

The Supplemental Nutrition Assistance Program and Child Weight Status: A Review



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Context: The Supplemental Nutrition Assistance Program (SNAP) is a food assistance program that helps Americans afford a healthy diet. However, its influence on children's weight status is unclear. This review examined the evidence of the relationship between SNAP participation and child weight.

Evidence acquisition: The following databases were searched: PubMed, EconLit, Web of Science, and the U.S. Department of Agriculture Economic Research Service. The last search was performed in October 2018. This systematic review gives a narrative synthesis of included studies.

Evidence synthesis: Twenty-three studies that examined the weight outcomes of children aged 2–18 years and SNAP participation were included. Eleven studies found no significant relationship between SNAP and child weight outcomes. Nine found that SNAP participation was associated with increased weight outcomes in certain subpopulations, and four found that SNAP was linked to a predicted decrease in weight outcomes in some subpopulations. However, many of these studies did not address a key methodologic challenge: self-selection. Of those that did, five found that SNAP participation was associated with an increased risk of being overweight and elevated weight in certain subpopulations.

Conclusions: SNAP participation may help boys maintain a healthy body weight but can be a contributing factor in being overweight or obese in girls who are long-term participants, or who are already overweight. Food security and participation in multiple food assistance programs may be important modifiers. These findings are relevant to policymakers who are considering reducing SNAP funding or restructuring the program. Further research that utilizes strong designs is needed. *Am J Prev Med* 2019;56(6):882–893. © 2019 American Journal of Preventive Medicine. Published by Elsevier Inc. All rights reserved.

CONTEXT

Nearly one in five children in the U.S. are obese.¹ Rates are highest in youth of lower SES. During 2011 to 2014, the obesity rate was 73% higher in youth with household income in the lowest income bracket, compared with youth living above 350% of the federal poverty level.² Recent studies suggest that the relationship between SES and obesity within industrialized nations like the U.S. exists largely because groups of low SES have greater access to energy-dense, nutrient-poor diets, as opposed to nutrient-rich diets.^{2,3} Food assistance programs are one method to improve access to a healthy diet and address the health inequalities of those of low SES.

The Supplemental Nutrition Assistance Program (SNAP) is the largest U.S. federal food assistance

program,⁴ with children comprising around 50% of participants.⁵ The program's stated goal is to reduce hunger and enable low-income households to obtain a more nutritious diet.⁶ To accomplish this, SNAP provides financial assistance to eligible families to purchase food for home consumption. SNAP benefits can purchase any food item, with the exception of hot foods and alcohol.⁷

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Total annual benefit costs exceeded \$66.5 billion in fiscal year 2016.⁸ Among households with children, families received on average \$388 in benefits each month.⁹ Children living in SNAP households may participate in other federal nutrition assistance programs (e.g. Special Supplemental Nutrition Assistance Program for Women, Infants, and Children [WIC], National School Lunch Program [NSLP], or School Breakfast Program). Participating in multiple programs may be a protective factor against obesity.^{10,11}

Although SNAP is meant to mitigate hunger and malnutrition in low-income groups, the increased prevalence of overweight and obesity in low-income populations¹² has led many to question the role that SNAP plays in this trend. This has fueled policy debates, from restricting specific foods from SNAP purchases^{13–16} to substantially restructuring the program.^{17–19} Furthermore, SNAP has multiple beneficiaries beyond participating households, notably the food and beverage industry. Paarlberg et al.²⁰ note that corporate lobby power from these industries are a main reason modification of the SNAP program has been largely unsuccessful. To illustrate, the American Beverage Association, together with individual beverage companies, spent \$16.2 million in SNAP-related lobbying in 2013.²¹ Although the rising rates of obesity are due to multiple complex factors, the increased availability and consumption of nutrient-deficient foods and beverages, like sugar-sweetened beverages, are major contributors.^{22–24} An unintended consequence of SNAP is that it in effect subsidizes the food and beverage industry that is a driver of higher rates of obesity.^{20,25,26}

