The Child and Adult Care Food Program and Food Insecurity

COLLEEN HEFLIN
University of Missouri

IRMA ARTEAGA
University of Missouri

SARA GABLE
University of Missouri

ABSTRACT The Child and Adult Care Food Program (CACFP) provides cash reimbursement to family day care, child-care centers, homeless shelters, and afterschool programs for meals and snacks served to children. Despite young children's known vulnerability to fluctuations in nutritional intake, prior literature has largely neglected the contributions of the CACFP to reducing household food insecurity. Using data from the Early Childhood Longitudinal Study–Birth Cohort (ECLS-B), we examine the association between CACFP provider participation and food insecurity, controlling for the nonrandom selection process into child-care centers that participate in CACFP. We find that accessing child care through providers that participate in the CACFP results in a small reduction in the risk of household food insecurity. Given the known cognitive and health consequences associated with food insecurity during early childhood, our results indicate the importance of improving access to the CACFP.

INTRODUCTION

High rates of food insecurity are a significant problem in the United States. Current estimates show that almost 49 million people live in food-insecure households, meaning that at some time during the previous year they were unable to acquire enough food or were uncertain of having enough food to meet their basic needs due to inadequate household resources (Coleman-Jensen, Nord, and Singh 2013). Rates of food insecurity are substantially higher among those in households with incomes below the poverty line

Social Service Review (March 2015).
0037-7961/2015/8901-0003$10.00

(40.9 percent) and in households with children headed by single women (35.4 percent). Levels of food insecurity increased across US households in 2008 as a result of the Great Recession, rising from around 11 percent from 2005–6 to the measured high of approximately 14.5 percent in 2008, where it remains essentially unchanged as of the 2012 estimate. In recognition of the magnitude of the social problem food insecurity presents, Congress passed the Healthy, Hunger-Free Kids Act of 2010 to improve the functioning and reach of child nutrition programs.

From a developmental perspective, prior literature shows that food insecurity has cumulative effects at different stages of development, beginning in the prenatal period (Morgane et al. 1993; Duncan, Brooks-Gunn, and Klebanov 1994; Pollit 1994; Scholl and Johnson 2000; Bhattacharya, Currie, and Haider 2004; Cook and Frank 2008). For infants, hunger has negative effects during the period of neurodevelopment. Controlled experiments with animals suggest that hunger results in irreversible damage to brain development, such as that associated with the insulation of neural fibers (Yaqub 2002). A lack of nutritional intake during the first 2 years of life can lead to increased susceptibility to infections, slowed cognitive development and physical growth, increased susceptibility to chronic diseases, and a higher risk of delivering low-birth weight babies. Other non-health-related problems include reduced school performance, increased school dropout rates, and reduced productivity during adulthood (Hoddinott et al. 2008).

Prior literature has largely neglected the contributions of the Child and Adult Care Food Program (CACFP) to alleviating household food insecurity. Two studies that evaluate the relationship between participation in the CACFP and child and household food insecurity find no effect (Gordon et al. 2010; Korenman et al. 2012), which is surprising given the influence that nutritional inadequacy can have on early developmental processes. We explain the CACFP in detail and review prior research examining CACFP participation. Then we describe our data and methods for each of our research questions. Using data from the Early Childhood Longitudinal Study–Birth Cohort (ECLS-B), we examine the association between CACFP provider participation and food insecurity status. After presenting our findings, we discuss their limitations and implications for state-level participation in the CACFP and the reauthorization of the Healthy, Hunger-Free Kids Act of 2010.

BACKGROUND AND LITERATURE REVIEW

THE CHILD AND ADULT CARE FOOD PROGRAM (CACFP)

The CACFP provides cash reimbursement to home-based child-care programs, child-care centers, homeless shelters, and after-school programs for meals and snacks served to children. While both adults and school-aged children are eligible, the large majority of the program's funding is directed toward younger children. In 2012, 3.4 million children received meals and snacks in an average day (vs. 112,000 adults). Except in special circumstances, children older than age 12 are not eligible to participate. Overall, participation is on the level of the Summer Food Service Program and is dwarfed by participation in the National School Lunch Program, which had 31.7 million participants in 2010 (USDA 2012).

Figure 1 shows the number of meals served in child-care centers and home-based child-care programs. From 1969 to 1976, meals were served only in centers, and the number of meals served increased sharply across this time period. However, after meals in homes were introduced, the number of meals served in homes increased more rapidly than the number

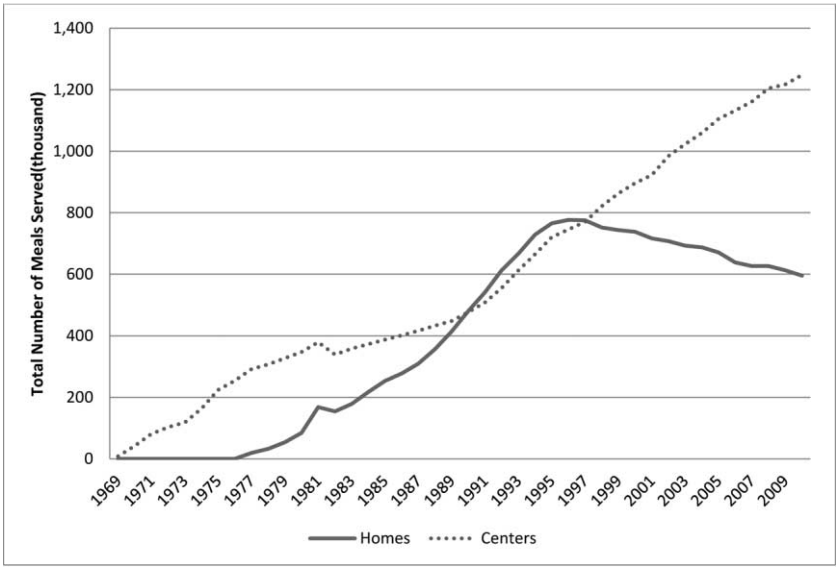

FIGURE 1. Total meals served in homes and centers, 1969–2010. A color version of this figure is available online.

served in centers, and in 1990 more home meals were served than center meals. In 1997, however, more meals were served in centers than in homes. Since then, the number of meals served in centers has continued to grow, while the number of meals served in homes has steadily decreased (USDA 2013). Unlike other countercyclical nutrition programs, such as the Supplemental Nutrition Assistance Program (SNAP), CACFP participation has increased steadily over time due to program expansion even when the economy has been strong (Hanson and Oliveira 2012). In fiscal year 2010, 3.3 million children participated through 52,000 child-care centers and 137,000 home-based child-care programs (Food Research and Action Center 2012).

