Supplemental Nutrition Assistance Program Participation and Child Food Security

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KEY WORDS

child food security, program participation, food assistance, SNAP, food stamps

ABBREVIATIONS

CI—confidence interval
OR—odds ratio
SNAP—Supplemental Nutrition Assistance Program
SNAPFS—SNAP Food Security
TANF—Temporary Assistance for Needy Families

Dr Mabli conceptualized and designed the study, conducted the analysis, and drafted the manuscript; Ms Worthington performed the literature review, conducted the analysis, and drafted the manuscript.

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WHAT'S KNOWN ON THIS SUBJECT: Recent studies have shown that participating in the Supplemental Nutrition Assistance Program (SNAP) is associated with improved household food security. With the exception of 1 descriptive analysis, studies have not examined how SNAP affects children's food security.

WHAT THIS STUDY ADDS: This article estimates the association between SNAP and children's food security using the largest, most rigorous national study of food security to date. Given current proposals to reduce program size, this study underscores SNAP's importance in affecting children's well-being.

abstract

OBJECTIVE: This article investigates the association between Supplemental Nutrition Assistance Program (SNAP) participation and child food security by using data from the largest national survey of the food security of SNAP participants to date.

METHODS: The analysis used a survey of nearly 3000 households with children and a quasi-experimental research design that consisted of 2 sets of comparisons. Using a cross-sectional sample, we compared information collected from SNAP households within days of program entry with information collected from a contemporaneous sample of SNAP households that had participated for ~6 months. Next, by using a longitudinal sample, we compared baseline information collected from new-entrant SNAP households with information from those same households 6 months later. Multivariate logistic regression analysis was used to estimate associations between SNAP and child food security.

RESULTS: SNAP participation was associated with an approximately one-third decrease in the odds of children being food insecure in both samples. In the cross-sectional analysis only, SNAP was also associated with a decrease in the odds of children experiencing severe food insecurity (designated very low food security). Findings were qualitatively robust to different empirical specifications.

CONCLUSIONS: After controlling for other possible confounders, we found children in households that had participated in SNAP for 6 months experienced improvements in food security. On the basis of these findings, we conclude SNAP serves a vital role in improving the health and well-being of low-income children by increasing food security. Future research is needed to determine whether specific groups of children experience differential improvements in food security. *Pediatrics* 2014;133:1–10

Although children in most US households have adequate access to enough food for a healthy, active life, millions of children experience food insecurity each year, facing food access limitations because of a lack of money or other resources. In 2011, 1 in 5 households with children was food insecure, nearly double the prevalence for households without children (1 in 8 households).[1] Children were food insecure in 10% of households with children (3.9 million). In ~1% of households with children (374 000), children experienced very low food security, a severe form of food insecurity consisting of reductions in food intake and disrupted eating patterns because their families were unable to afford enough food.

Research has shown that child food insecurity can be associated with a number of adverse health and developmental outcomes among children.[2,3] These include poorer health and repeated hospitalizations,[4–9] lower physical function including iron deficiency,[9–12] lower elementary school math and reading achievement,[13–15] higher likelihood of depression and anxiety,[9,12,16–18] and poorer psychosocial function.[12,15,17,19,20]

As the largest federal nutrition assistance program in the United States, the Supplemental Nutrition Assistance Program (SNAP) aims to reduce hunger and improve the health and well-being of low-income individuals and families. One of the program's goals is to reach disadvantaged families with children. SNAP provided benefits to 47 million Americans in 2012, with children making up nearly half of all participants.[21,22]

Policy makers, advocates, and those administering SNAP have long hypothesized that SNAP reduces food insecurity. However, estimating the effect of SNAP on food insecurity by using household survey data has been challenging because of selection bias. Eligible households that choose to participate in SNAP may differ in systematic ways from households that do not, making it difficult to identify whether differences in food insecurity between participants and nonparticipants reflect true program effects or differences in observable or unobservable characteristics of the 2 groups.[23–26] Most research studies have attempted to isolate SNAP's effect on food insecurity from the compositional differences between participants and nonparticipants by using a variety of data and empirical methods, but evidence of the program's effect on food security has been mixed. Some studies have found positive or no associations between SNAP and food insecurity,[27–31] whereas others, including some with the strongest designs, have found that SNAP was associated with a decrease in food insecurity.[23,32–39] Furthermore, with few exceptions,[2] nearly all research examining the effects of SNAP on food security has focused on household food security (measured by using responses to questions about access limitations faced by adults and children in the household); little is known about how SNAP affects children's food security (measured by using responses to questions about access limitations faced by children in the household).