With one in four children in the U.S. participating in SNAP,²⁷ it is essential to understand the relationship that SNAP participation may have with child obesity. There are multiple hypotheses regarding how SNAP may influence weight and alter participants' diet or their food-related behavior. First, SNAP can potentially improve weight outcomes by encouraging families to purchase groceries and prepare and eat meals at home, instead of purchasing meals outside of the home.²⁸ Restaurant meals tend to have more calories and a less favorable nutritional profile.^{29–31} Second, SNAP has the potential to moderate the paradoxical relationship between food insecurity and obesity. Increasing the household food budget can allow families to shift from focusing on obtaining the most calories per dollar—which are likely to be nutritionally poor, energy-dense foods—to purchasing more nutritionally rich foods, such as high-quality proteins and fresh fruits and vegetables.^{32–34} However, a recent review found that children participating in SNAP had lower diet quality than higher-income nonparticipants.³⁵

SNAP may also potentially lead to excessive weight gain. The distribution cycle of benefits can encourage over-consumption when benefits are first distributed, followed by restricted consumption, or a decline in dietary quality.^{36–38} This binge pattern is correlated with increased BMI.³⁶ Finally, the nature of SNAP also prompts recipients to spend more on food than they would if the benefits were unrestricted cash transfers.^{39–42} As families increase the amount of money that they spend on food, households may simply purchase a greater quantity of the foods they were previously consuming.^{39,43} If this includes a substantial amount of calorically dense and nutrient-poor foods, this can lead to weight gain.

These proposed mechanisms of how SNAP participation may influence weight lead to opposite predictions. The evidence is also mixed. Studies examining the impact of SNAP on weight status have found that participation is linked to a decreased probability of being overweight,^{11,44,45} and others have found that participation is associated with higher rates of overweight and obesity.^{46–51}

The SNAP structure presents methodologic challenges in identifying its impact on weight status (Table 1). This review emphasizes the methodologic challenges inherent when studying SNAP. That is, in addition to describing what these challenges are, this review explains how some techniques better control for unobservable characteristics and discusses study findings in light of these techniques.

Several reviews on the health impacts of federal food assistance programs exist,^{32,35,52–54} including a review on body weight outcomes in adults,⁵⁵ and in all participant age groups.^{43,56} Larson and Story⁵⁴ review the relationship between food insecurity and weight status, and examine the role that food assistance programs may play. Since the review by Larson and Story, many additional studies have emerged. Several newer studies use strong, econometric designs or include variables that were not previously included. Gundersen⁵⁶ discusses a selection of these studies that use strong research designs, but does not survey the entire body of work regarding SNAP and weight.

The objective of this review is to present the results from existing studies that examine the relationship between SNAP participation and child weight. Similar to Ver Ploeg and Ralston,⁴³ this review uses strength of the study design as a framework. This study builds on previous work by providing a recent, comprehensive review focused on children. It can also inform policy by improving understanding of the impact of this program. With the high rates of childhood obesity, the role of government assistance policies intended to combat food insecurity and malnutrition must be evaluated to assess the extent to which they are impacting child health and