Participation in the CACFP is open to most child-care providers and all children, but reimbursement rates vary depending on the type and auspice of care (e.g., center-based vs. home-based, if licensed and for-profit or not), the income level of the neighborhood, and the income of the children's households. In child-care centers, a reimbursement scheme parallel to that of the National School Lunch Program is used, wherein meals and snacks served are reimbursed at three payment levels tied to the family income of the children (sometimes termed "free," "reduced price," and "full price").[1] For home-based child-care providers, there are two levels of reimbursement that are determined by a mix of factors including neighborhood, provider, and family income. Children are eligible for CACFP participation if they reside in households with income below 185 percent of the federal poverty line or if they are part of a household that receives SNAP or Temporary Assistance for Needy Families (TANF).

CACFP STUDIES

Previous research on the CACFP has focused on modeling participation in the CACFP at the provider level (Kapur, Kilburn, and Fair 1999) and child level (Gordon et al. 2010). Poor children who reside in low-income areas are more likely to participate than poor children in wealthier areas and children from low-income households who spend more time in child care. Providers are more likely to participate if they have larger enrollments; are licensed,

1. Current per-child, per-day reimbursement rates for centers in FY2013 for breakfast, lunch, or supper and one snack are $0.63 for nonqualifying children, $4.21 for children who qualify for reduced price, and $5.31 for children who qualify for free meals (USDA 2013).

accredited, and not-for-profit; are Head Start programs; and serve participants who are categorically eligible to participate in the CACFP (Gordon et al. 2010). Significant variation in participation among eligible providers also exists by state (Kapur et al. 1999). Recent efforts have focused on identifying the barriers to serving healthy foods in CACFP-participating child-care settings (Institute of Medicine 2011, 2012).

Rachel Gordon and colleagues (2010) and Sanders Korenman and colleagues (2012) explore the child nutrition correlates of participation in the CACFP and hypothesize that CACFP participation should be associated with declines in food insecurity and greater consumption of healthy foods. Among a sample of low-income 4-year-olds enrolled at non–Head Start child-care centers, Gordon and colleagues find that children who participate in the CACFP are more likely to consume milk, vegetables, and fruit and are less likely to be underweight. Gordon and colleagues report no association between CACFP participation and child obesity or food insecurity status at the child or household level. A significant limitation of this study is that the models estimated do not control for the nonrandom selection process into a CACFP-participating child-care center. Given that this study identifies a number of individual- and provider-level factors that differ systematically between CACFP participants and nonparticipants, this is a noteworthy omission that may bias their findings, and this is something we will attempt to explore. Gordon and colleagues' study (2010) is also limited because they examine CACFP participation only among low-income children who attend child-care centers even though many participants access CACFP-reimbursed meals through home-based child care and Head Start. Additionally, because the CACFP provides a direct subsidy to programs, all children and families affiliated with the program may benefit from CACFP-reimbursed meals and nutritional guidelines, regardless of their income level.

Korenman and colleagues (2012) address some of these limitations by extending their analysis to include children in both Head Start and non–Head Start center care. However, they continue to exclude from their analysis children in home-based child-care programs that are also eligible to participate in the CACFP. More important, Korenman and colleagues use a nonstandard definition of food insecurity in which households that endorse any of the 18 items in the Core Food Security Module are considered to be food insecure, instead of using the standard cut-off of three endorsed items. As a consequence, their findings are not comparable with others in the lit-

erature. Additionally, they attempt to deal with the selection bias into the CACFP participation by using inverse propensity weighting, which only controls for selection on observable characteristics, leaving the bias from selection on unobservable characteristics present in their results. We address these limitations in our study by estimating effects of provider participation in the CACFP on the full sample of children participating in center-based, Head Start, and home-based child care programs using standard measures of food insecurity and instrumental variable models that control for selection bias on both observable and unobservable factors related to CACFP participation.

RELEVANT NON-CACFP STUDIES

While studies of the relationship between CACFP participation and child outcomes are scarce, evaluations of the WIC (Women, Infant, and Children) Program and the Food Stamp Program provide some guidance because all three programs are designed to improve access to nutritious food and must address the methodological issue of selection bias into program participation. That is, households that choose to participate in programs that offer nutritional benefits are often different from similarly eligible households that choose not to participate, and these differences are often unobservable when using survey data sets. Using a variety of methodological techniques to address selection bias, several studies have demonstrated that WIC recipients benefit from participation across a range of outcomes, beginning with pregnancy and birth outcomes, improved iron status among preschoolers, lowered prevalence of iron-deficiency anemia among young children, and reduced levels of household food insecurity and food insecurity with hunger (Kennedy et al. 1982; Bitler and Currie 2005; Bitler, Gundersen, and Marquis 2005; Lee, Mackey-Bilaver, and Chin 2006; Cook and Frank 2008; Mathews et al. 2010; Metallinos-Katsaras et al. 2010).

Several studies have examined the relationship between food insecurity and participation in the Food Stamp Program. A rigorous study that controlled for endogeneity of Food Stamp Program participation with an instrumental variable approach finds that participation in the Food Stamp Program reduced the severity of food insecurity (Yen et al. 2008). Similarly, using logistic regression, John Cook and Deborah Frank (2008) report that receipt of food stamps reduced negative child health consequences, including hospitalization, among food-insecure families and led to a 25 percent

reduction in the likelihood of household food insecurity. However, issues with selection bias in food stamp receipt and measurement error in reports of program participation have created identification problems in evaluating the treatment effect of food stamps (Gibson-Davis and Foster 2006; Gundersen, Joliffe, and Tiehan 2009; Gundersen and Kreider 2009; Kreider et al. 2009; Gundersen, Kreider, and Pepper 2011).

Drawing upon the prior research indicating positive effects of participation in WIC and the Food Stamp Program, we explore the contribution of the CACFP to household food insecurity status. We use instrumental variable methods to address issues of selection into CACFP-participating child-care programs, including child-care centers, Head Start, and home-based child-care programs. More specifically, we estimate the direct effect of provider participation in the CACFP on household food insecurity status for families at all income levels.