In this article, we estimate the association between SNAP and children's food security using statistical models that control for confounding demographic, economic, and household variables and by using recently collected, nationally representative data from almost 3000 households. The data come from the SNAP Food Security (SNAPFS) survey, which was conducted by Mathematica Policy Research for the US Department of Agriculture Food and Nutrition Service from 2011 to 2012.

METHODS

Study Design

We sought to minimize selection bias by comparing extant SNAP households to new households that had just entered SNAP (new-entrant households). Thus, a major source of selection bias in previous studies borne from comparing program participants to nonparticipants, many of which do not eventually even enter SNAP, was avoided in this study by interviewing new-entrant households and obtaining information from the month before entering SNAP. The analysis used a quasi-experimental research design that consisted of 2 sets of comparisons. The first design was a cross-sectional comparison group design composed of new-entrant households, defined as households that had been certified for SNAP in the 5 days before the sample date, and a group of participants who had been in the program for the previous 6 to 7 months (6-month households; Fig 1). We surveyed households that had participated ~6 months, relative to other lengths of time, to allow enough time after program enrollment for households to adjust their food purchase behavior while avoiding sample loss due to program attrition. The second design was a longitudinal comparison of the new-entrant households at program entry and that same group of participants 6 or 7 months later. This second design minimizes the bias associated with self-selection that exists when comparing different households at a point in time (as in the cross-sectional design) but may introduce biases due to changes in external factors over time. By using both experimental designs, we sought to address the weaknesses inherent in each to obtain the most definitive possible estimates of the association between SNAP participation and child food security. Additional details of the study design can be found in the survey report.[40]

The SNAPFS survey was constructed to obtain information from respondents that could explain food security differences between new-entrant and 6-month households and thus help further reduce selection bias. This information

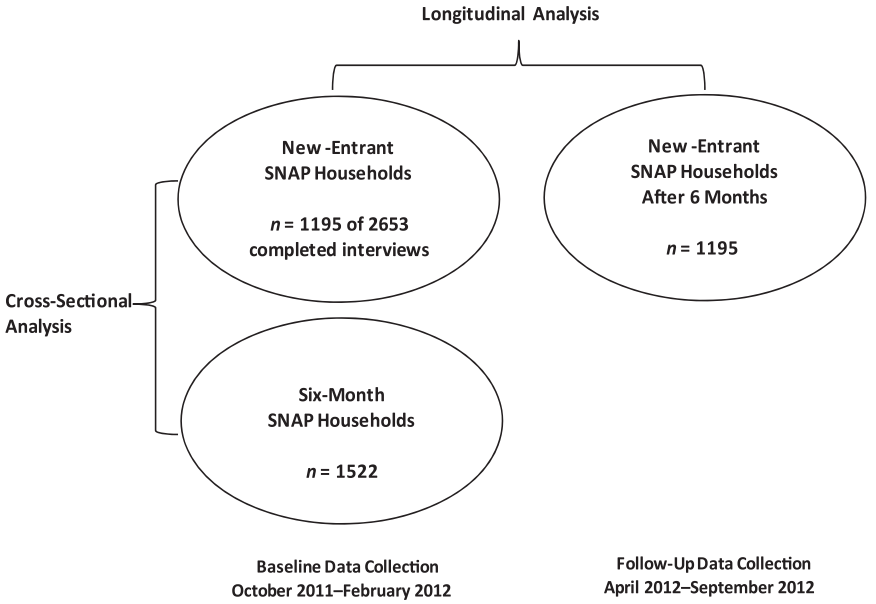

FIGURE 1

Study design. Data were derived from SNAPFS Survey 2012. The sample sizes denote numbers of households that completed the survey. In the analysis, the sample of new-entrant households with children was restricted to those households that also completed a follow-up interview 6 months later to improve the comparability between the new-entrant and 6-month households.

includes a rich set of demographic, economic, and household characteristics described later in the article.

Data Collection

Data were collected by using computer-assisted telephone interviewing. The cross-sectional analysis compares 1195 new-entrant households with children to 1522 6-month households with children interviewed from October 2011 through February 2012. The longitudinal analysis compares the 1195 new-entrant households at baseline with those same households 6 months later, from April to September 2012 (Fig 1). We restricted the sample of new-entrant households in the cross-sectional analysis to those that were still on the program 6 months later to increase comparability between new-entrant and 6-month households (the original sample size was 2653 new-entrant households at baseline).

To best measure the prevalence and characteristics of food-insecure households as they first entered the program, it was essential to interview new-entrant households as soon as possible after SNAP certification, before the household had adjusted its food purchasing and consumption behaviors based on its SNAP allotment. The length of the baseline field period was ∼2 weeks for new-entrant households and 4 weeks for 6-month households. The length of the field period for follow-up interviews with a new-entrant household 6 months later was ∼8 weeks. We obtained informed consent from all respondents.