Table 1. SNAP and Self-Selection

Question	Answer
Where does selection bias come from?	SNAP is an entitlement program available to all who meet eligibility criteria. Participants must apply, but not all who are eligible decide to apply and participate. Participants and income-eligible nonparticipants likely differ on unobservable characteristics. For example, people who decide to apply and participate may be more focused on obtaining a healthy diet. The unclear relationship between SNAP and weight outcomes is partially due to these unobservable differences and the resulting selection bias. Studies that assess the relationship between SNAP and weight outcomes attempt to control for as many differences between participants and nonparticipants as possible. ⁴³ However, not all research designs also attempt to address the bias resulting from selecting to apply and participate in the program.
How do studies examine SNAP and weight?	Many studies that examine SNAP participation and child weight use cross-sectional data and multiple regression or logistic analysis. Frequently, studies use income-eligible nonparticipants as a comparison group. These studies are excellent to describe prevalence or trends, and to assess associations between variables. However, these studies do not account for selection bias and only examine youth at one moment in time. Estimates from such studies may be biased from self-selection. Given the methodological challenges of studying SNAP, this review focuses on study design (See Rigdon et al., ⁶⁷ Kennedy and Guthrie, ⁶⁰ and Ver Ploeg and Ralston ⁴³).
What techniques do researchers use to account for selection bias?	Several techniques, such as instrumental variables or fixed-effects models, among others, are better able to control for unobservable characteristics and dampen selection bias. ⁷⁴ Panel data and techniques such as dynamic modeling gives a longer-term view of the relationship between SNAP participation and child weight. However, these methods do not control for other characteristics that could affect both SNAP participation and child weight (see Ver Ploeg and Ralston ⁴³). Other methods are necessary to account for these unobserved factors. Several of these methods were used in the included studies: <ul style="list-style-type: none"> • Five studies used panel data and fixed effects.^{45,51,73,82,85} Fixed-effects models control for unobserved, time-invariant characteristics.⁵¹ However, important variables that change over time, such as food security, are not included with fixed effects. Other techniques are necessary in order to include time-varying characteristics. • Four studies used instrumental variables.^{45,76,83,85} Instrumental variables models use factors that are strongly correlated with SNAP participation, but that are not associated with child weight. Child weight is then modeled using these factors. • One study⁸⁹ used a partial identification bounding approach, which models a range of estimates using increasingly restrictive assumptions and a nonparametric approach. • One study⁸⁴ used difference-in-differences propensity score matching. Propensity score matching predicts the likelihood that an individual participates in SNAP. Participants and nonparticipants are then matched based on this propensity score. Propensity score matching accounts for selection bias by regrouping individuals and defining more similar treatment and comparison groups.

SNAP, Supplemental Nutrition Assistance Program.

well-being. The purpose of this review is to answer the question: What is the relationship between SNAP participation and child weight status? Lessons learned will help inform the ongoing policy debate regarding changes to the SNAP program.

EVIDENCE ACQUISITION

Search Terms and Strategy

This study synthesizes the existing literature on the evidence of the relationship between SNAP participation and child weight outcomes. The first stage of the search strategy consisted of a search of PubMed, EconLit, Web of Science, and the U.S. Department of Agriculture's Economic Research Service website. The last search was performed in October 2018. The search included terms for *body weight*, *children*, and *SNAP*. There were no restrictions placed on publication date range. The first author performed the literature

search, article screening, and data extraction. This search was corroborated by a second researcher using the same phrase and inclusion and exclusion criteria. Minor disagreements were resolved by discussion, such as deciding to exclude a longitudinal study in which the sample was between the ages of 16 and 24 years in the first time period considered.⁵⁷ The second stage of the analysis included examining the reference lists of relevant studies for articles, which were subject to the same inclusion and exclusion criteria.

Inclusion and Exclusion Criteria

The criteria for study eligibility in this review are shown in [Appendix Table 1](#) (available online). Articles that were eligible for review included studies that examined the weight outcomes of children aged 2–18 years, with SNAP participation as the main explanatory variable. Weight outcomes used BMI measures, such as BMI percentile, or used weight status (e.g., whether or not the child was classified as being overweight or obese). All study designs were included.

Articles were ineligible if they included only adult body weight as the outcome, assessed other food assistance programs and did not examine the effect of SNAP independently, or did not conduct a primary analysis (e.g., articles that only report on the findings of other studies).

Selection Process

The initial search yielded 268 articles, 18 of which were duplicates. After scanning the titles and then the abstracts, 34 full-text articles were assessed for eligibility. Of these articles, 15 were excluded because they did not meet inclusion criteria: five articles only summarized the findings from other articles,^{43,58–61} eight discussed weight outcomes in adults only,^{28,57,62–67} and two examined SNAP as an effect modifier only.^{68,69} Four additional articles were identified from the reference lists of relevant articles,^{70–73} resulting in 23 studies included (Figure 1).