DATA AND METHOD

Our data come from the Early Childhood Longitudinal Study–Birth Cohort (ECLS-B). The ECLS-B includes a nationally representative sample of children born in 2001 and uses a multi-reporter, multi-method design to gather extensive information about children's home and educational experiences, including child care, from birth through kindergarten entry. About 10,700 parents and children participated at the study's initiation (i.e., when their child was 9 months old), and subsequent data were collected when the children were approximately 24 months old and 4 years old and when they entered kindergarten. The ECLS-B contains a wealth of information, including answers to the Core Food Security Model, parent(s)' demographic background, family use of federal assistance (including SNAP and WIC), household income and composition, and detailed parent and provider reports concerning the study child's child-care arrangements (including child-care program reports of CACFP participation). Our analysis focuses on the sample of 4-year-olds who attended child care and whose providers answered the Early Care and Education Provider (ECEP) interview ($n = 1{,}750$).[2] The ECLS-B uses a stratified cluster sample that consists of 90 strata with two clusters in each stratum. To account for the possibility

2. Previous analysis included the full sample, and its results were consistent with those presented here.

of any nesting of children, we used three degrees of weighting in our analysis: base (design) weights, population-sampling unit weights (PSUs), and poststratification weights (strata).[3]

Little is known about the role of the CACFP in the household food insecurity status of families with preschool-age children, in part because of the difficulty of identifying participating providers. Although parents are usually aware of their participation in most food and nutrition programs, they often do not know if their child-care providers are participating in the CACFP, which makes parental reports unreliable. A distinct strength of the ECLS-B is that CACFP participation data were gathered from child-care program directors and home-based child-care providers, thus reducing the type of measurement error one might expect from parental reports of CACFP participation (Gundersen and Kreider 2009).

One way to assess the relative importance of CACFP participation on household food insecurity during children's preschool years is to estimate the following Probit model:

$$Y_i = \alpha_{0i} + C_i\alpha_1 + X_i\alpha_2 + \varepsilon_i, \quad (1)$$

where Y_i indicates a measure of food security for household i, C_i identifies the child-care provider for household i's participation in CACFP; α_1 is a vector of estimated coefficients associated with C; X_i includes demographic, household composition, labor force participation, and other characteristics that prior literature indicates are associated with food security status; α_2 is a vector of estimated coefficients associated with X; and ε is a normally distributed error term with constant variance and mean of zero.

However, a potential problem with equation (1) is that children who attend child-care programs that participate in the CACFP are likely to be different from children who do not attend CACFP-participating care arrangements because children were not randomly assigned to a CACFP or non-CACFP care providers. This is known in the literature as the selection bias problem. This means that our Probit estimates from equation (1) are likely to be biased because CACFP use may be correlated with unobserved

3. The statistical software that we used for our analysis was STATA. We used the command 'svy' to make adjustments to standard errors associated with complex survey data. We also followed the National Center for Education Statistics guidelines when selecting and applying the sample weight variables that represent the strata, the clusters, the wave of data collection, and the respondent(s) (National Center for Educational Statistics 2006).

parental tolerance regarding their household's food insecurity. Although parental knowledge of the CACFP is likely to be limited, parents' child-care decisions may be influenced by whether the program provides nutritious meals and snacks. Thus, we suspect that there are unobserved factors that influence parents' child-care choices and that these factors may be correlated with the maximization process that parents pursue regarding their household food supply. To address this issue, we use an instrument with the two required properties: (i) our instrument predicts CACFP participation, but (ii) our instrument does not affect food insecurity except through its influence on CACFP.[4]

The first property is known in the literature as the *exogeneity condition*, and it is easily tested using a *F*-statistic on the excluded instrument on the first stage. The second property is known as the *exclusion restriction*, and there is no direct way to test it. However, factors that are external to the household, such as program access, are good candidates (Angrist and Krueger 2001; Angrist and Pischke 2009; Wooldridge 2011). Therefore, similar to T. Paul Schultz (1999) and Martin Ravallion and Quentin Wodon (2000), we use CACFP-provider availability as a determinant of CACFP participation for the child-care provider at the household level under the assumption that CACFP availability does not influence household food insecurity conditional on household participation. To measure the relative availability of CACFP providers at the state level, we calculate the ratio of the total number of CACFP participants divided by the total number of children under age 5 who lived in households with incomes below 200 percent of the federal poverty line, by state, for 2009. It is important to note that this is a rough estimate, as the total attendees will include a small number of older children and adults who participated in the CACFP. Additionally, since it is not possible to identify the total population under 185 percent of the federal poverty line, the number of children under age 5 who lived in households with incomes below 200 percent of the federal poverty line exceeds the number of children who were eligible for the CACFP since income eligibility extends only to children in households with income under 185 percent

4. An additional assumption for instrumental variable (IV) models is monotonicity, which means that the instrument may have no effect on some individuals but that all who are affected are affected in the same way. Stated differently, the direction of the effect is the same for all members of the sample. In addition, it is important to note that IV models estimate the causal effect for those affected by the instrument only. That is, our models estimate local treatment effects and not average treatment effects.

of the poverty line and households receiving SNAP or TANF. The first error (program participants) introduces a positive bias, and the second error (200 percent of the federal poverty line) introduces a negative bias in identifying the correct population coverage rate of the CACFP. While it is not perfect, we believe it is a good proxy for availability of the CACFP (see fig. 2 in the Discussion section). Additionally, this instrument meets the condition that it predicts CACFP participation but does not affect household food insecurity directly.[5] In other words, this instrument can be used to obtain a causal estimate of CACFP participation (Wooldridge 2011).

Thus, we use an instrumental variable approach to estimate the effects of the CACFP on food insecurity. In the first stage, we predict CACFP participation:

$$C_i = \beta_{1i} + Z_i\beta_2 + X_i\beta_3 + \mu_i, \tag{2}$$

where C_i identifies participation in the CACFP for the child-care provider for household I; Z includes an exogenous instrument that affects the CACFP but does not affect food insecurity directly (the relative availability of CACFP providers); β_2 is a vector of estimated coefficients associated with Z; X_i includes demographic, household composition, labor force participation, and other characteristics; β_3 is a vector of estimated coefficients associated with X; and μ is a normally distributed error term with constant variance and mean of zero.