Weighting

The study had a 2-stage sample design. First, we drew a sample of 30 states, by using probability-proportional-to-size sampling, with the number of SNAP households in each state as the measure of size. Second, we drew samples of participant households from caseload files provided by participating states. We used sampling weights for all analyses to account for the 2-stage design and to adjust for the potential effects of differential nonresponse. The findings in this article are based on weighted data and are nationally representative of new-entrant and 6-month SNAP households at the time of the baseline interviews.

Measuring Child Food Security

We used the same 18-question instrument to measure food security that is used by the US Census Bureau in an annual food security supplement to the Current Population Survey, with questions pertaining to a 30-day recall period (Table 1). Children's food security was measured by using a scale based on the 8-item child module. The analysis used 2 outcome measures[41]: a binary indicator of whether children in the household were food insecure based on ≥2 affirmative responses and a binary indicator of whether children in the household experienced very low food security based on ≥5 affirmative responses.

Statistical Analysis

We conducted multivariate logistic regression analysis to estimate the association between SNAP (6-month or new-entrant household) and children's food security. The regression models included the following set of explanatory variables (Table 2): gender, race, ethnicity, highest grade completed, employment status, and depression status of the household head[42]; household income-to-poverty ratio (based on the sum of earned and unearned income), size, and composition; age of the oldest child in the household; previous SNAP participation status; current participation in federal or state programs; changes in household size, housing status, employment, pay, or hours worked in the past 6 months (either job loss or gain and either increase or decrease in pay or hours worked); region of residence; state 25th percentile wage and state (nonseasonally adjusted) unemployment rate; and variables indicating whether the state offers broad-based categorical eligibility[43] to SNAP participants and the average SNAP certification period.[22]

TABLE 1 Questions Used to Assess the Food Security of Households

1. "We worried whether our food would run out before we got money to buy more." Was that often true, sometimes true, or never true for your household in the last 30 days?
2. "The food that we bought just didn't last, and we didn't have money to get more." Was that often, sometimes, or never true for your household in the last 30 days?
3. "We couldn't afford to eat balanced meals." Was that often true, sometimes true, or never true for your household in the last 30 days?
4. In the last 30 days, did you or other adults in your household ever cut the size of your meals or skip meals because there wasn't enough money for food? (Yes/No)
5. (If yes to Question 4) How many days did this happen in the last 30 days? Do you think it was more than 1 or 2 days?
6. In the last 30 days, did you ever eat less than you felt you should because there wasn't enough money for food? (Yes/No)
7. In the last 30 days, were you ever hungry but didn't eat because there wasn't enough money for food? (Yes/No)
8. In the last 30 days, did you lose weight because there wasn't enough money for food? (Yes/No)
9. In the last 30 days, did you or other adults in your household ever not eat for a whole day because there wasn't enough money for food? (Yes/No)
10. (If yes to Question 9) How many times did this happen in the last 30 days? Do you think it was more than 1 or 2 days?

Questions 11–18 were asked only if the household included children age 0–17

11. "We relied on only a few kinds of low-cost food to feed our children because we were running out of money to buy food." Was that often, sometimes, or never true for you in the last 30 days?
12. "We couldn't feed our children a balanced meal, because we couldn't afford that." Was that often, sometimes, or never true for you in the last 30 days?
13. "The children were not eating enough because we just couldn't afford enough food." Was that often, sometimes, or never true for you in the last 30 days?
14. In the last 30 days, did you ever cut the size of any of the children's meals because there wasn't enough money for food? (Yes/No)
15. In the last 30 days, did any of the children ever skip a meal because there wasn't enough money for food? (Yes/No)
16. (If yes to Question 15) How many days did this happen in the last 30 days? Do you think it was more than 1 or 2 days?
17. In the last 30 days, were the children ever hungry but you just couldn't afford more food? (Yes/No)
18. In the last 30 days, did any of the children ever not eat for a whole day because there wasn't enough money for food? (Yes/No)

SNAPFS Survey 2012. Coding of Responses: Questions 1–3 and 11–13 are coded as affirmative (ie, possibly indicating food insecurity) if the response is "often" or "sometimes." Questions 5, 10, and 16 are coded as affirmative if the response is "almost every day" or "some days but not every day." The remaining questions are coded as affirmative if the response is "yes." Household food security status is determined using responses to either questions 1–10 or questions 1–18. In this article, the food security status of children in the household is assessed by responses to the child-referenced questions, 11–18. Households reporting ≥2 of these conditions are classified as having food insecurity among children. Households reporting ≥5 are classified as having very low food security among children.