Data Extraction

The first author identified key characteristics of the included studies and extracted them in table format. Data items extracted included author, year, study design, geographic location, sample, programs assessed, weight outcome measure, controls used, and results/estimated effects. This systematic review gives a narrative overview of included studies.

Study Design

Overall strength of a study depends on many elements, including data quality and whether or not the analysis accounts for important covariates. In the present review, risk of bias was assessed by identifying the study design and the outcome measures, which were then compared against a strength of design framework (similar to Ver Ploeg and Ralston⁴³). Table 1 outlines the importance of considering self-selection bias in the risk of bias assessment of this review. Other important factors, such as the measurement of key variables, are also discussed.

Methods that address selection bias by attempting to control for both observable and unobservable characteristics include instrumental variables, fixed effects models, and difference-in-differences.⁷⁴ Researchers have used both cross-sectional data and longitudinal data in these studies. In the present review, risk of bias was assessed at both the study level (study design) and at the outcome level (how weight was measured). Studies with strong designs that address selection bias are highlighted in the Discussion section.

EVIDENCE SYNTHESIS

Article Population and Measurement Comparisons

The search strategy and the inclusion and exclusion criteria yielded 23 studies that were included in the review (Appendix Table 2, available online). All of the studies rely on observational data but use various designs and statistical approaches. Six studies used data that are not nationally representative.^{73,75–79}

Studies measured their dependent variables differently (Appendix Table 3, available online). Participation in SNAP was also measured differentially among the

studies. The majority of studies used a binary variable to capture participation, with most using current participation. Three studies used participation in the past year.^{11,80,81} However, level of exposure is likely to affect the relationship between SNAP participation and weight. Several studies included this information, such as examining length of program participation.^{45,51,76,79,82–85}

Main Findings

Among the 23 studies identified, 14 used cross-sectional data and did not account for selection bias in their research design.^{10,11,70–72,75,77–79,81,86–88} Nine studies controlled for self-selection.^{45,51,73,76,82–85,89} Eight studies used a robust definition of SNAP participation,^{45,51,76,79,82–85} almost all of which also accounted for selection bias. Although these studies were able to examine the dose–response relationship, there was no major similarities in their findings.

Height and weight were self-reported, except for 12 studies that used measured height and weight.^{71,73,75,77–81,86–89} There were no major differences in findings across studies using measured compared with reported height and weight. However, the results from studies that control for self-selection do differ from results of studies that do not.

Studies That Did Not Address Selection Bias

Eight of the 14 cross-sectional studies that did not account for selection bias found no association between child weight and SNAP participation when compared with income-eligible nonparticipants.^{70–72,75,86–88} Three studies found that SNAP was associated with higher weight outcomes overall,^{79–81} or when compared with higher-income nonparticipants.^{80,86} Three found that SNAP was associated with lower weight outcomes, in the overall sample,⁷⁸ or in specific subpopulations: in youth participating in multiple food assistance programs^{10,11} and in food-secure girls.¹¹

Two studies found that participation in multiple food assistance programs and food security level modify the association that SNAP participation has with child weight. Roy and colleagues¹⁰ found that participating in both SNAP and the NSLP was associated with a lower probability of being obese. However, participating in either SNAP or NSLP alone were not significant. Jones et al.¹¹ found that among food-insecure girls, participating jointly in SNAP, NSLP, and the School Breakfast Program reduced the odds of being overweight. Among food-secure girls, participating in all three programs was not significantly associated with being overweight, but SNAP by itself decreased the odds of being overweight. These studies highlight the importance of examining food security and participation in multiple food

