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Children's Food Security and USDA Child Nutrition Programs

Katherine Ralston, Katie Treen, Alisha Coleman-Jensen, and Joanne Guthrie

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Abstract

USDA's child nutrition programs (National School Lunch Program, School Breakfast Program, Summer Food Service Program, and Child and Adult Care Food Program) have as goals to improve food security and provide children with a regular source of nutritious meals. In this report, we present updated statistics on food insecurity among school-age children from the Food Security Supplement to the Current Population Survey for 2014 and 2015. We then summarize recent research on the effects of child nutrition programs on children's food security and diets and discuss recent developments in nutrition assistance for school-age children. Studies that account for the greater likelihood of participation in these programs among children from food-insecure households find that school meal programs reduce food insecurity among children. Child nutrition programs also contribute to diet quality and academic performance for children from low-income and food-insecure households.

Keywords: Children, food security, food insecurity, child nutrition, school meals, National School Lunch Program, School Breakfast Program, Summer Food Service Program, Child and Adult Care Food Program

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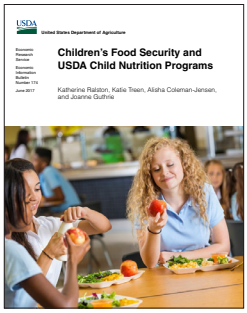

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Children's Food Security and USDA Child Nutrition Programs

Katherine Ralston, Katie Treen, Alisha Coleman-Jensen, and Joanne Guthrie

What Is the Issue?

Food insecurity among children has been associated with negative health, social, and academic outcomes. USDA school meal programs and other child nutrition programs are intended to improve food security. They do so both by augmenting overall household resources and by providing children with a regular source of nutritious meals. Understanding the role that school meal programs play in the dietary adequacy of children at risk for food insecurity is helpful for assessing program effectiveness.

Recent developments in food assistance for school-age children may provide additional protection against food insecurity. The Healthy, Hunger-Free Kids Act authorized the Child and Adult Care Food Program to offer afterschool suppers in all 50 States. The Act also established the Community Eligibility Provision as a new option to provide universal free meals under the National School Lunch Program and School Breakfast Program in schools in high poverty areas that lowers the administrative burden associated with household applications.

ERS monitors food security in U.S. households using data from the U.S. Census Bureau's Current Population Survey Food Security Supplement to classify the food security level of U.S. households. Food-insecure households are those reporting difficulty at some time during the year providing adequate, nutritious food for all their members due to a lack of resources. In this report, we present updated statistics on the prevalence of food insecurity among school-age children (ages 5-17) for 2014 and 2015. We then summarize the results of recently published research on the effects of school meal programs on children's food security and diets.

What Did the Study Find?

- In 2015, 16.6 percent of households with children were classified as food insecure (adults, children, or both were food insecure). Children were reported to be food insecure in 7.8 percent of all households with children.
- Among households with children and incomes below the Federal poverty line during the 2-year period 2014-15, 44 percent experienced food insecurity among any members and 23 percent experienced food insecurity among children specifically.

ERS is a primary source of economic research and analysis from the U.S. Department of Agriculture, providing timely information on economic and policy issues related to agriculture, food, the environment, and rural America.

- Food insecurity was more prevalent in households with older children than in households with younger children. Children were food insecure in 4.3 percent of households with only young children ages 0 to 4. Children were food insecure in 10 percent of households that included teenagers.
- Low-income food-insecure households with school-age children are more likely to participate in school meal programs than are low-income food-secure households with school-age children.
- Most studies of the National School Lunch Program, Summer Food Service Program, and Child and Adult Care Food Program found that the programs were associated with significantly lower rates of food insecurity for households with children, after accounting for assistance program eligibility and increased likelihood of food insecurity among low-income households. Effects of School Breakfast Program availability were significant for marginal food security but not for food insecurity.
- Studies also found that child nutrition programs improved diet quality and academic performance for children in low-income and food-insecure households.

How Was the Study Conducted?

This study includes updated statistics on food insecurity for households with children and a literature review of the effects of child nutrition programs on food insecurity. For background, we cite estimates of food insecurity for households with children and the prevalence of food insecurity among children, based on the 2015 Current Population Survey Food Security Supplement (CPS-FSS) and reported in the ERS report, *Household Food Security in the United States, 2015.* New statistics on food insecurity in households with school-age children combine data from 2014 and 2015 to produce a larger sample of households with school-age children and more reliable estimates of food insecurity. For all prevalence estimates, households were classified by food security status based on responses to questions on experiences of food inadequacy in the CPS-FSS. Measures of food insecurity included experiences over the past 12 months as well as the past 30 days before the December survey.

In reviewing studies of the effects of school meals on food insecurity and diet outcomes, we gave greater weight to studies that addressed selection bias with statistical techniques that account for the greater likelihood of program participation among children from food-insecure households.

Children's Food Security and USDA Child Nutrition Programs

Introduction

While most American children have adequate access to sufficient food, some do not. These children may experience deleterious educational and health outcomes related to being food insecure, and they may be particularly reliant on USDA child nutrition programs that provide healthy meals and snacks at school, summer meal sites, and afterschool or childcare settings. Food insecurity is an economic and social condition that may result in hunger (a physiological condition) if it is severe or prolonged. Food-insecure households have difficulty at some time during the year providing adequate food for all their members due to a lack of resources. In 2015, 16.6 percent of U.S. households with children were food insecure (Coleman-Jensen et al., 2016).

The National School Lunch Program (NSLP), the largest of USDA's child nutrition programs, subsidizes school lunches for millions of America's children. Eligible children living in low-income households can receive meals at a free or reduced rate. School meals provide a reliable source of food and offer nutritious food to vulnerable children in food-insecure households. USDA's child nutrition programs also include the Summer Food Service Program (SFSP) and the Child and Adult Care Food Program (CACFP), which further assist low-income households with children through provision of meals and snacks.

Understanding the role that child nutrition programs play in the dietary adequacy of children at risk for food insecurity is helpful for assessing program effectiveness. In this report, we present updated statistics on food insecurity among households with children and synthesize previously published research on the effects of school meal and other child nutrition programs on food security and diets in households with children.

Food Insecurity Among Households With Children

Food-insecure households are defined as those households unable to acquire adequate food for one or more household members because of insufficient money and other resources for food. ERS uses data from the Current Population Survey Food Security Supplement (CPS-FSS) to estimate the prevalence of food insecurity among all U.S. households and among households with children. The FSS contains a list of questions about the household's experience of food adequacy, and household food security status is categorized based on the number of affirmative responses (see box, "How Is Food Security Measured in Households With Children?").

In 2015, 83.4 percent of U.S. households with children were *food secure* throughout the year (figure 1). The remaining 16.6 percent of households with children (6.5 million households) were *food insecure* at some time during the year. This level represents a decline from the 2009 peak (21.3 percent), but remains higher than in 2007 (15.8 percent) before the full effects of the recession (Coleman-Jensen et al., 2016).

How Is Food Insecurity Measured in Households With Children?