We performed sensitivity analyses to test whether the findings are robust to decisions regarding functional form, variable inclusion, and sample restrictions. This includes fixed-effects estimation, which is designed to account for time-invariant differences across households. This can reduce the chances of having omitted variable bias caused by correlations between an unobserved household factor that is constant over time and both SNAP participation and food security. It also included testing whether attrition bias might have affected the results by using the full set of new-entrant households rather than the restricted sample.

SEs were estimated by using a variance estimator based on a first-order Taylor series approximation. We accounted for the complex survey design of the SNAPFS survey when estimating SEs by using Stata 12.1's "svy" commands (Stata Corp, College Station, TX). All statistical tests were 2-sided.

RESULTS

Table 2 displays characteristics of the samples included in the analysis. In the cross-sectional sample, compared with new-entrant households, 6-month households were more likely to receive Temporary Assistance for Needy Families (TANF), to have conducted their interview in English, and to be employed and were less likely to be Hispanic, to report being depressed, and, in the past 6 months, to have experienced a change in household size, been evicted from their house/apartment, or experienced a change in employment, pay, or hours worked. Six-month households also had higher income (expressed as a percentage of poverty) than did new-entrant households. Comparisons in the longitudinal sample were similar to those in the cross-sectional sample.

Table 3 provides basic data on the prevalence of food insecurity, before any multivariate adjustments. The prevalence of food insecurity and very low food security was lower among 6-month households than among new-entrant households. In the cross-sectional sample, the percentage of households in which children were food insecure was 37.2% for new-entrant households and 27.1% for 6-month households: a −10.0 percentage point difference. Similarly, in the longitudinal sample, the percentages were 37.2% and 24.7%, respectively: a −12.4 percentage point difference. The prevalence of very low food security was 6.7% among new-entrant households and was 4.0% and 4.7% among 6-month households in the cross-sectional and longitudinal samples, respectively.

Table 4 presents the findings from the logistic regression analyses. Participating in SNAP for 6 months was associated with a lower likelihood of child food insecurity in both the cross-sectional and longitudinal analyses. The odds ratio (OR) of children experiencing food insecurity was 0.64 in the cross-sectional sample; this indicates that after controlling for other possible confounders, children in households that had participated in SNAP for 6 months were 36% less likely to be food insecure (OR: 0.64; confidence interval [CI]: 0.52–0.77). In the longitudinal sample, children in 6-month households were 38% less likely to be food insecure (OR: 0.62; CI: 0.52–0.73).

TABLE 2 Descriptive Characteristics of New-Entrant and 6-Month Households With Children

	Cross-Sectional Estimates[a]			Longitudinal Estimates[b]		
	New-Entrant Households	6-Month Households	*P* of Difference	New-Entrant Households	6-Month Households	*P* of Difference
Household head is female, %	83.2	82.4	.66	83.2	83.0	.90
Race and ethnicity of household head, %						
Non-Hispanic white	37.7	43.2	.06	37.7	36.8	.91
Non-Hispanic African American	24.8	24.6	—	24.8	24.8	—
Non-Hispanic other	6.3	7.7	—	6.3	6.1	—
Hispanic	34.7	29.1	—	34.7	35.6	—
Age of household head, %						
18–24	23.8	23.5	.65	23.8	23.2	.62
25–49	66.8	68.3	—	66.8	68.3	—
50–64	8.2	7.1	—	8.2	7.4	—
≥65	1.3	1.1	—	1.3	1.1	—
Mean age of oldest child	8.6	8.4	.99	8.6	8.2	.98
Highest grade completed, %						
Less than high school	23.3	22.6	.75	23.3	24.0	.79
High school	29.9	28.9	—	29.9	29.9	—
Some college	38.8	41.5	—	38.8	39.0	—
College and beyond	8.0	7.0	—	8.0	7.1	—
Employment status of household head, %						
Not employed	70.8	63.9	.008	70.8	64.5	<.001
Employed full-time	9.4	10.4	—	9.4	9.6	—
Employed part-time	19.8	25.7	—	19.8	25.8	—
Household head felt depressed in past 30 d,[c] %	77.1	73.1	.03	77.1	66.3	<.001
Interview conducted in English language, %	84.0	87.9	.07	84.0	83.8	.90
Mean monthly income as a percentage of the federal poverty level	63.0	71.7	.008	63.0	72.4	.003
Mean household size	3.5	3.6	.99	3.5	3.5	.99
Household contains children, %	100.0	100.0	—	100.0	100.0	—
Household contains elderly, %	3.7	3.6	.93	3.7	3.5	.82
Household contains disabled person, %	19.2	20.6	.38	19.2	14.1	.004
Participated in SNAP before current spell, %	56.2	53.8	.26	56.2	56.3	.97
Participation in federal or state programs, %						
TANF	5.5	9.5	<.001	5.5	8.9	.003
Welfare	2.2	2.9	.42	2.2	2.6	.65
SSI	6.6	6.9	.82	6.6	6.5	.88
Unemployment compensation	10.0	10.7	.64	10.0	10.7	.74
Experienced trigger events in past 6 months, %						
Change in household size	25.1	17.5	<.001	25.1	13.6	<.001
Eviction	3.8	2.0	.03	3.8	2.7	.17
Change in employment, pay, or hours worked	44.2	32.7	<.001	44.2	25.6	<.001
Region of residence, %						
Northeast	11.0	10.3	<.001	11.0	11.0	.99
Mid-Atlantic	5.7	13.0	—	5.7	5.7	—
Midwest	22.3	13.6	—	22.3	22.3	—
Southeast	12.5	13.6	—	12.5	12.5	—
Southwest	5.7	6.3	—	5.7	5.7	—
Mountain Plains	12.1	17.1	—	12.1	12.1	—
Western	30.7	26.1	—	30.7	30.7	—
Mean state 25th percentile wage	10.8	10.8	.99	10.8	10.8	.99
Mean state unemployment rate	8.9	8.5	.99	8.9	8.9	.99
State offers BBCE,[d] %	89.9	88.4	.85	89.9	89.8	.99
Mean state SNAP certification period[e]	12.1	12.2	.99	12.1	12.1	.99