In the second stage, we predict food insecurity, similarly to equation (1). The only difference between our food insecurity estimate and equation (1) is that we use the predicted value for the CACFP that was calculated during the first stage, $\hat{C}_i$, to predict food insecurity in the second stage:

5. For this method to work well, it is necessary to include control variables for geographic heterogeneity because latent effects due to omitted variables correlated with program placement can bias the estimated effects. Particularly, one concern might be that any omitted geographic heterogeneity might be a confounder. We use geographic controls that have been widely used in the literature: population density, share of urban population, state-level income, health spending indicators, and education spending indicators. We also estimate a number of falsification tests to test the exclusion restriction, such as modeling the relationship between CACFP access and household food insecurity among 9-month-olds, household income, the total number of children in the household, and welfare participation. All models indicate that CACFP state access did not influence these other outcomes, supporting the exclusion restriction.

$$Y_i = \alpha_{0i} + \hat{C}_i\alpha_1 + X_i\alpha_2 + \varepsilon_i. \quad (3)$$

For each of our models, we present results for four different groups of children. First, we consider the sample of children who attend child care and estimate the effect of CACFP participation on household food insecurity status. Next, we divide the sample by type of child-care arrangement (center-based child care, Head Start, and home-based child care), because there are different requirements for participation and reimbursement rates in the different child-care settings. It is plausible that both participation requirements and reimbursement levels could directly affect the estimated relationship between CACFP participation and household food insecurity.

We consider the effect of CACFP program participation on household food insecurity status among our sample of households with children. Nationally, 80.5 percent of all households with children under age 18 were food secure in 2013, with the remaining 19.5 percent reporting being food insecure at some point during the year (Coleman-Jensen et al. 2014). Qualitative reports suggest that adults in the household may further reduce their own intake to protect children from experiencing food insecurity (Polit, London, and Martinez 2001), and empirical evidence indicates that this occurs frequently. In about half of all households that were food insecure in 2013, or 9.6 percent of all households with children, only adults reported being food insecure, while both children and adults reported being food insecure in the other 9.9 percent of food-insecure households with children (Coleman-Jensen et al. 2014).[6] Participation in food and nutrition programs that increase the supply of food to children may not only affect the food security status of the participating child but also increase the food consumed by adults in the household. As a consequence, our analyses will explore the effects of program participation on household food insecurity.

Household food insecurity is derived from the US Department of Agriculture's (USDA) Core Food Security Module, which asks participants 18 questions in order to rate food security for their households. Using validated cut-off points, we consider a household to be food secure if 0–2 items in the scale were answered affirmatively (this category includes the marginally food secure). If three or more items were answered affirmatively, we consider a household to be food insecure (Nord 2009). See appendix table A1

6. It is important to note that there is also evidence that children may take actions to shield adults from food insecurity as well (Fram et al. 2011).

(appendix tables A1–A5 are available online) for the Core Food Security Module.

Our control variables include a set of child and parental characteristics that the extant literature correlates with food security status. Child characteristics include the child's age in months, the child's gender, and a maternal report of the child's health and race (black, Hispanic, Asian, mixed, and other vs. white). Parent characteristics include maternal age in years, maternal education level (less than high school, some college, college degree vs. high school degree), marital status of the adults in the household where the child was living at the time of the interview (1 = married vs. not married), household income level (measured in categories), the number of household members younger than 18, the number of household members 18 and over, the household's region (Midwest, South, West vs. East), and the type of neighborhood the household is located in (1 = metropolitan area residence vs. all others). Table 1 presents descriptive statistics for the full sample and by child-care arrangement for our main measures, and table 2 presents descriptive statistics for demographic and socioeconomic characteristics.

Our analysis also explores the causal pathway through which CACFP might affect food insecurity. One potential mechanism is a proxy for *quality of food service*. The National Center for Educational Statistics (NCES) created the quality of food service variable using child-care provider interview data. Using an index from 1–7, this variable reflects the appropriateness and timing of the foods served, the sanitary conditions in which the food is

TABLE 1. Descriptive Statistics

Variable	Full Sample (N = 1,750)	Center Care (n = 950)	Head Start (n = 450)	Home-Based (n = 350)
Dependent variable:				
Household food insecurity in wave 3:				
Food secure (%)	85.37	90.99	74.38	86.39
Food insecure (%)	14.63	9.01	25.62	13.61
Variable of interest:				
CACFP participation:				
No participation (%)	50.15	58.74	13.81	79.88
Participation (%)	49.85	41.26	86.19	20.12
Instrument:				
Availability of CACFP providers (%)	10.70	10.82	10.48	10.64
Mediator:				
Mean index of quality of food	3.0395	2.7926	3.7464	2.6864

Note.—Numbers represent percentages unless noted as means.

TABLE 2. Descriptive Statistics for Demographic and Socioeconomic Characteristics