Food insecurity is measured in a nationally representative survey using a series of survey questions about conditions and behaviors that characterize households when they are having difficulty meeting basic food needs. The Food Security Supplement (FSS) is part of the monthly Current Population Survey (CPS) conducted by the U.S. Census Bureau in December each year and sponsored by USDA's Economic Research Service. In addition to questions on food expenditures and participation in food assistance programs, the FSS includes 18 questions on food insecurity:

- Three questions about food conditions of the household as a whole,
- Seven questions about food conditions of adults in the household, and
- Eight questions about children's food conditions, in households with children.

Each question asks whether the condition or behavior occurred at any time during the previous 12 months and specifies a lack of money and other resources to obtain food as the reason.

Households are classified as having *high food security* if the respondent gives no affirmative answers. If the respondent gives one or two affirmative responses, the household is classified as having *marginal food security.* Households are classified as *food insecure* if they report 3 or more affirmative responses to the entire set of 18 questions. Food-insecure households are further classified as having either low food security or very low food security. Households without children are classified as having very low food security if they report six or more food-insecure conditions. Households with children age 0-17 are classified as having very low food security if they report eight or more food-insecure conditions among adults and/or children.

—continued

How Is Food Insecurity Measured in Households With Children? (continued)

The food security status of children in the household is determined by responses to the last eight questions, which reference children specifically. Households providing affirmative responses to two or more of these questions are classified as having *food insecurity among children*. Households with five or more affirmative responses to questions about children's food security are classified as having *very low food security among children*.

USDA definitions of food security for households with children

USDA designation	USDA definition	Number of affirmative responses to food security questions
Household food security status		
High food security	No reported indications of food-access problems or limitations.	0 of 18
Marginal food security	Few reported indications—typically of anxiety over food sufficiency or shortage of food in the house. Little or no indication of changes in diets or food intake.	1 or 2 of 18
Low food security	Reports of reduced quality, variety, or desirability of diet. Little or no indication of reduced food intake.	3 – 7 of 18
Very low food security	Reports of multiple indications of disrupted eating patterns, such as skipping meals, and reduced food intake.	8 or more of 18
Child food security status		
Food insecurity among children	Caregivers report that one or more child in the household lacked adequate, nutritious food at times during the year.	2 or more of 8
Very low food security among children	Caregivers reported that children were hungry, skipped a meal, or did not eat for a whole day because there was not enough money for food.	5 or more of 8

Questions Used To Assess the Food Security of Households in USDA's Annual Food Security Survey:

1. "We worried whether our food would run out before we got money to buy more." Was that often, sometimes, or never true for you in the last 12 months?
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 you in the last 12 months?
3. "We couldn't afford to eat balanced meals." Was that often, sometimes, or never true for you in the last 12 months?
4. In the last 12 months, did you or other adults in the 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 often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?

—continued

How Is Food Insecurity Measured in Households With Children? (continued)

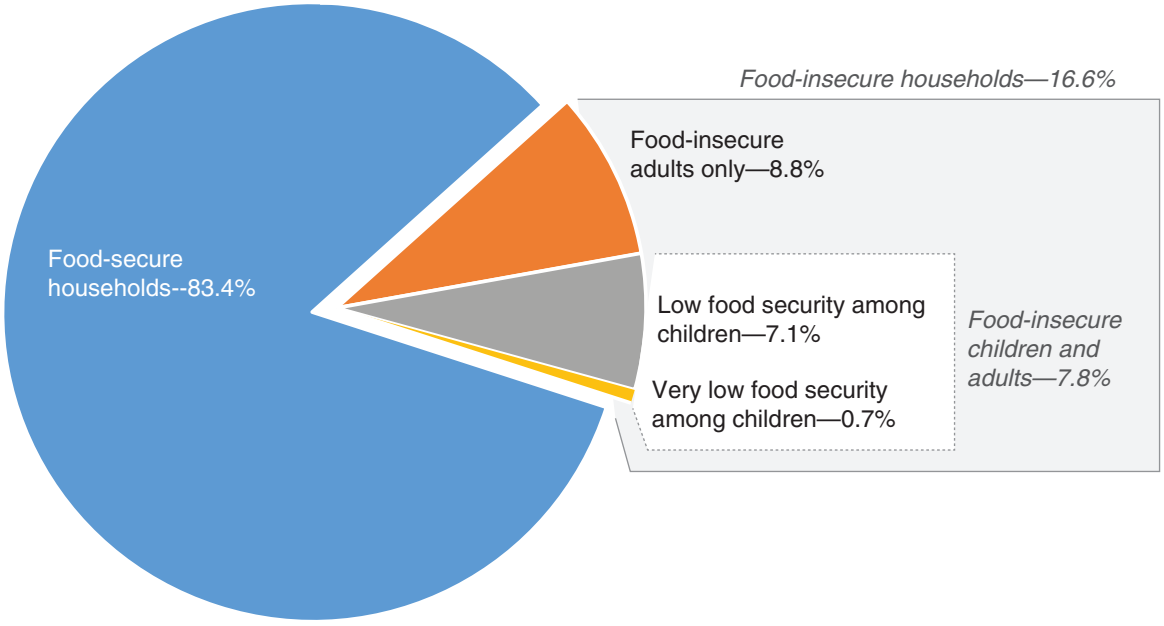
6. In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food? (Yes/No)
7. In the last 12 months, were you ever hungry, but didn't eat, because there wasn't enough money for food? (Yes/No)
8. In the last 12 months, did you lose weight because there wasn't enough money for food? (Yes/No)
9. In the last 12 months, 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 often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?

(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 12 months?
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 12 months?
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 12 months?
14. In the last 12 months, 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 12 months, were the children ever hungry but you just couldn't afford more food? (Yes/No)
16. In the last 12 months, did any of the children ever skip a meal because there wasn't enough money for food? (Yes/No)
17. (If yes to question 16) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?
18. In the last 12 months did any of the children ever not eat for a whole day because there wasn't enough money for food? (Yes/No)

Source: USDA, Economic Research Service. For more information on household food security measurement see: http://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/measurement.aspx. For more information on food insecurity among children, see Coleman-Jensen et al., 2013.

Figure 1
U.S. households with children by food security status of adults and children, 2015



Source: USDA, Economic Research Service using data from U.S. Department of Commerce, U.S. Census Bureau, 2015 Current Population Survey Food Security Supplement.

Food insecurity in households with children can be further differentiated by whether it affected the dietary intake of adults only or adults and children, and by the severity of food insecurity experienced. Parents and guardians try to shield children from experiencing food insecurity to the extent possible, and they are often able to maintain adequate food intake and normal meal patterns for their children even when parents themselves experience food insecurity.[1] In approximately half of the 16.6 percent of food-insecure households with children in 2015, only adults were food insecure (8.8 percent of all households with children). In the remaining 3 million food-insecure households with children (7.8 percent of all U.S. households with children), both adults and children were food-insecure (figure 1). In 0.7 percent of households with children (274,000 households), food insecurity among children was so severe that caregivers reported that children were hungry, skipped a meal, or did not eat for a whole day because there was not enough money for food. This most severe category of food insecurity measured by USDA is described as very low food security among children (for more information on how food insecurity is measured in households with children, see Coleman-Jensen et al., 2013).

