1	-.03 (.10)		.02 (.08)	
Food insecurity in wave 2		.22* (.13)		.17 (.11)
Lagged dependent variable:				
Externalizing scale in wave 1	.51*** (.08)	.51*** (.07)		
Internalizing scale in wave 1			.53*** (.08)	.54*** (.08)

NOTE.—Robust standard errors in parentheses.

*
 $p < 0.10$.***
 $p < 0.01$.

Table 5

ROBUSTNESS TEST: REGRESSION MODELS WITH PROPENSITY SCORE VARIABLE

INDEPENDENT VARIABLE IN WAVE 2	DEPENDENT VARIABLES IN WAVE 2			
	Externalizing	Externalizing	Internalizing	Internalizing
Dichotomous food insecurity	.31 (.80)	.00 (.78)	-.40 (.83)	-.63 (.67)
Parenting stress		2.39*** (.33)		1.27***
Parental warmth		-.30 (.46)		.24 .37
Psychological distress		.09 (.08)		.08 (.07)
Parent's self-esteem		-.01 (.75)		-1.47* (.70)
Propensity score of food insecurity in wave 2	4.23** (2.10)	1.65 (2.25)	2.49 (2.29)	.90 (2.57)

NOTE.—Robust standard errors in parentheses.

*
 $p < 0.10$.**
 $p < 0.05$.***
 $p < 0.01$.