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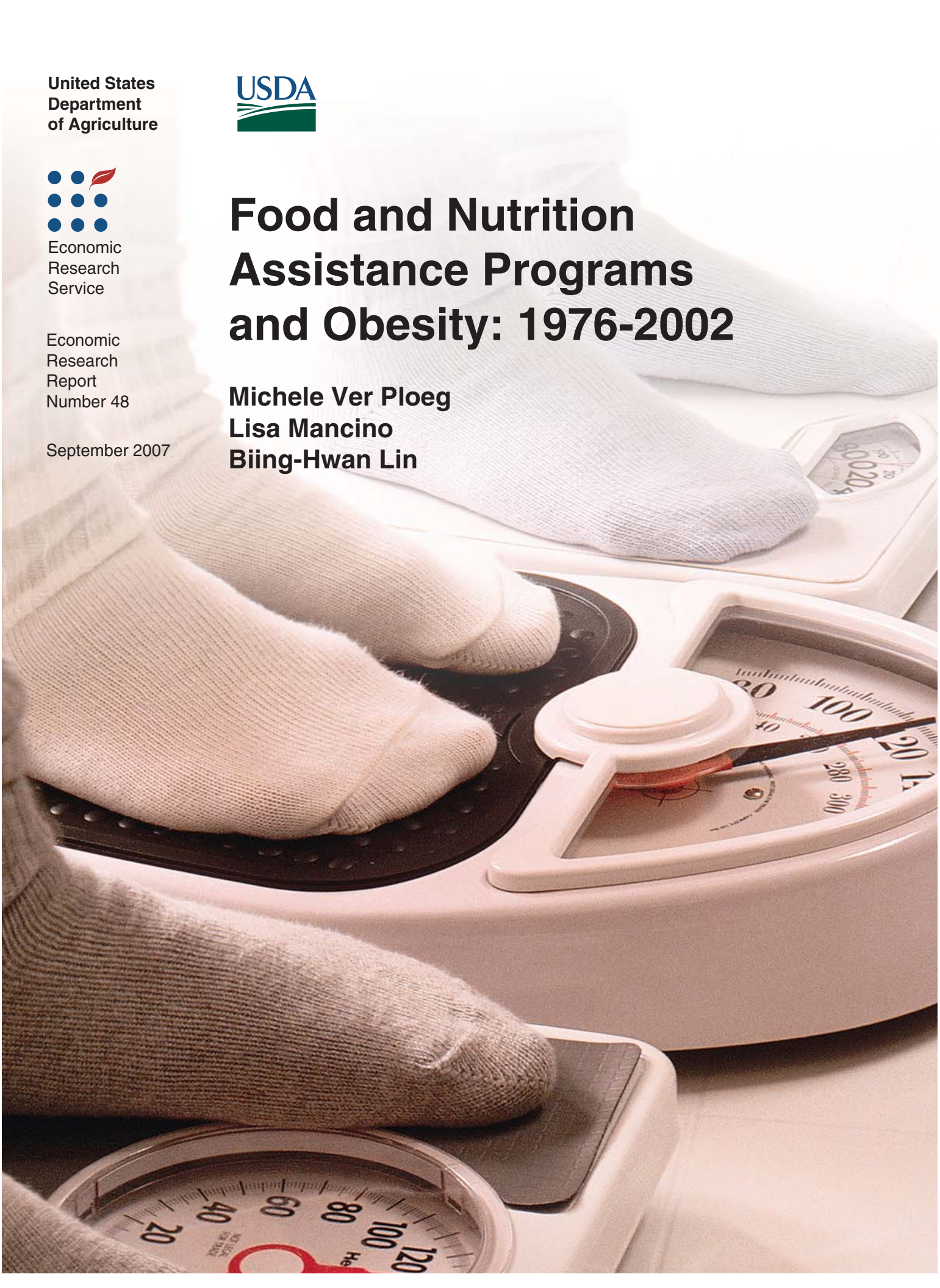
Michele Ver Ploeg
Lisa Mancino
Biing-Hwan Lin



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Food and Nutrition Assistance Programs and Obesity: 1976-2002