[1] For example, Nord (2013) showed that adolescents were less likely to be food insecure than adults in the same household based on self-reported food security status of both adults and adolescents. The youth-adult gap in the likelihood of food insecurity was greater when food insecurity among adults was more severe. Qualitative studies also find that parents indicate they try to protect their children from food insecurity (Fram et al., 2014). However, both qualitative and quantitative research finds that adolescent self-reported food insecurity and adult-reported food insecurity of adolescents sometimes do not match and that parents are not always aware of food insecurity among children (Fram et al., 2014; Nord and Hanson, 2012). Further, adolescents sometimes take an active role in trying to reduce household food insecurity and/or protect their younger siblings from experiencing food insecurity (Fram et al., 2014) and are aware of parental attempts to shield them from food insecurity (Connell et al., 2005).

Food Insecurity More Prevalent for Lower Income Households and for Households With Older Children

Because food insecurity is related to a lack of economic resources, food insecurity is more common in low-income households. Table 1 shows the prevalence of food insecurity by income group among households with children, both at the household level—which could affect adults and children or only adults—and for children specifically. The table combines data from 2 years, 2014 and 2015, in order to produce a larger sample and more reliable estimates.

The 2014-15 food insecurity rate for all households with children was 17.9 percent, ranging from 43.9 percent for households with income below the Federal poverty level to 7.2 percent for households with income above 185 percent of the Federal poverty level. The subset of these households in which *children* were food insecure was smaller but followed a similar pattern by income group.

Table 1
Prevalence and distribution of food insecurity in households with school-age children, by selected household characteristics, 2014-15 average

Characteristic	Food-insecure households[1]		Households with food-insecure children[2]	
	Prevalence[3]	Share[4]	Prevalence[5]	Share[6]
	Percent			
All households with children	17.9	100	8.6	100
Annual household income[7]:				
Below Federal poverty line	43.9	39.4	23.0	43.2
100-130 percent of poverty line	35.2	9.8	15.7	9.1
131-185 percent of poverty line	29.1	16.2	13.7	15.9
Above 185 percent of poverty line	7.2	19.7	3.2	18.5
Income not reported	13.2	14.9	5.7	13.3
Age of oldest child in the household:				
0-4 years	14.5	14.7	4.3	9.2
5-8 years	18.4	19.6	8.1	18.0
9-12 years	18.5	22.0	9.3	23.2
13-15 years	19.4	24.1	10.3	26.7
16-17 years	18.1	19.6	10.2	22.9

[1] Food-insecure households are those with low or very low food security among adults or children or both in the past year.
[2] In some food-insecure households with children, only adults were food insecure. Households with food-insecure children are those with low or very low food security among children in the past year.
[3] Households with food insecurity among adults or children as a percentage of all households with the specified characteristic.
[4] Households with the specific characteristic and with food insecurity among adults or children as a percentage of all households with food insecurity among adults or children.
[5] Households with food insecurity among children as a percentage of all households with the specified characteristic.
[6] Households with the specific characteristic and with food insecurity among children as a percentage of all households with food insecurity among children.
[7] In 2015, the poverty line was $24,036 for a family of four.
Source: USDA, Economic Research Service calculations using data from the December 2014 and December 2015 Current Population Survey Food Security Supplements.

About one-quarter of households with income below the Federal poverty level reported food insecurity among children, compared to 3 percent of households with income above 185 percent of poverty.

Food insecurity tends to be more prevalent in households with older children than in households with younger children.[2] In households with children below school age only (0 to 4 years), household food insecurity is less prevalent than in households with school-age children (5 to 17 years)—14.5 percent versus 18-19 percent (table 1). Similarly, the share of households with children that reported child food insecurity is 4.3 percent for households with children ages 0 to 4 and 10 percent for households with teenagers.

We also examined the prevalence of overall household food insecurity and food insecurity among children for low-income households (annual incomes less than 185 percent of the Federal poverty level) with school-age children (ages 5-17) participating in USDA food assistance programs. Table 2 reports food insecurity experienced in the 30 days before the survey (from mid-November to mid-December) by receipt of free or reduced-price school lunches through NSLP and participation in the Supplemental Nutrition Assistance Program (SNAP) in the 30 days before the survey. A 30-day reference period is used to ensure that measured food security status reflects current participation in nutrition assistance programs.[3]

Food insecurity in households with children is most prevalent among those low-income households participating in both SNAP and receiving free or reduced-price lunch (31.1 percent, table 2; see box, "USDA Child Nutrition Programs"). This reflects in part that those households most in need of food assistance are more likely to participate. An estimated 46 percent of low-income food-insecure households with children received assistance from SNAP and free or reduced-price lunches through NSLP. An estimated 10 percent of low-income food-insecure households with children did not participate in SNAP or receive free or reduced-price school lunch. Among those low-income households with children that did not participate in SNAP or receive free or reduced-price school lunches, 8.7 percent were food insecure.

School meal programs and other child nutrition programs may reduce child food insecurity because they provide additional food resources for children in households at risk for food insecurity. In addition to providing nutritious meals directly to children, these programs free up other household resources that can help to improve household food security. Households can purchase foods for home consumption or other expenses with the money saved by not having to purchase full price school meals or pack meals from home.[4]

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[2] The USDA food security measure asks about all children in the household, rather than individual children. As such, we cannot examine the food security of children of various ages. However, we can examine the food security status of different households based on the age of the oldest child in the households.

[3] Statistics from November and December may reflect additional food resources given to low-income households during the holiday season, or they could reflect a perception of greater food hardship. Thus, the estimates of food insecurity from those months could be different from that experienced at other times of the year. We focus here on the relationship between food insecurity and participation in food assistance programs.

[4] Bartfeld (2016) analyzed the contribution of the National School Lunch Program (NSLP) and School Breakfast Program (SBP) to total household resources by valuing school meals at the USDA reimbursement rates, finding that the programs supply an average of 8.5 percent of total resources—income plus food assistance—for the households of low-income participating children, and a much higher percentage for the lowest income households.

Table 2

Prevalence and distribution of food insecurity during the 30-day period ending in mid-December for low-income households[1] with school-age[2] children, by participation in SNAP and free or reduced-price school lunch, 2014-2015 average

Program participation	Households with food insecurity among adults or children[3]		Households with food insecurity among children (low or very low food security among children)[4]	
	Prevalence[5]	Share[6]	Prevalence[7]	Share[8]
	Percent			
All low-income households with school-age children[1,2]	21.1	100	10.2	100
Received SNAP[9] and free or reduced-price school lunch	31.1	45.8	16.2	46.5
Received SNAP[9] only	24.0	6.4	11.8	6.1
Received free or reduced-price school lunch only	23.5	37.7	11.8	36.7
Did not receive SNAP[9] or free or reduced-price school lunch	8.7	10.1	4.7	10.7

[1] Analysis was limited to households with annual incomes less than 185 percent of the Federal poverty level. Most households with incomes above that range were not asked whether they received benefits from food assistance programs. In 2015, the poverty threshold was $24,036 for a family of four.