Variable	Full Sample	Center Care	Head Start	Home-Based Care
Child's race:				
White (%)	45.62	50.52	28.54	58.02
Black (%)	21.55	16.80	34.67	14.51
Hispanic (%)	17.53	14.48	24.31	16.05
Asian (%)	6.06	9.04	2.54	2.78
Mixed and other (%)	9.24	9.15	9.94	8.64
Child's gender:				
Female (%)	48.68	48.79	48.00	49.38
Male (%)	51.32	51.21	52.00	50.62
Child's health status:				
Excellent (%)	51.43	52.63	44.44	57.14
Very good (%)	34.29	31.58	44.44	28.57
Good (%)	11.43	10.53	11.11	14.29
Fair (%)	2.86	5.26	.00	.00
Poor (%)	.00	.00	.00	.00
Mother's education status:				
Less than high school (%)	13.36	7.75	24.00	11.76
High school (omitted; %)	32.53	25.55	46.53	30.96
Some college (%)	26.18	26.94	24.21	27.55
College degree or above (%)	27.92	39.77	5.26	29.72
Marital status:				
Not married (%)	38.86	30.87	57.05	32.72
Married (%)	61.14	69.13	42.95	67.28
Urban status:				
Not in the urban area (%)	17.84	15.27	22.29	17.41
In the urban area (%)	82.16	84.73	77.71	82.59
Region:				
Northeast (omitted) (%)	16.95	20.00	16.21	10.19
Midwest (%)	25.21	21.39	20.84	41.67
South (%)	39.58	41.62	45.26	25.62
West (%)	18.26	16.99	17.68	22.53
Household income:				
$5,000 or less (%)	5.88	5.26	10.00	NA
$5,001–$10,000 (%)	5.88	5.26	10.00	NA
$10,001–$15,000 (%)	8.82	5.26	20.00	14.29
$15,001–$20,000 (%)	8.82	5.26	10.00	14.29
$20,001–$25,000 (%)	8.82	5.26	10.00	NA
$25,001–$30,000 (%)	5.88	5.26	10.00	14.29
$30,001–$35,000 (%)	5.88	5.26	10.00	NA
$35,001–$40,000 (%)	5.88	5.26	10.00	NA
$40,001–$50,000 (%)	5.88	5.26	10.00	14.29
$50,001–$75,000 (%)	11.76	15.79	NA	14.29
$75,001–$100,000 (%)	11.76	15.79	NA	14.29
$100,001–$200,000 (%)	11.76	15.79	NA	14.29
$200,001 or more (%)	2.94	5.26	NA	NA
Mean age of child (months)	52.95	53.18	53.08	52.18
Mean age of mother (years)	32.02	33.40	29.87	31.58
Mean no. of children in household	2.45	2.30	2.72	2.47
Mean no. of adults in household	2.06	2.03	1.99	2.20
State variables:				
Population density	245.69	276.72	237.62	176.48
Percentage of urban population (%)	76.74	77.65	75.49	76.27
Log of income per capita	9.96	9.97	9.94	9.96
Log of health expenditure	8.58	8.59	8.58	8.58
Log of expenditure in education	9.00	9.01	8.99	8.99
Percentage spent on childhood nutrition (%)	19.93	20.02	20.25	19.02

Note.—Numbers represent percentages unless noted as means. NA = Not available: data suppressed due to IES concerns regarding confidentiality.

prepared, and whether well-balanced and nutritional meals and snacks are served; the scale takes a value of zero if a meal is not served. (See table 1 for more details.)

RESULTS

To examine the possible effect of CACFP participation on household food insecurity, we estimated a series of two-stage Probit models. Due to the nonrandom assignment of CACFP participation at the child-care arrangement level, we control for the nonrandom selection process on both observable and unobservable factors by using an instrumental variable method. Results from the first-stage model, in which we estimate the probability of CACFP participation, are shown in appendix table A2.

CACFP PARTICIPATION: IV RESULTS FOR FULL SAMPLE

We begin with results for models that do not control explicitly for the type of child-care arrangement. In appendix table A2, we find that our instrument, the relative availability of CACFP providers, positively affects CACFP participation (coefficient = 2.903; $p < .001$). Moreover, the F-statistic test that excludes this variable from the regression estimation also shows that the instrument used is relevant ($F = 10.031$; $p < .001$), as shown in table 3.

We then used the predicted values for CACFP participation to estimate its effect on food insecurity (details of the second-stage estimation can be found in appendix table A3). Table 3 shows marginal effects of CACFP participation on food insecurity. Beginning with the top row in table 3, we present results for models that do not control explicitly for the type of care. We find that when we control for unobserved factors related to CACFP participation using instrumental variable models, a 4.19 percentage point reduction ($p = .007$) in household food insecurity is evident for the sample of children who attend child-care programs that participate in CACFP.

CACFP PARTICIPATION: IV RESULTS BY CHILD-CARE ARRANGEMENT TYPE

Next, we turn to results by child-care arrangement, beginning with non–Head Start center-based care. Children living in states with greater relative access to CACFP providers are more likely to participate in the CACFP (coefficient = 2.112; $p < .01$; as shown in appendix table A2). However, we find

TABLE 3. Marginal Effect of CACFP on Food Insecurity, IV Models

	dF/dx	*z*	*p* > *z*	*F*-Test for IV[a]
Overall (n = 1,750)	−.0419	−2.72	.007	10.0311[+]
	(.0178)			
Center-based care (n = 950)	−.019	−3.27	.001	11.523[+]
	(.0124)			
Head Start (n = 450)	−.4551	−1.12	.261	.256
	(.4058)			
Home-based care (n = 350)	−9.34E-06	−2.28	.023	3.537
	(.00003)			

Note.—Robust standard errors adjusted for clustering at the state level are in parentheses.
[a] The *F*-statistic on the excluded instruments using the test proposed by Stock and Yogo (2005).
[+] Significant at the 10% level.

no effect of the instrument on CACFP participation for children who attend Head Start, which is expected since all Head Start providers are categorically eligible to participate in the program. Finally, we examine children in home-based child-care programs and find no effect of the instrument on CACFP participation. Therefore, our identification strategy only identifies CACFP participation for non–Head Start center-based care.

Turning to the marginal effects of predicted CACFP participation on food insecurity, for children in non–Head Start center-based care, model estimates suggest the presence of a small, negative marginal effect (-0.019; $p = .001$) of experiencing household-level food insecurity, a similar sign as the overall group but a smaller magnitude. In terms of the magnitude of the estimated treatment effect, our findings suggest that, among all 4-year-old children who attend child-care centers, those who attend centers that participate in the CACFP have an estimated 1.9 percentage point reduction in the probability of being food insecure. While this is a small average treatment effect, the magnitude is spread across all participants in the center.

SENSITIVITY ANALYSIS

Our finding that the CACFP reduces household food insecurity after unobserved factors related to program participation are included in the model is consistent with the findings relating to other nutritional support programs (Yen et al. 2008; Schmeiser 2012). However, the CACFP differs from other programs such as SNAP or WIC because nutritional support is provided to the child-care program and not directly to the household. What, then, is the mechanism linking exposure to the CACFP with the household food supply?

As a sensitivity analysis, we explore one possible mechanism through which CACFP participation at the child-care program level might influence

TABLE 4. Sensitivity Analysis: Marginal Effects of CACFP on Food Insecurity, IV Models with Mediator

	dF/dx	*z*	*p* > *z*	*F*-Test for IV[a]
Overall (*n* = 1,750)	−.0344	−1.11	.267	1.5289
	(.0297)			
Center-based care (*n* = 950)	−.0067	−.65	.517	.2514
	(.0113)			
Head Start (*n* = 450)	−.3122	−.89	.372	.1784
	(.3545)			
Home-based care (*n* = 350)	−5.36E-06	−2.21	.027	2.669
	(.00002)			

Note.—The mediator used is a proxy for quality of food created by the National Center for Education Statistics. The measure is a composite rating for appropriateness and timing of the food served, the sanitary conditions in which the food is prepared, and whether a well-balanced and nutritional food is served. Robust standard errors adjusted for clustering at the state level are in parentheses.