Michele Ver Ploeg, Lisa Mancino, and Biing-Hwan Lin

Abstract

The Food Stamp Program and the Special Supplemental Nutrition Program for Women, Infants and Children (WIC) address poor nutrition among low-income adults, infants, and children in the United States. Higher rates of obesity among the populations these programs serve have led to concern that the programs may, ironically, contribute to the problem. To analyze the relationships between program participation and body weight, the study used cross-sectional data spanning the period 1976-2002. The authors compared participants with nonparticipants subdivided into three income categories: income-eligible for food and nutrition assistance, moderate income, and higher income. Results were most striking for adult women receiving food stamps. The most recent data showed that, in contrast to prior years, women food stamp participants had a Body Mass Index similar to that of income-eligible nonparticipating women and women with moderate incomes and were no more likely to be overweight or obese. For other sex and age groups, the associations between program participation and weight were inconsistent over time and varied by race and ethnicity. These variations illustrate the difficulty of using cross-sectional data to establish causal relationships between food and nutrition assistance program participation and weight status.

Keywords: food and nutrition assistance programs, food stamps, WIC, overweight, obesity, Body Mass Index, weight trends, National Health and Nutrition Examination Survey.

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Contents

Summary

The marked rise of obesity in the United States has many wondering what factors have contributed to this trend. Technological changes that have affected the price of food and the time costs of preparing it, increased variety and frequency of food consumption, and increasingly sedentary lifestyles have been named as suspects. Environmental factors, such as the per capita number of restaurants, and unintended consequences of policies such as State cigarette taxes, have also been blamed for increases in obesity.

What Is the Issue?

High rates of overweight and obesity among low-income populations in the United States have raised questions about whether Federal food and nutrition assistance programs contribute to the problem. Critics contend that the Food Stamp Program (FSP), the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), and National School Lunch and School Breakfast Programs, all designed to reduce poor nutrition, may, ironically, encourage participants to overeat and gain weight. To examine this possibility, the study investigated the extent to which overweight and obesity have increased over time for food and nutrition assistance recipients (focusing on FSP and WIC). and the degree to which increases may simply mirror national trends in overweight and obesity. For this analysis, the study compared food and nutrition assistance program participants to low-income individuals who were not participating in the programs and to individuals with higher incomes.

What Did the Study Find?

In contrast to previous years, the most recent data from the National Health and Nutrition Examination Surveys (NHANES) show almost no relationship between food stamp participation and weight status. The most striking shift over time is observed among non-Hispanic White women, Data from 1976-1980 showed that food stamp participants had a greater body mass index (BMI) and were more likely to be overweight and obese than nonparticipants. However, data from 1999-2002 show no differences between food stamp participants and income-eligible nonparticipants. Further, BMI and the likelihood of overweight and obesity were similar for both moderate-income non-Hispanic White women and food stamp participants. For other age, sex, and race/ethnicity groups, an inconsistent relationship between food stamp participation and weight measures was found.

More detailed results of the comparisons within demographic groups were:

Women—Data from 1976-80 and 1988-94 showed a strong positive association between Food Stamp Program participation and each of the three weight outcomes in adult non-Hispanic White women. Data from 1999-2002, however, showed no correlation between any of the three weight outcomes and food stamp participation status. Further, 1999-2002 data for non-Hispanic White women showed no differences in all three weight outcomes between food stamp participants and moderate income women

and showed that only higher income women had lower BMI and were less likely to be obese than food stamp participants. For non-Hispanic Black women, data from 1976-80 and 1988-1994 did not show a consistent relationship between food stamp participation and body weight—only non-Hispanic Black women with the highest incomes had lower BMI and were less likely to be overweight or obese than food stamp participants. In 1999-2002, even this difference did not exist. Results for Mexican-American women reflect those of non-Hispanic White women.

Men—Data from the earlier years show the association between program participation, income, and weight among men was nearly the opposite of that for women. Male food stamp participants were less likely to be overweight than eligible nonparticipants and moderate and higher income men. But in 1999-2002, for non-Hispanic Black and White men, no weight gap was observed between food stamp participants and nonparticipants.