[2] Analysis was limited to households with school-age children (ages 5-17).

[3] Food-insecure households are those with low or very low food security among adults or children or both in the past 30 days.

[4] In some food-insecure households with children, only adults were food insecure. Households with food-insecure children are those with low or very low food security among children in the past 30 days.

[5] Households with food insecurity among adults or children as a percentage of all households with the specified characteristic.

[6] Households with the specific characteristic and with food insecurity among adults or children as a percentage of all households with food insecurity among adults or children.

[7] Households with food insecurity among children as a percentage of all households with the specified characteristic.

[8] Households with the specific characteristic and with food insecurity among children as a percentage of all households with food insecurity among children.

[9] SNAP = Supplemental Nutrition Assistance Program.

Source: USDA, Economic Research Service calculations using data from the December 2014 and December 2015 Current Population Survey Food Security Supplements.

USDA Child Nutrition Programs

The **National School Lunch Program (NSLP)** provides nutritious lunches for school children and is the second largest federally assisted food assistance program. The program provides cash subsidies and donated foods (called USDA foods) to participating schools for each meal served. Over 100,000 public and nonprofit private schools serve lunches using the NSLP. NSLP served lunch to 30.5 million participants in fiscal year (FY) 2015. Approximately 73 percent, or 22 million participants, received free or reduced-price lunch in 2015 (USDA FNS, 2016a). Any child attending a school participating in NSLP can receive a lunch through the program at low or no cost. Students may be eligible for free or reduced-price meals if they participate in other assistance programs—such as the Supplemental Nutrition Assistance Program, Temporary Assistance for Needy Families, and the Food Distribution Program on Indian Reservations—or if they are categorized as migrants, homeless, or foster children. In addition, students may qualify based on the following income eligibility thresholds:

- **Free Meals:** Children from households with incomes at or below 130 percent of the Federal poverty level. For a family of four, this was $31,590 for the 2016-2017 school year.
- **Reduced-Price Meals:** Children from households with incomes between 130 percent and 185 percent of the Federal poverty level. For a family of four, 185 percent of the Federal poverty level amounted to $44,955 for the 2016-2017 school year.
- **Full Price Meals:** Children from households with incomes over 185 percent of the Federal poverty level pay the full price for their lunches, though their lunches are still subsidized to some extent. Local school food authorities set their own prices for full price (paid) meals but must operate as nonprofit programs.

The **School Breakfast Program (SBP)** provides a nutritious breakfast for school children. Approximately 14 million children participated in SBP daily in fiscal year 2015. As with the NSLP, children may qualify for free or reduced-price breakfast at school, based on the same Federal poverty guidelines described above. Schools receive cash subsidies and donated USDA foods depending on the number of meals served free, reduced price, or full price, and receive an additional "severe need" subsidy of up to 30 cents per breakfast if 40 percent or more of lunches served through NSLP are served free or at a reduced price 2 years prior.

The **Summer Food Service Program (SFSP**) provides children with nutritious meals when they are out of school for the summer. The program serves children under the age of 18 and persons over 18 with a disability. In July 2015, 2.6 million children participated in SFSP daily. Most often, SFSP sites operate in high-need areas where at least half of all children come from families with incomes at or below 185 percent of the Federal poverty level. Meals at these sites are served at no cost to all participants.

The **Child and Adult Care Food Program (CACFP)** provides meals for children enrolled in child care centers and day care homes, children in emergency shelters, and children participating in afterschool care programs. The program also serves adults enrolled in adult day care centers. Approximately 4.2 million children participated in CACFP daily in FY 2015.

Source: USDA FNS, 2016a; USDA FNS, 2016b.

Child Nutrition Programs Reduce Food Insecurity in Households with Children

The negative outcomes associated with food insecurity can be costly to individuals, families, schools, and society (see box, "Consequences of Food Insecurity for Children"). USDA's food and nutrition assistance programs aim to reduce food insecurity and improve outcomes for children at risk for food insecurity by providing food and in-kind assistance to those children and households that meet eligibility requirements. Most food-insecure households with children are eligible to participate in school meal programs, since about 85 percent of such households include a school-age child and 65 percent have incomes below 185 percent of the Federal poverty level. Further, participation in school meal programs is high among those eligible for free and reduced-price meals (Ralston and Newman, 2015).

The statistics in table 2 may seem to imply that household participation in nutrition assistance programs does not improve food security; however, low-income households that choose to participate in assistance programs are more likely to be food-insecure. Thus, a simple comparison of participants and nonparticipants may reflect what researchers call reverse causation due to selection bias, resulting from the self-selection of more vulnerable households into the group receiving food assistance.

Consequences of Food Insecurity for Children

Food insecurity is associated with negative health, developmental, and educational outcomes for children. A 2013 ERS report (Coleman-Jensen et al., 2013; pp. 11-12 and 39-48) summarized statistically significant findings linking food insecurity to numerous adverse outcomes among school-age children compared to their counterparts in food-secure households:

- Poorer parent-reported health of children and adolescents
- Lower bone mineral content in adolescent boys
- Impaired interpersonal relations, self-control, and approaches to learning in elementary school-age children
- Iron deficiency among children and adolescents
- Increased frequency of stomach aches, headaches, and colds in children and adolescents
- Poorer psychological function and psychosocial development among school-age children
- Higher rates of depressive disorder and suicidal symptoms among adolescents
- Higher rates of anxiety and depression among school-age children
- Increased frequency of chronic health conditions among children
- Increased withdrawal, anxiety, and other "internalizing" behaviors among children
- Slower progress in math and reading
- Higher likelihood of repeating a grade among children age 6-11

We reviewed 11 studies that examined the effectiveness of child nutrition programs in ameliorating food insecurity (described in appendix table 1). The studies rely on a variety of data sources, some of which use a different measure of food insecurity than used here (see box, "How Is Food Insecurity Measured in Households With Children?"). Some studies measured the association between program participation and food insecurity while others looked at program availability; this distinction was more relevant for programs other than NSLP, which is almost universally available. The studies also used different approaches to account for self-selection.

Almost all studies found that, after adjusting for selection bias, participation in or availability of child nutrition programs was significantly associated with lower rates of food insecurity for households with children. While this result is consistent with the expectation that adding to household resources would reduce food hardship, the strength of the study designs merits more weight than the number of studies finding one result or another.

National School Lunch Program. Five nationally representative studies examined the impact of participation in the NSLP on a household's food security status. Of these studies, four found that participation in NSLP was associated with a significant reduction in food insecurity (appendix table 2) using different definitions of participation and food insecurity (Arteaga and Heflin, 2014; Gundersen et al., 2012; Huang et al., 2015; Kabbani and Kmeid, 2005). One study (Ishdorj and Higgins, 2015) found an association between NSLP participation and food insecurity that was positive but not statistically distinguishable from zero.