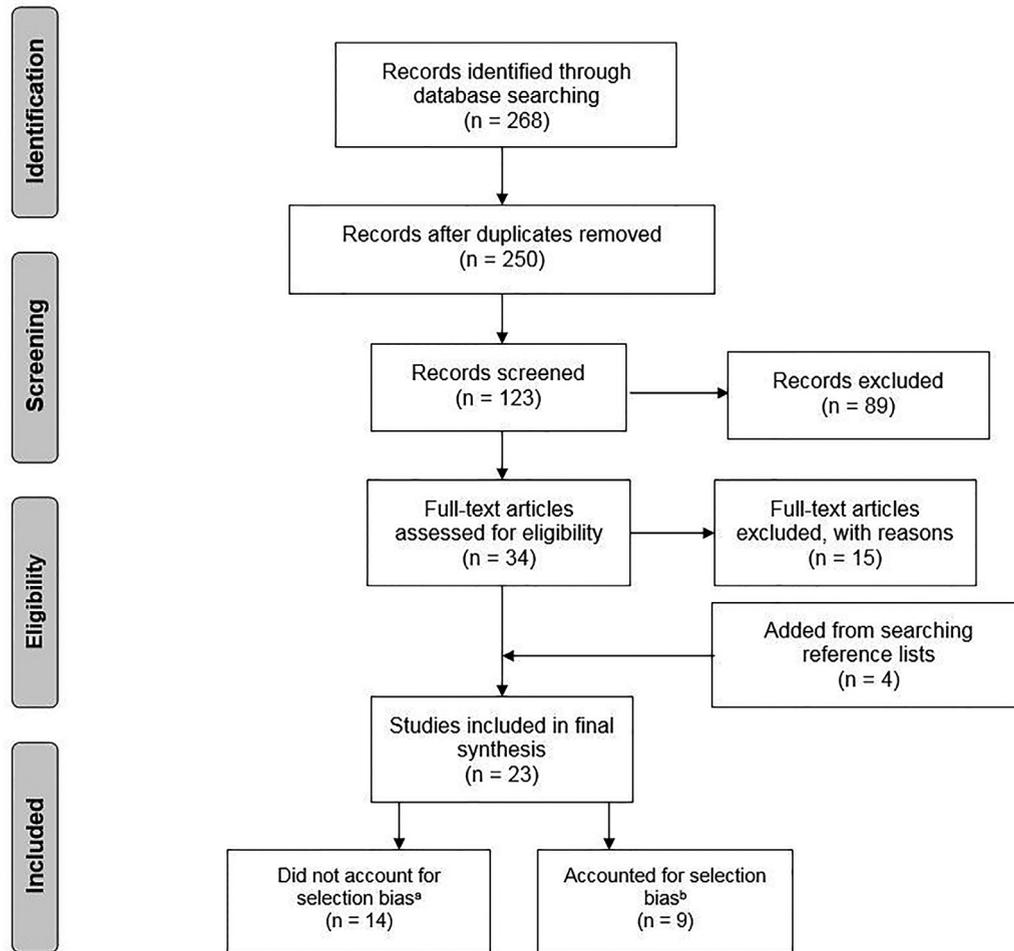


Figure 1. PRISMA flow diagram.

Source: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Med*. 2009;6(7):e1000097. <https://doi.org/10.1371/journal.pmed.1000097>.

Note: The Boolean phrase entered was (“BMI” OR “body mass index” OR “BMI percentile” OR “obes*” OR “overweight” OR “weight status”) AND child* AND (SNAP OR FSP OR “food stamp*”). The terms *FSP* and *food stamp* were included to account for the 2008 name change to the Supplemental Nutrition Assistance Program from the Food Stamp Program (FSP). The Economic Research Service website is not designed primarily as a search database, and it was not possible to enter all of the search terms at one time. The search was originally conducted using the abbreviated phrase (“BMI” OR “body mass index” OR “BMI percentile”) AND child* AND (SNAP OR FSP OR “food stamp*”). Variations of the search terms that also accounted for weight status did not produce new articles.

^aThese studies control for observable characteristics, such as race, age, and household income, but do not account for the bias due to people selecting into the program.