[a] Indicates that the *F*-statistic on the excluded instruments is strong using the test proposed by Stock and Yogo (2005).

household food insecurity: the quality of the food service. The idea is that children attending a child-care center that serves high-quality food may reduce the burden on the household food supply because their parents do not need to send food from home for them to eat while they are in care. The classic mediation analysis suggests that the strength of the CACFP coefficient will be reduced when a correlated mediator is added to the model. Therefore, we reestimate the same IV models shown in table 3 with the hypothesized mediator, quality of food service. As table 4 indicates, CACFP participation declines substantially in magnitude and is no longer statistically significant when the quality of food service variable is added to the model.[7] This suggests that the CACFP may improve the household food supply by providing more predictable meals, a more sanitary food preparation space, and more nutritious meals. The very rough analysis presented here suggests one possible mechanism by which food eaten at the child-care center may improve the availability of food at home. However, additional work in this area is clearly needed.

DISCUSSION

The CACFP is an underresearched piece of the bundle of national food assistance programs available to low-income households. Participation in

7. First- and second-stage model results for table 4 can be found in appendix tables A4 and A5 (available online).

the CACFP is at the child-care program level and is open to all home-based child-care providers, Head Start, all nonprofit child-care centers, and for-profit centers that serve a substantial low-income population. Participating providers receive reimbursements for meals served, and the level of reimbursement is similar to that of the National School Lunch Program in that it is based on the mix of household incomes of children served.

We used nationally representative data from the ECLS-B to examine the relationship between provider participation in the CACFP and food insecurity with the expectation that access to the CACFP would be associated with decreased food insecurity. We applied an IV approach to account for the fact that unobserved parental preferences for child-care program types may be correlated with unobserved parental decisions about managing the household food supply. We analyzed separate models for the sample of children attending child care and by child-care setting, including center-based care, Head Start, and home-based child-care programs. The instrumental variable approach indicates that attending CACFP-participating child care has a negative marginal effect on the observed probability of household food insecurity for the general sample ($p = .005$) and specifically for children who attend non–Head Start child-care centers ($p = .001$), although the substantive size of that effect is quite low. We find no effect of provider participation in the CACFP program for children who attend Head Start (for whom participation is mandatory) or home-based care. However, the lack of significance for Head Start programs should not be interpreted as indicating that the CACFP program does not reduce household food insecurity since there is not enough variation within Head Start programs in CACFP participation with which to identify a treatment effect.

We also identify one potential causal pathway through which CACFP participation might decrease household food insecurity. Providers that participate in the CACFP are more likely to provide higher quality food service than providers that do not participate in the CACFP. It is reasonable to assume that the demands on the household food supply are lower when parents do not need to send food along with their children to daycare. Thus, the finding that CACFP participation reduces the risk of household food insecurity may be explained by the increased likelihood of child-care providers, particularly child-care centers, reducing household food burden by directly supplying food, especially high-quality food, to children in their care. However, this evidence is only suggestive, and further research into the mechanisms by which CACFP supports the household food supply is warranted.

This article is not without limitations that must be noted. First, we rely upon contemporaneous reports of food insecurity with CACFP participation and without clear temporal ordering, which weakens our ability to draw causal inferences from our IV models. Second, our data were collected around 2005 when the United States had a particularly strong macroeconomy, likely downward-biasing the importance of participation in the CACFP during more dire economic times, as well as limiting the external validity of our findings.

Given wide eligibility criteria that render the majority of child-care providers eligible and tight operating margins within the child-care industry, it is interesting to note the wide variation in CACFP coverage at the state level. In figure 2, we present the state-level distribution of relative availability of the CACFP in 2009, which we use as our instrumental variable. CACFP participation in states at the low end of the spectrum (Nevada, Arizona, Idaho, and South Carolina) is below 7 percent of vulnerable children, even with the positive bias introduced by using 200 percent of the poverty line as a threshold rather than the official threshold for eligibility of 185 percent. In contrast, there is a group of states (North Dakota, Minnesota, Nebraska, and Wyoming) with levels of estimated participation among eligible populations over 20 percent. This wide level of state variation suggests that access to the nutritional benefits of the CACFP may have significant implications in light of our findings and that CACFP program participation may lessen household food insecurity.

Given the known cognitive and health-related consequences associated with food insecurity during early childhood and our findings that the CACFP provides a small amount of nutritional support for reducing the risk of household food insecurity, focus should now be directed toward improving access to the CACFP. The USDA has used the Healthy, Hunger-Free Kids Act of 2010 to increase access to the CACFP through the expansion of afterschool meal programs and to improve the quality of meals and snacks reimbursed. Our research suggests that reauthorization of the Healthy, Hunger-Free Kids Act, which is set to expire in September of 2015, should include further measures to increase access to the CACFP and the quality of food provided by child-care providers as an important strategy to address childhood food insecurity in this country.