While all five studies adjusted for selection bias, Huang's study—using several waves of the U.S. Census Bureau's Survey of Income and Program Participation—is the only one to use true longitudinal data, allowing the authors to capture changes in food security over time in response to changes in the availability of meals.[5] Because most schools are not open during the summer, NSLP is not available during these months. Many communities provide meals through the Summer Food Service Program (SFSP) or Seamless Summer Option (SSO),[6] but the availability of and participation in these programs is lower than for meals served during the school year, resulting in increased food insecurity during summer months. Huang modeled the changes over 10 months in food insufficiency, an indicator of food hardship, based on a single question[7] instead of the full 18-question food-security module. Food insufficiency increased in summer months for NSLP-participant households but not for income-eligible nonparticipants, who had lower and more stable rates of food insufficiency throughout the year.

The results imply that NSLP participation significantly reduces food insecurity among households with children, with three caveats. First, comparisons to other results are limited because Huang used a different measure of food hardship than some of the other studies. Second, part of the implied effect on food security should be partially attributed to the School Breakfast Program as well, since many low-income students participate in the SBP along with the NSLP and do not have access to either of these meals during the summer. Finally, Huang's analysis did not include whether children in the household received meals through SFSP or SSO during the summer; to the extent that

[5] The authors published a similar analysis of the same data with similar results (Huang et al., 2016).

[6] Under the Seamless Summer Option, school districts offer meals during the summer through the NSLP and SBP, at slightly different reimbursement rates than under the Summer Food Service Program.

[7] The food sufficiency question asks which statement best describes the household's food sufficiency experience. The measure is set equal to 1 if a household answered "sometimes not enough to eat" or "often not enough to eat."

low-income students participate in summer meals programs, Huang's estimate may underestimate the true effect of child nutrition programs since food insufficiency in the summer could be worse without those programs.

The other studies of the NSLP used cross-sectional data collected at a single point in time. Kabbani and Kmeid (2005) devised a time-related strategy to adjust for the fact that households with greater need are more likely to participate in NSLP. In that study, the authors used several waves of the Current Population Survey but restricted the sample to low-income households that experienced food insecurity in the previous 12 months, and then tested for an association between NSLP participation and food insecurity in the previous 30 days. Out of this restricted sample, households that participated in NSLP were significantly less likely to be food insecure during the prior 30 days, although (again) part of this effect should be attributed to participation in the SBP.

Arteaga and Heflin used data from the last wave of the Early Childhood Longitudinal Study - Birth Cohort (ECLS-B), collected in 2006 and 2007 as children in the survey entered kindergarten and gained access to NSLP. Because different States have different enrollment cutoff dates for when students must have reached their 5th birthday, the distance between the child's birthday and the cutoff date in the child's State is a variable that influences access to NSLP that is not under the household's control. The authors used that variable to predict NSLP participation and then used the predicted value of NSLP participation to estimate the effect on food insecurity in a two-equation approach. They found that NSLP participation at kindergarten entry was significantly associated with lower food insecurity. While the results do not generalize to children at different ages, they apply to an important developmental stage.

Gundersen and colleagues (2012) took a different approach to adjusting for selection bias and accounted for the misreporting of NSLP participation. The authors used data from the National Health and Nutrition Examination Survey for 2001-04 and explored how estimates of the relationship between participation and food insecurity are influenced by the imposition of plausible assumptions about the degree of participation misreporting and the expected direction of effects of participation on food insecurity. The imposition of these two assumptions together results in estimated effects on food insecurity that are beneficial and statistically significant. The authors justify the directional assumption by asserting that providing access to free meals would be expected to increase food consumption for the household and therefore affect food security only beneficially, if at all. While this assumption has some justification, it does not allow for the possibility that, for some reason, NSLP participation could actually increase food insecurity. While we include this study for completeness, we give greater weight to other studies that adjust for selection bias without imposing this assumption.

Ishdorj and Higgins (2015) used data from the third School Nutrition and Dietary Assessment (SNDA III), collected in school year 2004-05, and found that NSLP participation increased food insecurity, though the effect was not statistically significant. Like Arteaga and Heflin, Ishdorj and Higgins used a two-equation approach to adjust for the fact that households with greater need are more likely to participate in NSLP.[8] The authors used the time available to eat lunch as an instrumental variable that affects participation but is out of the household's control.

[8] In this case, residuals from the prediction equation rather than predicted values for NSLP participation were added to the equation for food insecurity.

Further analysis would be required to determine why the study by Ishdorj and Higgins finds an insignificant positive effect of NSLP participation on food insecurity, in contrast to the other studies that find a statistically significant negative effect (i.e., participation decreases food insecurity). Yet the weight of the evidence supports the conclusion that the NSLP reduces food insecurity in households with children, especially given the results of the strongest longitudinal study by Huang and colleagues.

School Breakfast Program (SBP). Four analyses examined the contribution of the SBP by itself on food insecurity and marginal food security—a less severe designation for households that answered affirmatively to one or two food hardship questions—either through participation in SBP or availability of the program (appendix table 1). The studies found evidence of beneficial effects of program availability, but not participation, and found stronger evidence of reductions in marginal food security than food insecurity (appendix table 2). Although SBP is now almost as universally available as NSLP, historically the gap has been wider.[9] Because program availability is not directly controlled by household decisions,[10] using program availability in analyses reduces the problem of selection bias for individual households. In a study of third graders in the Early Childhood Longitudinal Study-Kindergarten Cohort collected in 2002, Bartfeld and Ahn (2011) found a significant reduction in marginal food security associated with availability of SBP at the school, as well as a reduction in food insecurity that was not statistically significant. An analysis of the same data found that participation in SBP was significantly associated with higher food insecurity and marginal food security (Bartfeld et al., 2009), likely reflecting the more severe levels of need in households that choose to participate. The results from third graders are consistent with results from an analysis of the nationally representative Current Population Survey that used the ratio of State-level SBP participation to NSLP participation as a proxy for State-level availability and accessibility of the SBP (Bartfeld and Dunifon, 2006). That study also found lower food insecurity associated with higher availability of the SBP as reflected by the SBP/NSLP participation ratio, but the effect was also not significant.

Summer Food Service Program and Seamless Summer Option. Three studies provide insights into the role of summer meals that help fill the gap in food access when school is not in session. Two studies are national in scope, using data from the Current Population Survey (Bartfeld and Dunifon, 2006; Nord and Romig, 2006), while one uses data from the California Health Interview Survey (Miller, 2016). The studies all combined the two programs that provide meals during the summer in low-income communities, but used different measures of food insecurity and different measures of program availability or accessibility. All the studies found a significant beneficial effect of the summer programs (appendix table 2), though the California study found a significant effect on very low food security but not food insecurity.

Child and Adult Care Food Program (CACFP). Two studies examined the effect of the CACFP on food security, both using the Early Childhood Longitudinal Survey–Birth Cohort collected in 2005, but using different measures of food insecurity and different statistical techniques. Heflin and colleagues (2015) found that 4-year-olds enrolled with childcare providers that participated in the CACFP had significantly lower food insecurity than those with providers that did not. Korenman

[9] In school year 2013-14, 89,000 schools offered SBP compared to over 100,000 for NSLP (USDA FNS, 2013a, USDA FNS, 2013b). In 2001, 70,000 schools offered SBP (Bernstein et al., 2002).