Data were derived from SNAPFS Survey 2012. BBCE, broad-based categorical eligibility; SSI, Supplemental Security Income.

[a] The cross-sectional estimates compare new SNAP participants with a contemporaneous set of participants who have received SNAP for ∼6 months. Cross-sectional estimates are based on a data set with 2717 households with children (1195 new-entrant households with children interviewed at both baseline and 6-month follow-up and 1522 6-month households with children interviewed at baseline). The original sample of new-entrant households with children was restricted to the 1195 households with children that also completed a follow-up interview 6 months later to improve the comparability between the new-entrant and 6-month households.

[b] The longitudinal estimates compare new SNAP participants with the same participants ∼6 months later. Longitudinal estimates are based on the 1195 new-entrant households with children and a comparison of their circumstances at baseline and again at follow-up 6 months later. The original sample of new-entrant households with children was restricted to the 1195 households with children that also completed a follow-up interview 6 months later to improve the comparability between the new-entrant and 6-month households.

[c] Broad-based categorical eligibility refers to noncash TANF- or state maintenance of effort-funded benefits or services that confer categorical eligibility to virtually all households applying for SNAP.

[d] Depression was measured by using the (Kessler) K6 screening scale.

[e] SNAP participants are required to periodically be recertified to continue to receive benefits. The certification period varies with the likelihood of a change in a SNAP household's financial circumstances. In fiscal year 2011, SNAP households were certified for benefits for an average of 12 months.

TABLE 3 Descriptive Tabulation of Child Food Security Status in 6-Month and New-Entrant SNAP Households With Children

	Cross-Sectional Tabulations[a]				Longitudinal Tabulations[b]			
	Percentage of New-Entrant Households (Baseline)	Percentage of 6-Month Households	Difference	*P* of Difference	Percentage of New-Entrant Households (Baseline)	Percentage of New-Entrant Households (6-Mo Follow-Up)	Difference	*P* of Difference
Food Secure	62.9	72.9	10.0	<.001	62.9	75.3	12.4	<.001
Food Insecure	37.2	27.1	−10.0	<.001	37.2	24.7	−12.4	<.001
Food insecure with low food security	30.4	23.2	−7.3	<.001	30.4	20.0	−10.4	<.001
Food insecure with very low food security	6.7	4.0	−2.8	.007	6.7	4.7	−2.0	.02

Data were derived from SNAPFS Survey 2012.

[a] The cross-sectional estimates compare new SNAP participants with a contemporaneous set of participants who have received SNAP for ∼6 months. Cross-sectional estimates are based on a data set with 2717 households with children (1195 new-entrant households with children interviewed at both baseline and 6-month follow-up and 1522 6-month households with children interviewed at baseline). The original sample of new-entrant households with children was restricted to the 1195 households with children that also completed a follow-up interview 6 months later to improve the comparability between the new-entrant and 6-month households.