^bThese studies account for selection bias by attempting to control for both observable and unobservable characteristics through their designs, such as by using panel data methods, differences-in-differences, or instrumental variables. See Angrist and Pischke⁷⁴ for an excellent discussion of the selection problem, and designs that can address selection bias. Note that these designs do not mitigate selection bias in and of themselves. Whether or not these techniques actually mitigate the selection problem depends on how well the methods are used and how well the assumptions are met. SNAP, Supplemental Nutrition Assistance Program; ERS, Economic Research Service.

assistance programs as modifiers in the relationship between SNAP and child weight.

The majority of the above 14 cross-sectional studies did not find a significant association between SNAP and child weight.^{10,70–72,75,77,87,88} Two studies identified important modifiers in the relationship between SNAP participation and weight: participation in multiple food assistance programs^{10,11} and food security level.¹¹

Studies That Did Address Selection Bias

Nine studies attempted to address selection bias through their design and analysis. Five studies used panel models and fixed effects.^{45,51,73,82,85} Four studies used instrumental variables^{45,76,83,85}; one study used partial identification bounding methods⁸⁹; and one study used difference-in-difference propensity score matching to control for selection into SNAP.⁸⁴ Although a complete

discussion of these techniques is beyond the scope of this review, a brief overview is provided (Table 1).

The findings of the studies addressing selection bias are much less consistent than the studies that do not address self-selection. Three studies found no significant association between SNAP and child weight outcomes.^{83,84,89} One found that SNAP participation led to a predicted decrease in overweight; Burgstahler and colleagues⁷⁶ found that SNAP participation was negatively associated with overweight across three measures in children between the ages of 2 and 18 years. Furthermore, results varied by gender and age. Schmeiser⁴⁵ found that SNAP participation led to a lower probability of being overweight in boys and girls aged 5–11 years, and in boys aged 12–18 years. By contrast, one study found that SNAP participation led to a predicted increase in weight for boys aged 12–18 years if they were underweight.⁸⁵ One study examined how participation in multiple food assistance programs and area food prices modify the relationship between SNAP and child weight. Kimbro and Rigby⁷³ found that participation in any federal nutrition assistance program (WIC, SNAP, school meals, and the Child and Adult Care Food Program) was associated with lower BMI percentile in cities with low food prices, but with higher BMI percentile in cities with high food prices. SNAP alone was marginally related to increased BMI percentile in cities with high food prices.

Of the studies addressing selection bias, four studies found evidence that SNAP participation is linked with an increase in weight outcomes in girls. Two found this for younger girls aged 5–11 years,^{51,82} and two found this for only older girls/young women aged 12–18 years.^{45,85} Of these four studies, three found that SNAP led to a predicted increase in child weight in girls who were already overweight⁸⁵ or long-term participants.^{51,82} Similarly, in the state fixed effects model, Schmeiser⁴⁵ found that SNAP participation increased BMI percentile, and the probability of being overweight or obese in girls/young women aged 12–18 years. Although these results were not seen in the instrumental variable specification, the fixed effects model and longitudinal data control for many unobservable characteristics and make this a strong design. From the studies reviewed, evidence suggests that SNAP participation may help boys maintain a normal body weight,^{45,85} but that program participation contributes to being overweight or obese in girls who are long-term participants, or who are already overweight.^{45,51,82,85}

Overall Findings

Overall, 11 of the 23 included studies found no significant relationship between SNAP and child weight

outcomes.^{10,70–72,75,77,83,84,87–89} Nine studies found that SNAP participation was linked to higher weight outcomes.^{45,51,73,79–82,85,86} Four studies found that SNAP participation was associated with lower weight outcomes.^{11,45,76,78} Of the studies controlling for self-selection, three found no significant relationship.^{83,84,89} Two found that SNAP was related to a lower risk of elevated weight in the overall sample,⁷⁶ or in young boys and girls, and older boys.⁴⁵ Five studies that controlled for self-selection found that SNAP was associated with a higher risk of obesity and overweight, or elevated weight in certain subpopulations: young girls if they are long-term participants,^{51,82} older girls if they are already overweight,⁸⁵ older girls when using fixed effects modeling,⁴⁵ and in children if they reside in cities with high food prices.⁷³