[10] Because SBP is targeted to low-income school districts, household decisions about where to reside can affect program availability less directly. This effect is judged to be small relative to the selection bias from the effect of food insecurity on SBP participation decisions.

and colleagues (2012) also found a negative effect of the childcare provider's participation in CACFP on the household's food insecurity, but the effect was not statistically significant. The difference in the strength of the findings may reflect differences in statistical technique as well as a difference in the measure used to indicate food insecurity.[11]

[11] The studies also differed in the sample: while the samples were the same size, (rounded to nearest 50 as required by data use agreement), Korenman and colleagues limited the sample to children based in centers while Heflin and colleagues included children in non-center providers but limited the sample to children with providers who completed a provider interview.

Child Nutrition Programs Contribute to Diet Quality and Academic Performance

Several studies have examined the role of school meal programs in diet quality and academic performance. Potamites and Gordon (2010) used data from the third School Nutrition Dietary Assessment (SNDA III) collected in 2004-5 to examine the role of school meals in diets of students in food-insecure households, finding that school meals provided a higher proportion of daily calories (as well as all food groups and many nutrients) for students in food-insecure households compared to students from food-secure households. In some cases, the contribution of school meals for students in households with marginal food security was higher.

While comparisons by food security status have not been studied using more recent data, Cullen and Chen (2017) examined the role of school meals in the diets of children who ate both school breakfast and school lunch using the National Health and Examination Survey (NHANES) for 2007-2012. Since SBP participation is skewed toward lower income students, the Cullen/Chen sample is largely low income. During 2007-2012, students in the group obtained nearly half (47 percent) of their calories from school meals, while obtaining 77 percent of daily milk and 58 percent of daily fruit. The higher shares for these foods compared to that for calories as a whole suggests that the meals obtained at school contained more milk and fruit than meals eaten during the remainder of the day. These students obtained lower daily percentages from school meals for starchy vegetables (29 percent) but also dark green vegetables (43 percent) and lean proteins (38 percent), suggesting that school meals—as consumed—provided less of these foods than meals outside of school (figure 2).

These results are consistent with an earlier analysis using data from NHANES 2005-2010, which found NSLP contributing both positively and negatively to diet quality (Condon et al., 2015). NSLP participants receiving free or reduced-price lunch were found to consume fewer empty calories and more fiber, milk, fruit, and vegetables compared to income-eligible nonparticipants, both at lunch and during a full 24 hours, though participants also consumed less whole grains and more sodium.[12] NSLP participants in the study were also significantly more likely to have adequate usual intake of calcium, Vitamin A, and zinc than income-eligible non-participants.

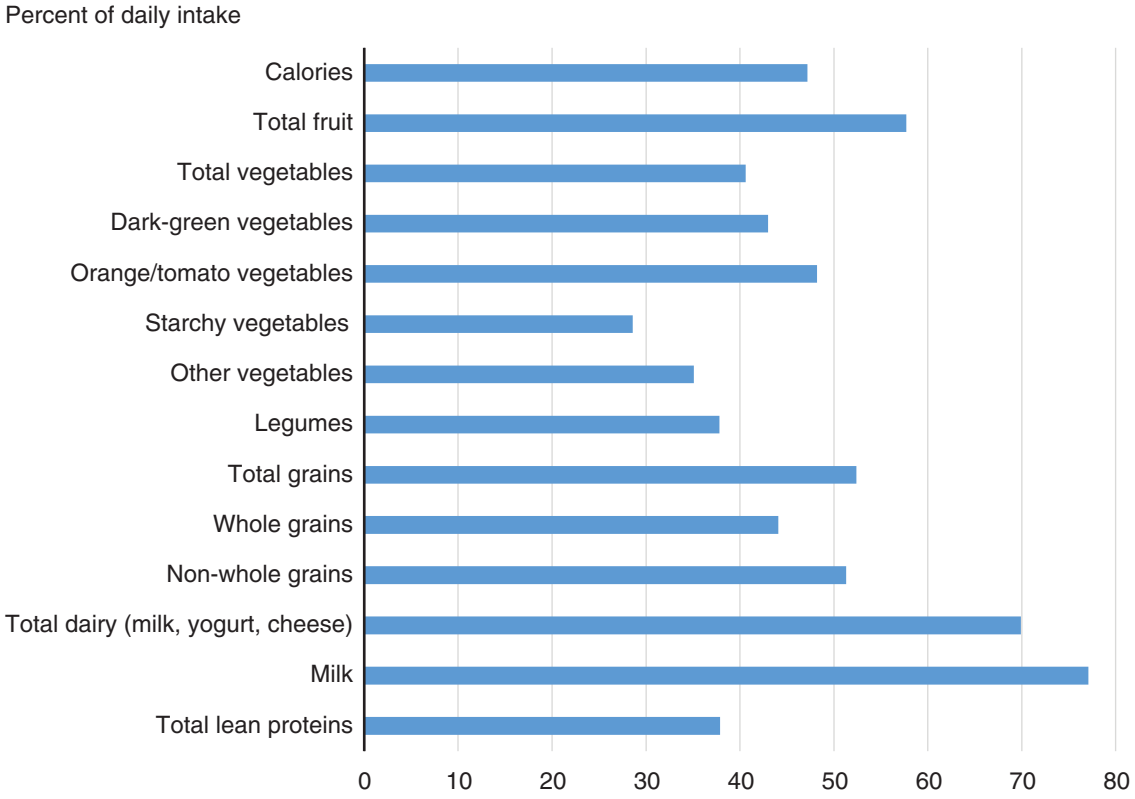
Korenman and colleagues' (2013) study of CACFP (Child and Adult Care Food Program) impacts also examined the impact on consumption of specific food groups (Korenman et al., 2013). The study, based on the Early Childhood Longitudinal Study–Birth Cohort, analyzed data gathered in 2005 on 4-year-olds in low-income households. Children enrolled in centers participating in CACFP were found significantly more likely than children in nonparticipating centers to consume at least 2 cups of milk and 2 servings of vegetables (other than potatoes) each day. At the same time, CACFP participation was also associated with lower likelihood of limiting sugar-sweetened beverages to no more than 1 to 3 servings per day.

Other studies have gone further to address whether child nutrition programs can be shown to improve academic performance. Frisvold (2015) found that students in States with a binding mandate to provide school breakfasts had significantly higher standardized scores for math. The

[12] An earlier review by Fox et al. (2004) found evidence that NSLP participants consumed more of several vitamins and minerals as well as higher levels of fiber, but also fat and saturated fat, both at lunch and over 24 hours. That review did not reflect changes in school meal requirements in 1996 that reduced the allowable level of fat and saturated fat. The limit on fat was removed in updated requirements in school year 2012-13.

Figure 2

Percent of daily intake from National School Lunch and School Breakfast Program meals, for students participating in both programs, NHANES 2007-12



Source: Cullen and Chen (2017), based on 448 children ages 5-18 participating in the National Health and Nutrition Examination Study, 2007-12.

mechanism for this difference appeared to be higher rates of breakfast consumption in States with a mandate of breakfast, and higher consumption of nutrients by SBP participants.