[b] The longitudinal estimates compare new SNAP participants with the same participants ∼6 months later. Longitudinal estimates are based on the 1195 new-entrant households with children and a comparison of their circumstances at baseline and again at follow-up 6 months later. The original sample of new-entrant households with children was restricted to the 1195 households with children that also completed a follow-up interview 6 months later to improve the comparability between the new-entrant and 6-month households.

The evidence was mixed regarding whether SNAP was associated with a decrease in child very low food security (Table 4). In the cross-sectional analysis, children in households that had participated in SNAP for 6 months were 52% less likely to experience very low food security (OR: 0.48; CI: 0.20–0.76). Although the association was also negative in the longitudinal analysis, it was not statistically significant (OR: 0.85; CI: 0.49–1.21).

Most findings were qualitatively robust to different empirical specifications (Table 5). In the longitudinal analysis of food insecurity, for example, this included (1) using a more parsimonious set of explanatory variables (OR: 0.57; CI: 0.50–0.65), (2) using the full set of new-entrant households rather than the restricted sample of households (OR: 0.62; CI: 0.49–0.74), (3) including household fixed effects (OR: 0.63; CI: 0.55–0.70), and (4) clustering SEs at the household level (OR: 0.64; CI: 0.50–0.76). The findings were also robust for the cross-sectional analyses of food insecurity and very low food security (Table 5). Unlike in the main specification, several of the sensitivity analyses for very low food security showed statistically significant associations in the longitudinal analysis.

As an additional robustness check, we examined the sensitivity of the findings to the amount of time between new-entrant households receiving SNAP benefits and the interview date. One objective in conducting the telephone survey with new entrants was to minimize the time from program entry to the baseline interview so that the food security responses pertained to the time period before entry into SNAP. Our assumption was that the sooner after SNAP certification a household was interviewed, the less likely it would be that the household had adjusted its food purchasing and consumption behavior based on its SNAP allotment. Sixteen percent of new-entrant households were interviewed before receiving SNAP benefits, 13% within 5 days of receiving their SNAP benefits, 23% within 6 to 10 days, 24% within 11 to 15 days, 13% within 16 to 20 days, and 11% within at least 21 days. To examine the sensitivity of the findings to the amount of time since benefit receipt, we categorized new-entrant households into 2 groups based on whether the household had received benefits before the interview and re-estimated the models. The findings were robust to when new-entrant households were interviewed relative to when they received their SNAP benefit (Table 5). There was some tendency for the households interviewed before receiving benefits or within a short time of receiving benefits to have slightly stronger associations between SNAP and child food security. This was also true for very low food security in the longitudinal analysis.

We also examined whether large-benefit households experienced a larger improvement in child food security than small-benefit households (Table 5). This was true only in the cross-sectional sample.

DISCUSSION

The results suggest that SNAP participation is associated with a reduction in child food insecurity in the cross-sectional and longitudinal samples and a reduction in very low food security in the cross-sectional sample. The association with very low food security in the longitudinal sample was not statistically significant.

Considered from the perspective of the past literature, it is difficult to compare our estimates to those from other studies because, to the best of our knowledge, there are no multivariate analyses of the association between SNAP participation and child food security. There is a growing

TABLE 4 Associations Between Child Food Insecurity or Child Very Low Food Security and Participating in SNAP for 6 Months

	Cross-Sectional Estimates[a]			Longitudinal Estimates[b]		
	OR[c]	95% CI	*P*	OR[c]	95% CI	*P*
Food insecurity	0.64	(0.52–0.77)	<.001	0.62	(0.52–0.73)	<.001
Very low food security	0.48	(0.20–0.76)	<.001	0.85	(0.49–1.21)	.41

Data were derived from SNAPFS Survey 2012.

[a] The cross-sectional estimates compare new SNAP participants with a contemporaneous set of participants who have received SNAP for ∼6 months. Cross-sectional estimates are based on a data set with 2717 households with children (1195 new-entrant households with children interviewed at both baseline and 6-month follow-up and 1522 6-month households with children interviewed at baseline). The original sample of new-entrant households with children was restricted to the 1195 households with children that also completed a follow-up interview 6 months later to improve the comparability between the new-entrant and 6-month households.

[b] The longitudinal estimates compare new SNAP participants with the same participants ∼6 months later. Longitudinal estimates are based on the 1195 new-entrant households with children and a comparison of their circumstances at baseline and again at follow-up 6 months later. The original sample of new-entrant households with children was restricted to the 1195 households with children that also completed a follow-up interview 6 months later to improve the comparability between the new-entrant and 6-month households.