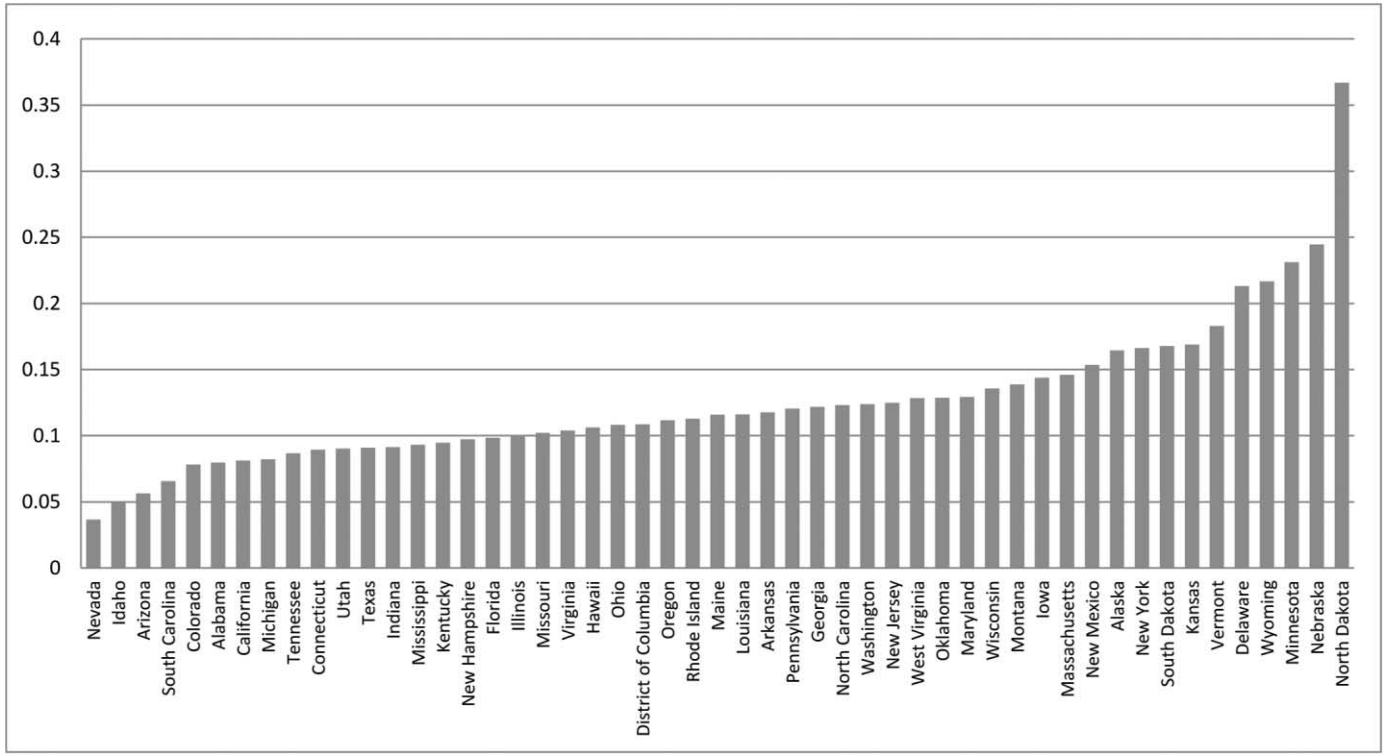

FIGURE 2. Ratio of number of CACFP participants to number of children (under 18 years old) living in families with incomes less than 200 percent of the Federal Poverty Line. A color version of this figure is available online.

NOTE

Colleen Heflin is an associate professor of public affairs at the University of Missouri. Her interdisciplinary research program focuses on understanding the survival strategies employed by low-income households to make ends meet, the implications of using these strategies for individual and household well-being, and how public policies influence well-being.

Irma Arteaga is an assistant professor of public affairs at the University of Missouri. Her research focuses on early childhood interventions in the developed and developing world, especially the factors that determine food insecurity, health, and academic outcomes in preschool and the early school years.

Sara Gable is an associate professor of nutrition and exercise physiology at the University of Missouri. She has conducted research about the child-care workforce; modifiable factors associated with the onset and persistence of childhood obesity; and the social, emotional, and academic consequences of obesity that persists across childhood and into adolescence.

This project was supported with a grant from the University of Kentucky Center for Poverty Research through funding by the US Department of Agriculture, Food and Nutrition Service, contract no. AG-3198-B-10-0028. The opinions and conclusions expressed herein are solely those of the authors and should not be construed as representing the opinions or policies of the UKCPR or any agency of the federal government.

REFERENCES

Angrist, Joshua D., and Alan B. Krueger. 2001. "Instrumental Variables and the Search for Identification: From Supply and Demand to Natural Experiments." *Journal of Economic Perspectives* 15 (4): 69–85.

Angrist, Joshua D., and Jörn-Steffen Pischke. 2009. *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton, NJ: Princeton University Press.

Bhattacharya, Jayanta, Janet Currie, and Steven J. Haider. 2004. "Poverty, Food Insecurity, and Nutritional Outcomes in Children and Adults." *Journal of Health Economics* 23 (4): 839–62.

Bitler, Marianne P., and Janet Currie. 2005. "Does WIC Work? The Effects of WIC on Pregnancy and Birth Outcomes." *Journal of Policy Analysis and Management* 24 (1): 73–91.

Bitler, Marianne P., Craig Gundersen, and Grace S. Marquis. 2005. "Are WIC Nonrecipients at Less Nutritional Risk than Recipients? An Application of the Food Security Measure." *Review of Agricultural Economics* 27 (3): 433–38.

Coleman-Jensen, Alisha, Christian Gregory, and Anita Singh. 2014. "Household Food Security in the United States in 2013." Report ERR-173, US Department of Agriculture, Economic Research Service, Washington, DC.

Cook, John T., and Deborah A. Frank. 2008. "Food Security, Poverty, and Human Development in the United States." *Annals of the New York Academy of Science* 40:1–16.

Duncan, Greg J., Jeanne Brooks-Gunn, and Pamela Kato Klebanov. 1994. "Economic Deprivation and Early Childhood Development." *Child Development* 65 (2): 296–318.

Food Research and Action Center. 2012. "Child and Adult Care Food Program Paperwork Reduction." Memos. Food Research and Action Center, Washington, DC. http://frac.org/federal-foodnutrition-programs/child-and-adult-care-program/.

Fram, Maryah Stella, Edward A. Frongillo, Sonya J. Jones, Roger C. Williams, Michael P. Burke, Kendra P. DeLoach, and Christine E. Blake. 2011. "Children Are Aware of Food Insecurity and Take Responsibility for Managing Food Resources." *Journal of Nutrition* 141 (6): 1114–19.

Gibson-Davis, Christina, and E. Michael Foster. 2006. "A Cautionary Tale: Using Propensity Scores to Estimate the Effect of Food Stamps on Food Insecurity." *Social Service Review* 80 (1): 93–126.

Gordon, Rachel, Robert Kaestner, Sanders Korenman, and Kristin Abner. 2010. "The Child and Adult Care Food Program: Who Is Served and What Are Their Nutritional Outcomes?" NBER Working Paper 16148. National Bureau of Economic Research, Cambridge, MA.