The available results on school meals and diet quality predate new standards for school meals implemented in 2012 requiring higher levels of green leafy non-starchy vegetables and more whole grains, as well as other changes that expanded access to school meals.

Expanding Access to Healthier Choices

Many of the studies of school meals' effect on food security were conducted before recent changes to school meals that could strengthen program benefits for food-insecure households with children. The 2010 Healthy, Hunger-Free Kids Act (HHFKA) required USDA to issue new nutrition standards for school meals and, for the first time, nutrition standards for all foods sold in schools. The new requirements for lunches, implemented in school year 2012-13, include increasing the availability of whole grains, fruits, and vegetables; requiring children to select a fruit or vegetable daily; and setting calorie ranges for the average meal offered over the course of the week. New requirements for breakfast—including increased whole grains and fruit—were implemented in school year 2013-14. New rules for snacks—including restrictions on sodium, fat, saturated fat, and sugar; size restrictions for beverages; and a requirement that snacks provide ingredients from healthy food groups—went in effect for school year 2014-15.[13]

The HHFKA also introduced the Community Eligibility Provision (CEP), an administrative option for qualifying local educational agencies (LEAs) and schools in high-need areas. Traditionally, schools have been required to collect household applications to determine individual student eligibility for free or reduced-price meals. The CEP allows participating LEAs and schools in high-need areas to serve breakfast and lunch at no cost to all enrolled students, without the burden of collecting and processing individual household applications. Instead, schools use eligibility data from other means-tested Federal assistance programs, such as SNAP, and certain demographic criteria to determine the percentage of students enrolled in the prior school year that could be directly certified for free meals, called the identified student percentage. USDA subsidizes the "directly certified" portion of meals at the free rate and the rest at the paid rate; schools cover the difference. If the identified student percentage is equal to or greater than 40 percent, the LEA or school qualifies to operate CEP. Prior to national implementation, CEP was phased in over a 3-year period, beginning in school year 2011-12. By school year 2016-17, half of eligible school districts participated.

CEP may encourage participation among children in food-insecure households just above the income qualifying limits, or students from eligible households that fail to submit an application. CEP also reduces the stigma sometimes associated with participation in the NSLP and SBP, encouraging participation among all students. Further, many school districts participating in the CEP pilot found CEP eased the implementation of alternative breakfast models, such as Breakfast in the Classroom. Alternative breakfast models help schools improve access to and participation in the SBP, often leading to increased reimbursements (Segal et al. 2016).

Beginning in 2010, the CACFP expanded at-risk afterschool suppers from 13 pilot States to all States; qualifying afterschool care programs serving children 18 and under in areas where at least 50 percent of the children are eligible for free and reduced-price meals may offer a federally subsidized snack and/or meal to participating children during the school year. In order for an afterschool care program to qualify, it must offer an educational or enrichment activity. Like NSLP and SBP, the meals served must meet the USDA nutritional guidelines, including an updated meal-pattern requirement scheduled to take effect October 2017. CACFP suppers provide an additional resource

[13] In May 2017, USDA announced plans to allow flexibilities in implementing standards for whole grains, low-fat flavored milk, and sodium content in order to assist school districts facing challenges due to low student acceptance of school meals (USDA 2017).

for food-insecure children and their households, allowing them to save resources for weekends or when school is not in session.

Another provision targeted to improve children's food security focuses on the summer. Although the Summer Food Service Program (SFSP) reduces food insecurity for those who participate, SFSP sites generally have low participation rates, reaching fewer children than either the NSLP or the SBP. To test methods to address food insecurity during summer months when children lack access to school meals, USDA launched in 2011 the Summer Electronic Benefit Transfer for Children (Summer EBT) demonstration.

Summer EBT tested the impact of an additional monthly benefit during the summer on children's food security. Using the EBT infrastructure of SNAP and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), Summer EBT gives households with eligible school-age children more resources to purchase food during the summer. Participants can use their EBT card like a debit card at participating food retailers. States and Tribal Nations participating in the demonstration elected whether to administer Summer EBT benefits in a manner similar to SNAP—allowing recipients to use benefits to purchase foods of their choice—or in a manner similar to WIC, which restricts benefits to a limited list of food items.

At this time, Summer EBT is a demonstration pilot of an additional nutrition benefit that is funded through annual appropriations and only operates in States and Tribal Nations that applied for and were awarded grants to carry out the project; it is not an entitlement program. The structure of the program allows researchers to use an experimental random-assignment research design with control (participants not receiving Summer EBT) and experimental (participants receiving Summer EBT) groups.

The Summer EBT pilot allotted $60 a month per child in 2012, with 10 States and Tribal Nations participating. The additional $60 per child was found to reduce food insecurity among children by one-third (Collins et al., 2014). In 2013, the benefit amount was reduced to $30 a month per child for some Summer EBT participants to test whether the smaller amount would confer similar benefits. Both amounts were found to have the same impact on the most severe form of food insecurity. However, the larger amount ($60) had a greater impact on less severe food insecurity among children, adults, and households (Collins et al., 2014). In addition, participating children in households with Summer EBT ate more fruits and vegetables, whole grains, and dairy foods while consuming fewer sugar-sweetened beverages.

Conclusion

While the U.S. food insecurity rate declined with the abatement of the 2007-09 recession, food insecurity in households with children remains above pre-recession levels. Healthy meals are essential in protecting children from negative health, developmental, and educational consequences of food insecurity, and USDA child nutrition programs are intended to improve access to reliable, healthy food for America's children.

For low-income households with school-age children, food insecurity is more prevalent among those participating in free or reduced-price school meals than those not participating. However, this is likely due to differences in unobserved factors affecting the level of need. When research carefully addresses the fact that households with greater need are more likely to participate in child nutrition programs, a number of studies show that participation in USDA school meals reduces food insecurity and has positive effects on diet and academic performance. Thus, while child nutrition programs and other food assistance programs may not be enough to counter the full effects of factors resulting in food insecurity in these households, evidence indicates they provide a nutrition safety net for many food-insecure children. Children from food-insecure households may stand to benefit the most from recent changes to strengthen nutritional requirements for school meals and to expand access to school meals and summer meals when school is not in session.