DISCUSSION

Study Evidence

This study contributes to the existing literature on the relationship between SNAP participation and child weight by reviewing the results of prior studies in order to synthesize findings and identify trends. This study builds on previous work by providing a recent, comprehensive review focused on children. The evidence is mixed, but several main findings stand out. The evidence from the literature on SNAP participation and child weight suggests that program participation may help boys maintain a normal body weight,^{45,85} but that SNAP may play a part in girls being overweight or obese.^{45,51,82,85}

Existing evidence indicates that girls who participate long-term in SNAP, or who are already overweight, are more likely to be overweight or obese. These findings mirror the results found in adult women.^{46–50} Furthermore, Gibson⁸² found that long-term SNAP participation is associated with a greater risk of overweight in girls, but only when her mother was also overweight. The reason that this mechanism exists for girls and not for boys is unclear. It may be that children tend to mimic the same-sex parent,^{90,91} or that boys are more likely to be engaged in regular physical activity than girls,^{92,93} thus offsetting the relationship between SNAP and weight status. Furthermore, many studies discuss how and why women experience greater physiologic consequences of poverty, including increased risk of obesity.^{94–96} The studies included in the review largely omitted an assessment of how gender inequalities might cause obesity in both mother and child.⁹⁷ Structural barriers associated with poverty, such as being unable to afford or access healthy food, can drive both poor health and obesity.^{98,99} Females and racial/ethnic

minorities are exposed to a greater degree to social and economic inequality.¹⁰⁰ As an example, women, blacks, and Latinos experience higher rates of food insecurity.^{101,102} Cross-country studies have found that higher levels of gender inequality are associated with higher levels of female obesity.^{95,103} The findings from several studies included in the present review suggest that these structural differences manifest early in life, placing girls at greater risk of obesity.

Other themes have begun to emerge in the literature. First, several studies suggest that participation in multiple food assistance programs may have a spillover effect that is not seen when assessing either SNAP or another food assistance program alone,^{10,11,73} and that joint participation is associated with a lower risk of being overweight.^{10,11} Second, several studies include a family's food security status as a covariate, and find differential effects of SNAP depending on food security. Jones et al.¹¹ found that for food-secure girls, SNAP alone was a protective factor, and led to a lower likelihood of being overweight. By contrast, for girls who are food insecure, SNAP alone did not have a significant effect, but SNAP, the NSLP, and the School Breakfast Program together led to a lower probability of being overweight. A recent study that examined how participation in SNAP or the NSLP modified the relationship between food security and weight in children found that food insecurity was associated with higher weight status for non-SNAP participants, and a negative but not significant association among SNAP participants.⁶⁸ This suggests that food assistance programs may help protect against obesity in food-insecure youth.

It is important to consider how well SNAP is meeting its stated goal of helping Americans afford a more nutritious diet. The inconsistent findings across many studies indicate that SNAP may be inadequate by itself to improve the weight outcomes of low-income children. Additional policies such as restricting food marketing to children and taxing sugar-sweetened beverages hold the potential to improve the diet quality and diet-related health of SNAP participants.¹⁰⁴ Furthermore, there is mounting evidence that SNAP may have unintended negative consequences, as reflected in higher weight outcomes in some subpopulations. Many scholars and policymakers have proposed changes to SNAP, notably restricting nutritionally poor items such as sugar-sweetened beverages from eligible purchases, and incentivizing purchases of healthy foods, such as fruits and vegetables.^{14,15,105} Both restricting purchases and providing incentives for purchases of healthy foods have been found to improve diet quality.^{106–110} These strategies hold potential, though they are not without substantial caveats (see Schwarz¹⁰⁵ and Cawley and Wen¹⁰⁴).

Conducting and evaluating pilot projects would better clarify the effectiveness of such strategies.