[d] The ORs are adjusted for gender, race, ethnicity, highest grade completed, employment status, and depression status of the household head; household income-to-poverty ratio, size, and composition; age of the oldest child in the household; previous SNAP participation status; current participation in federal or state programs; changes in household size, housing status, employment, pay, or hours worked; region of residence; state 25th percentile wage and state (nonseasonally adjusted) unemployment rate; and variables indicating whether the state offers broad-based categorical eligibility to SNAP participants and the average SNAP certification period.

body of literature on the effects of SNAP on household food security, however. As reviewed earlier, parts of the past literature have failed to find an association, or even found positive associations between SNAP and food insecurity.[27–31] Compared with these studies, our analysis suggests that SNAP is associated with substantial improvements in food security for children. Several studies also have found that SNAP is associated with reductions in household food insecurity, which concurs with the findings in this study for child food security.[23,32–39]

SNAP reduces child food insecurity by providing benefits to low-income households to purchase food. The average monthly benefit for households with children was $413 in 2011.[22] Receiving the benefit has been shown to be only part of the pathway through which SNAP reduces food insecurity. Recent qualitative research has shown that SNAP households that are food secure, compared with those that are food insecure, are more likely to rely on family networks for financial help and meal provision, shop at multiple stores to obtain the lowest prices, and only buy certain foods such as meat when it is on sale.[44]

The main policy implication of the current study is that SNAP plays a vital role in the overall low-income safety net. Ensuring that benefits remain robust and that SNAP public outreach efforts continue are of great importance. From a clinical perspective, it is important that pediatric practices and other public and private agencies be alert to signs of food insecurity among the children they serve and provide information to low-income families about how to apply for SNAP.

There are several limitations of the study design. By comparing 6-month participants with those that just entered SNAP, our evaluation design reduces the extent of selection bias present when comparing participants with nonparticipants. However, measuring child food security immediately before SNAP entry may capture households' lowest point, typically measured over a year, in terms of economic resources (often referred to as Ashenfelter's dip or the preprogram dip).[45,46] If some of these households rebound quickly, then we may be overestimating the association between SNAP and improved child food security. We addressed this, at least in part, by including measures of changes over time in employment, income, housing, and household size and composition, even in the cross-sectional analysis, using variables that ask about changes in these measures over the past 6 months. Furthermore, by focusing on households that have participated in SNAP for 6 months, the design inherently excludes children in households that rebounded quickly from the pre-SNAP "dip" in economic circumstances and exited SNAP only a few months after entering.

Another limitation is the potential bias from not interviewing all new-entrant households before they received their first benefit allotment. However, although the magnitudes of the associations differed depending on whether households received SNAP benefits, the overall finding that SNAP is associated with an improvement in children's food insecurity was robust to when households received benefits in relation to the interview date.

A third limitation of the design is the remaining possibility of selection bias. We have sought to address this issue by using a carefully developed nonrandom design that seeks to control for observable differences between SNAP new entrants and ongoing participants. However, there remains some risk that observed associations of variables could be due to differences across households that are not observable. To address this, we estimated an alternative model based on household fixed effects. Our findings were robust to the inclusion of fixed effects. Future research may be able to identify and control for other differences between new-entrant and extant SNAP households through random assignment, using a richer set of explanatory variables in the model, such as information about household coping strategies related to food purchasing, and conducting interviews of SNAP leavers to learn why they left and how their food security changed.

TABLE 5 Associations Between Child Food Insecurity or Child Very Low Food Insecurity and Participating in SNAP for 6 Months, by Alternative Model Specifications, Number of Days Since SNAP Benefit Receipt for New-Entrant Households, and SNAP Benefit Amount