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Appendix

Table A.1
Studies that examined the effects of child nutrition programs on food insecurity

Authors (Year)[1]	Outcome measures used for food insecurity[2]	Data Source	Population (sample size)	Measure of treatment	Analysis methods, adjustment for selection bias
National School Lunch Program					
Arteaga and Heflin (2014)	Persistent food insecurity[3]	Early Childhood Longitudinal Study – Birth Cohort, 2007.	Households below 185 of the poverty line with children who entered kindergarten in 2006 or 2007. (n=3,850)	Participation	Uses variation in State kindergarten eligibility dates
Gundersen et al. (2012)	Household reported low, marginal, or high food security during past 12 months	National Health and Nutrition Examination Survey 2001-2004	Households below 185 percent of poverty with children age 6 – 17, in schools that participate in NSLP (n=2,693)	Participation	Imposition of assumptions for level of participation misreporting, direction of instrument effect, and direction of treatment effect.
Huang et al. (2015)	Food insufficiency[4]	Four panels of the Survey of Income and Program Participation (1996, 2001, 2004, 2008)	NSLP participant households vs. income-eligible non-participants. (n=18,263)	Participation	Multilevel modeling, linear growth curve analysis
Ishdorj and Higgins (2015) Gao (2012)	Household reported low, marginal, or high food security during past 12 months	School Nutrition Dietary Assessment III (school year 2004-05)	School-age children in NSLP participating schools (n=2,012)	Participation	Two equation model; NSLP participation modeled using time available for eating lunch as instrument, food insecurity modeled using residual from participation model.
Kabbani and Kmeid (2005)	Household reported low food security during past 30 days	Current Population Survey 1995, 1997, 1999, 2001	Households that experienced food insecurity during the past 12 months AND were below 185 percent of poverty with school-age children (n=2,505)	Participation	Sample restricted to households that experienced food insecurity during previous 12 months.

—continued

Table A.1
Studies that examined the effects of child nutrition programs on food insecurity—continued

Authors (Year)[1]	Outcome measures used for food insecurity[2]	Data Source	Population (sample size)	Measure of treatment	Analysis methods, adjustment for selection bias
School Breakfast Program					
Bartfeld and Dunifon (2006)	Households reported low or marginal food security during past 12 months	Current Population Survey 1998-2001	Households with school-age children (n=70,942)	Availability	Hierarchical random slope models with State-level SBP availability proxied by ratio of SBP participation over NSLP participation
Bartfeld et al. (2009)	Household reported low or marginal food security during past 12 months	Early Childhood Longitudinal Survey-Kindergarten Cohort, grade 3 wave collected in 2002	Third grade students below 185 percent of poverty line (n=10,350)	Participation	Probit models of food insecurity and marginal food security as a function of SBP participation with controls for observable characteristics
Bartfeld et al. (2009)	Household reported low or marginal food security during past 12 months	Early Childhood Longitudinal Survey-Kindergarten Cohort, grade 3 wave collected in 2002	Third grade students below 185 percent of poverty line (n=10,350)	Availability	Two equation model; school level availability of SBP modeled using State breakfast mandate as instrument, food insecurity and marginal food security modeled using predicted SBP availability.
Bartfeld et al. (2011)	Household reported low or marginal food security during past 12 months	Early Childhood Longitudinal Survey-Kindergarten Cohort grade 3 wave collected in 2002	Third grade students below 185 percent of poverty line, in schools offering SBP	Availability	Probit models of food insecurity and marginal food security as a function of SBP availability with controls for observable characteristics
Summer Food Service Program					
Bartfeld and Dunifon (2006)	Households reported low or marginal food security during past 12 months	Current Population Survey 1998-2001	Households with children (n=70,942)	Availability	Hierarchical random coefficient models with State-level variables for SFSP or Seamless Summer Option participation as proxy for State-level program availability

—continued

Table A.1
Studies that examined the effects of child nutrition programs on food insecurity—continued

Authors (Year)[1]	Outcome measures used for food insecurity[2]	Data Source	Population (sample size)	Measure of treatment	Analysis methods, adjustment for selection bias
Miller et al. (2016)	Food insecurity and very low food security	California Health Interview Survey	Low-income households with children (n=5,394)	Accessibility[5]	Use of summer meal accessibility rather than participation
Nord and Romig (2006)	Household reported low food security during past 30 days	Current Population Survey Food Security Supplement 1995-2001	Households with incomes less than 185 percent of the poverty line, with and without children age 6-17. (n=24,394)	Availability	Natural experiment resulting from alternation of survey schedule between April and August/September
Child and Adult Care Food Program					
Heflin et al. (2015)	Food insecurity with standard cutoffs	Early Childhood Longitudinal Study – Birth Cohort	Low-income 4 year-olds whose providers answered provider interview (n=1,750)	Provider participation	Two-equation model: provider participation in CACFP modeled using State density of CACFP providers per number of low-income preschool children as instrument, food insecurity modeled using predicted CACFP participation
Korenman, et al. (2013)	Respondent endorsed 1 item on Food Security Supplement	Early Childhood Longitudinal Study – Birth Cohort	Low-income 4 year-olds enrolled in centers (n=1,750)	Provider participation	Propensity score weighted regressions; inclusion of lagged values for food security

[1] Studies that examined more than one program are listed in multiple sections.
[2] Unless otherwise noted, food security measures are based on an 18 item scale that classifies households as food insecure, or having low food security, if 3 or more affirmative responses are reported. Households are classified as having marginal food security if one affirmative response is reported. Households have high food security if no affirmative response is reported. See box "Measuring Food Insecurity" for questions.
[3] Households were categorized as persistently food insecure if the respondent answered "Almost every month" in response to "How often did this happen?" for two or more food hardship experiences.
[4] Food insufficiency measure is based on a question asking the respondent which statement best describes the household's food sufficiency experience. The measure is set equal to 1 if household answered "sometimes not enough to eat" or "often not enough to eat."
[5] Accessibility is constructed as a geospatial index for each respondent summing the number of sites divided by the distance to sites, with distance weighted by an additional factor indicating "demand" for the sites based on the nearby eligible population.

Table A.2

Findings from studies that examined the impact of child nutrition programs on food insecurity

Program	Results statistically significant	Results not statistically significant		Results statistically significant
	Availability or participation associated with significantly lower food insecurity	Availability or participation associated with lower food insecurity but not significantly	Availability or participation associated with higher food insecurity but not significantly	Availability or participation associated with significantly higher food insecurity
NSLP	Arteaga and Heflin (2014) [Participation; food insecurity] Gunderson et al. (2012) [Participation; food insecurity] Huang et al. (2015) [Participation; food insufficiency] Kabbani and Kmeid (2005) [Participation; food insecurity]		Ishdorj and Higgins (2015) [Participation; food insecurity]	
SBP	Bartfeld and Ahn (2011) [Availability; marginal food security]	Bartfeld and Dunifon (2006) [Proxied availability; food insecurity] Bartfeld et al. (2009) [Predicted availability; marginal food security] Bartfield and Ahn (2011) [Availability; food insecurity]	Bartfeld et al. (2009) [Predicted availability; food insecurity]	Bartfeld et al. (2009) [Participation; food insecurity and marginal food security]
SFSP	Bartfeld and Dunifon (2006) [Availability; food insecurity] Nord and Romig (2006) [Availability; food insecurity] Miller (2016) [Accessibility; very low food security]	Miller (2016) [Accessibility; food insecurity]		
CACFP	Heflin et al (2015) [Provider participation; food insecurity]	Korenman et al (2012) [Provider participation; one food hardship endorsed]		

Note: Cell entries show the authors and publication date. Information on treatment variable and outcome variable are included in brackets; further details in Table A.1. NSLP=National School Lunch Program; SBP = School Breakfast Program; SFSP= Summer Food Service Program; CACFP = Child and Adult Care Food Program.