Gundersen, Craig, Dean Joliffe, and Laura Tiehen. 2009. "The Challenge of Program Evaluation: When Increasing Program Participation Decreases the Relative Well-Being of Participants." *Food Policy* 32 (4): 367–76.

Gundersen, Craig, Brent Kreider, and John Pepper. 2011. "The Economics of Food Insecurity in the United States." *Applied Economic Perspectives and Policy* 33 (3): 281–303.

Gundersen, Craig, and Brent Kreider. 2009. "Bounding the Effects of Food Insecurity on Child Health Outcomes." *Journal of Health Economics* 28 (5): 971–83.

Hanson, Kenneth, and Victor Oliveira. 2012. "How Economic Conditions Affect Participation in USDA Nutrition Assistance Programs." Economic Information Bulletin no. (EIB-100) 25. Economic Research Service, US Department of Agriculture, Washington, DC.

Hoddinott, John, John A. Maluccio, Jere R. Beherman, Rafael Flores, and Reynaldo Martorell. 2008. "Effect of a Nutrition Intervention during Early Childhood on Economic Productivity in Guatemalan Adults." *Lancet* 371 (9610): 411–16.

Institute of Medicine. 2011. *Child and Adult Care Food Program: Aligning Dietary Guidance for All.* Washington, DC: National Academies Press.

———. 2012 *Research Methods to Assess Dietary Intake and Program Participation in Child Day Care: Application to the Child and Adult Care Food Program: Workshop Summary.* Washington, DC: National Academies Press.

Kapur, Kanika, M. Rebecca Kilburn, and C. Christine Fair. 1999. "An Analysis of the Child and Adult Care Food Program in Child Care Centers." Report. RAND Corporation, Santa Monica, CA. http://www.rand.org/pubs/monograph_reports/MR1167z0.

Kennedy, Eileen, Stanley Gershoff, Robert Reed, and James Austin. 1982. "Evaluation of the Effect of WIC Supplemental Feeding on Birth Weight." *Journal of the American Dietetic Association* 80 (3): 220–27.

Korenman, Sanders, Kristin Abner, Robert Kaestner, and Rachel Gordon. 2012. "The Child and Adult Care Food Program and the Nutrition of Preschoolers." *Early Childhood Research Quarterly* 28 (2): 325–36.

Kreider, Brent, John V. Pepper, Craig Gunderson, and Dean Jolliffe. 2009. "Identifying the Effects of Food Stamps on Child Health Outcomes When Participation Is Endogenous and Misreported." Working Paper no. 09023. Department of Economics, University of Iowa.

Lee, Bong Joo, Lucey Mackey-Bilaver, and Meejung Chin. 2006. "Effects of WIC and Food Stamp Program Participation on Child Outcomes." Report. Economic Research Service, US Department of Agriculture, Washington, DC.

Mathews, Lisa, Michelle Neyman Morris, Julie Schneider, and Keiko Goto. 2010. "The Relationship between Food Security and Poor Health among Female WIC Participants." *Journal of Hunger and Environmental Nutrition* 41 (4): 85–99.

Metallinos-Katsaras, Elizabeth, Kathleen S. Gorman, Parke Wilde, and Jan Kallio. 2010. "A Longitudinal Study of WIC Participation on Household Food Insecurity." *Maternal and Child Health Journal* 15 (5): 627–33.

Morgane, Peter J., Robert Austin-LaFrance, Joseph Bronzino, John Tonkiss, Sofia Diaz-Cintra, L. Cintra, Tom Kemper, and Janina R. Galler. 1993. "Prenatal Malnutrition and Development of the Brain." *Neuroscience Biobehavior Review* 17 (1): 91–128.

National Center for Educational Statistics. 2006. *User's Manual for the ECLS-B Longitudinal 9-Month-Preschool Restricted: Use Data File.* Washington, DC: National Center for Educational Statistics.

Nord, Mark. 2009. "Food Security in Households with Children: Prevalence, Severity, and Household Characteristics." Economic Information Bulletin no. 56. Economic Research Service, US Department of Agriculture, Washington, DC.

Polit, Denise F., Andrew S. London, and John M. Martinez. 2001. "The Health of Poor Urban Women: Findings from the Project on Devolution and Urban Change." Report. MDRC, New York.

Pollit, Ernesto. 1994. "Poverty and Child Development: Relevance of Research in Developing Countries to the United States." *Child Development* 65 (2): 997S–1001S.

Ravallion, Martin, and Quentin Wodon. 2000. "Does Child Labor Displace Schooling? Evidence on Behavioral Responses to an Enrollment Subsidy." *Economic Journal* 110:C158–C175.

Schmeiser, Maximilian D. 2012. "The Impact of Long-Term Participation in the Supplemental Nutrition Assistance Program on Child Obesity." *Health Economics* 21 (4): 386–404.

Scholl, Theresa O., and William G. Johnson. 2000. "Folic Acid: Influence on the Outcome of Pregnancy." *Medical Journal of Clinical Nutrition* 71 (5): 1295S–1303S.

Schultz, T. Paul. 1999. "Health and Schooling Investments in Africa." *Journal of Economic Perspectives* 13 (3): 67–88.

Stock, James H., and Motohiro Yogo. 2005. "Testing for Weak Instruments in IV Regression." 80–108 in *Identification and Inference for Econometric Models: A Festschrift in Honor of Thomas Rothenberg,* edited by Donald W. K. Andrews and James H. Stock. Cambridge: Cambridge University Press.

USDA (US Department of Agriculture). 2012. "National School Lunch Program." Website. US Department of Agriculture, Washington, DC. http://www.fns.usda.gov/nslp/.

———. 2013. "Child and Adult Care Food Program." Website. US Department of Agriculture, Washington, DC. http://www.fns.usda.gov/cacfp/.

Wooldridge, Jeffrey M. 2011. *Econometric Analysis of Cross-Section and Panel Data.* Cambridge, MA: MIT Press.

Yaqub, Shahin. 2002. "Chronic Poverty: Scrutinizing Estimates, Patterns, Correlates, and Explanations." CPRC Working Paper 21. University of Manchester, Manchester, UK.

Yen, Steven T., Margaret Andrews, Zhuo Chen, and David B. Eastwood. 2008. "Food Stamp Program Participation and Food Insecurity: An Instrumental Variables Approach." *Journal of Agricultural Economics* 90 (1): 117–32.