The majority of the studies used data from the 1990s and early 2000s. SNAP has changed since then, notably the addition of the nutrition education component, which has been found to improve dietary intake,¹¹¹ as well as the temporary increase in benefits that was part of the American Recovery and Reinvestment Act, which has been found to improve food security.¹¹² Because of these developments, as well as the methodologic challenges of identifying the relationship between SNAP participation and child weight, there is a need for additional research that uses more recent data and strong research designs that control for selection into SNAP. Including additional factors, such as physical activity levels, and interactions between food security and multiple food assistance programs, will help better isolate the impact of SNAP participation on child weight status. However, longitudinal data that include all of these variables are presently unavailable. [Table 2](#) provides additional research recommendations.

Limitations

There are several limitations to the studies examined and to this review. First, the inconsistency in results may be because of the various designs used, the different measurements of key variables, or the failure to take into account important factors such as food security. In addition, studies used a variety of age ranges in their analyses. The prevalence of obesity increases with age,¹¹³ and these differences could contribute to inconsistent findings among studies. Finally, assessing the relationship between SNAP participation and child weight status is prone to selection effects and reverse causality. Although multiple studies attempted to address this through using panel data techniques, propensity score matching, or instrumental variables, the majority of studies did not. Second, this review did not include the gray literature, such as white papers or dissertations. Therefore, the review may have excluded studies that examine the effects of SNAP on child weight status. The review's methodology focused on peer-reviewed or U.S. Department of Agriculture–developed research.

SNAP has the potential to affect weight by changing participants' diet or their diet-related behavior. SNAP may modify the quality and quantity of food a family purchases and consumes, or alter food-related behaviors, such as encouraging at-home food consumption. Thus, the relationship between SNAP and children's weight outcomes is an indirect relationship. A limitation of this review is that it does not examine these pathways. Additional research that studies these

Table 2. Recommendations for Future Research on SNAP Participation and Child Weight Outcomes

Recommendations
Conduct longitudinal studies in order to shed light on the dynamics of the relationship between SNAP participation and youth weight. Such studies should include a diverse population of different age ranges. This can help improve understanding of why long-term participants may face greater risk of overweight.
Future studies should further examine the pathways through which SNAP can influence weight. In particular, analyzing food shopping data and dietary data can illuminate how SNAP affects diet. In addition, qualitative research would be valuable in understanding the complex nature of gender differences and the impact of family relations.
Conduct pilot projects to evaluate the feasibility and effectiveness of proposed changes to SNAP. Specifically, assess the impact of restricting nutritionally poor foods from SNAP, and of providing incentives for purchases of nutritionally rich foods like fruits and vegetables.
Use updated, currently available data in designs that control for selection bias. Instrumental variables, quasi-experimental designs, and new matching methods are promising methods to address the challenge of self-selection.
Analyze the dose–response relationship between SNAP participation and child weight outcomes. Rather than examining SNAP as a binary variable, incorporate richer information when it is available, such as the duration of benefits or the amount of benefits.
Include additional measures of body weight when possible. In particular, waist-to-height ratio and waist circumference have been found to be more accurate indicators for obesity and are stronger predictors of disease than BMI percentile. ^{114,115}

SNAP, Supplemental Nutrition Assistance Program.

mechanisms is needed and can shed light on how SNAP influences weight.

Finally, using BMI percentile or weight status as outcome measures does not provide a complete picture of a child's health. Multiple studies have examined other health-related outcomes of SNAP, including diet quality and nutrient intake,³⁵ which are important measures of health. However, diet quality was beyond the scope of this review. Physical activity level is another important variable in determining a child's overall health, and a few studies have begun to incorporate this into their analysis.^{72,81}

CONCLUSIONS

The present study systematically reviewed and synthesized the evidence on the relationship between SNAP participation and child weight outcomes, using strength of the study design as a framework. This has the potential to inform policy by improving our understanding of the impact of SNAP. Continuing research in these areas can develop a more comprehensive—possibly more consistent—picture of the effects of SNAP on body weight outcomes in children. This can lead to improved policy design that captures the positive effects of SNAP while mitigating any potential negative program impacts.

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SUPPLEMENTAL MATERIAL

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