	Cross-Sectional Estimates[a,b]			Longitudinal Estimates[b,c]		
	OR	95% CI	*P*	OR	95% CI	*P*
Food insecurity						
Main specification	0.64	0.52–0.77	<.001	0.62	0.52–0.73	<.001
Alternative model specification or sample						
Smaller set of explanatory variables[d]	0.60	0.50–0.70	<.001	0.57	0.50–0.65	<.001
Unrestricted sample that includes all new-entrant households	0.68	0.54–0.82	<.001	0.62	0.49–0.74	<.001
Fixed effects included in the longitudinal analysis	—	—	—	0.63	0.55–0.70	<.001
SEs clustered at household level	—	—	—	0.64	0.50–0.76	<.001
Time since benefit subsamples[e]						
New-entrant households that had not received benefits before interview	0.59	0.33–0.85	.002	0.53	0.27–0.79	<.001
New-entrant households that had received benefits before interview	0.65	0.52–0.78	<.001	0.64	0.53–0.75	<.001
SNAP benefit amount as percentage of the maximum SNAP benefit[f]						
Small	0.83	0.65–1.00	.05	0.60	0.46–0.74	<.001
Large	0.50	0.34–0.67	<.001	0.62	0.45–0.80	<.001
Very low food security						
Main specification	0.48	0.20–0.76	<.001	0.85	0.49–1.21	.41
Alternative model specification or sample						
Smaller set of explanatory variables[d]	0.49	0.26–0.72	<.001	0.73	0.44–1.02	.07
Unrestricted sample that includes all new-entrant households	0.51	0.31–0.72	<.001	0.77	0.50–1.04	.09
Fixed effects included in the longitudinal analysis	—	—	—	0.78	0.50–1.06	.13
SEs clustered at household level	—	—	—	0.84	0.51–1.17	.33
Time since benefit subsamples[e]						
New-entrant households that had not received benefits before interview	0.40	0.12–0.68	<.001	0.52	0.16–0.87	.008
New-entrant households that had received benefits before interview	0.49	0.19–0.78	<.001	0.88	0.51–1.25	.52
SNAP benefit amount as percentage of the maximum SNAP benefit[f]						
Small	0.60	0.21–0.99	.04	0.90	0.42–1.37	.67
Large	0.20	−0.02 to 0.41	<.001	0.83	0.09–1.56	.64

Data were derived from SNAPFS Survey 2012.

[a] The cross-sectional estimates compare new SNAP participants with a contemporaneous set of participants who have received SNAP for ∼6 months. Cross-sectional estimates are based on a data set with 2717 households with children (1195 new-entrant households with children interviewed at both baseline and 6-month follow-up and 1522 6-month households with children interviewed at baseline). The original sample of new-entrant households with children was restricted to the 1195 households with children that also completed a follow-up interview 6 months later to improve the comparability between the new-entrant and 6-month households.

[b] The ORs are adjusted for: gender, race, ethnicity, highest grade completed, employment status, and depression status of the household head; household income-to-poverty ratio, size, and composition; age of the oldest child in the household; previous SNAP participation status; current participation in federal or state programs; changes in household size, housing status, employment, pay, or hours worked; region of residence; state 25th percentile wage and state (nonseasonally adjusted) unemployment rate; and variables indicating whether the state offers broad-based categorical eligibility to SNAP participants and the average SNAP certification period.

[c] The longitudinal estimates compare new SNAP participants with the same participants ∼6 months later. Longitudinal estimates are based on the 1195 new-entrant households with children and a comparison of their circumstances at baseline and again at follow-up 6 months later. The original sample of new-entrant households with children was restricted to the 1195 households with children that also completed a follow-up interview 6 months later to improve the comparability between the new-entrant and 6-month households.

[d] The set of explanatory variables was limited to household size, composition, and income; region of residence; interview conducted in English; and previous SNAP participation.

[e] All samples use the original set of 6-month households. Only the sample of new-entrant households is restricted by days since benefit receipt.

[f] We computed the SNAP benefit for each household as a percentage of the maximum benefit (by household size) and divided the households into 2 equally sized groups. Small and large benefit groups correspond to households with benefits of 1 to <55% of the maximum and ≥55% of the maximum in the cross-sectional sample, and benefits of 1 to <54% of the maximum and ≥54% of the maximum in the longitudinal sample.

CONCLUSIONS

With its large sample size, carefully structured quasi-experimental research design, and robust and statistically significant findings, this study provides convincing evidence of the association between SNAP and improved child food security and the best estimate to date of the extent of the improvement. Given the growing body of research establishing associations between children's health and development and food security, this study's findings underscore the importance of SNAP in affecting children's current circumstances and future well-being.

Future studies should evaluate whether certain groups of children experience larger improvements in food security compared with other groups of children, to help policy makers identify the

most effective pathways through which SNAP affects child food security. Given that SNAP was associated with a reduction in, but not elimination of, food insecurity, additional research is also needed to identify the factors associated with child food insecurity among SNAP participants. In particular, there is value in examining how low-income households make their food purchase decisions, to determine the roles that SNAP benefits play in this process.[44] This includes obtaining more information on fluctuations in household expenses and income to understand how SNAP households reallocate scarce resources to meet obligations such as rent, utilities, transportation, and other basic needs; exploring family networks as a food coping strategy, including how nonstandard work arrangements and household structure affect food insecurity[47]; and understanding how household food purchase decisions relate to food security. Given that TANF participation increased after 6 months of participation in SNAP, examining how participation in multiple programs affects child food insecurity is useful. Finally, the mixed evidence of a reduction in child very low food security warrants additional research on whether SNAP is in fact reaching those most in need and, given the recent work examining the adequacy of SNAP benefit allotments,[48] whether allotments are sufficient to meet households' needs.

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