Children—The largest proportion of recipients in both the Food Stamp and WIC programs are children, who have recently comprised about 50 percent of participants in both programs. For the analysis, the study authors divided them into two age groups, as follows:

School-Age Children (ages 5-17)—Analysis for this group showed no systematic associations between receipt of food stamps and weight. Differences in weight between participants and nonparticipants existed only in some years and for some racial and ethnic groups. Further, the direction of the estimated coefficient signs varied over time and by subgroup. The results also varied according to whether a household or individual measure of food stamp participation was used, particularly for Mexican-American children.

Young Children (ages 2-4)—No differences in weight outcomes were found between WIC participants and eligible nonparticipants. However, the more recent data showed some differences between WIC participants and higher income boys, with higher income boys having significantly lower BMI and risk of overweight.

How Was the Study Conducted?

To examine the relationship between body weight and food and nutrition program participation over time, the authors used multivariate analysis with multiple periods of cross-sectional data from the National Health and Nutrition Examination Surveys (NHANES) for 1976-80, 1988-94, and 1999-2002. For adults, the authors examined BMI, probability of overweight, and probability of obesity, and for children, BMI, probability of at-risk for overweight, and probability of overweight. For adults and school-age children, the association between Food Stamp Program participation and weight was investigated by comparing participants with income-eligible and moderate and higher income nonparticipants. For young children (ages 2-4), similar comparisons were made for WIC participation and weight. Separate models by sex and race/ethnicity (non-Hispanic White, non-Hispanic Black, and Mexican American) were examined.

Introduction

The marked rise of obesity in the United States has generated an active literature on how economic factors may have contributed to this trend. Technological changes that affected the relative price of food, time costs of food preparation, increased variety and frequency of food consumption, and increasingly sedentary lifestyles have been named as suspects (Cutler and Glaeser, 2003; Lakdawalla and Philipson, 2002; Philipson and Posner, 2003). So has a willingness to eat more and exercise less in the present despite the risk of health problems in the future (Komlos, Smith, and Bogin, 2004; Smith, Bogin, and Bishai, 2005). Environmental factors, such as the per capita number of restaurants, and unintended consequences of policies, such as State cigarette tax rates, have also been blamed for increases in obesity (Rashad, Grossman, and Chou, 2005).

The especially high prevalence of overweight and obesity among low-income adults and children has led some to question why excess weight occurs disproportionately among those with the least resources. In trying to resolve this paradox, some analysts have pointed to the U.S. food and nutrition assistance programs—which were designed to provide a nutritional safety net for low-income households—as a causal factor.

Several studies have tried to determine if food and nutrition assistance programs contribute to overweight, with most of these studies focusing on the effects of Food Stamp Program participation. Methodological and data constraints complicate such efforts. Studies that simply make comparisons between food and nutrition assistance program participants and eligible nonparticipants are useful for describing these populations, but researchers do not always control for other differences between the groups of participants and nonparticipants. Some studies go beyond simple correlations and aim to link program participation to body weight using multivariate regression and single periods of cross-sectional data. However, such data may not be well suited to analyzing the general causes of weight gain, which results from a long-term energy imbalance, or for fully understanding how extended periods of food stamp benefits may affect weight gain. Studies using longitudinal data on the same individuals over time have advanced what is known about the relationship between food stamp benefits and weight. But even longitudinal studies have limitations because of possible unobserved heterogeneity between those who participate in food and nutrition assistance programs and those who do not. Individuals choose (or self-select) whether to participate in these programs—just over half of those who are eligible for food stamps ultimately receive them (Castner and Schirm, 2005). All studies about the causal connections between program participation and weight status have data and methodological limitations that make it difficult to draw conclusions.

In light of the difficulties in examining the causal relationship, this study addressed the issue indirectly by analyzing the association between food and nutrition assistance program participation (both Food Stamp and WIC programs) and body weight over time and across demographic groups. We used multiple periods of cross-sectional data covering 26 years and multiple regression analysis to examine for adults the association between participa-

tion in the Food Stamp Program and body mass index (BMI) and the probability of being overweight and obese. We followed the same methodology to examine for school-age children (ages 5-17) the relationship between participation in the Food Stamp Program and BMI and the probability of being at risk of overweight or being overweight.[1] We also examined the association between WIC program participation and BMI and the probability of being at risk of overweight for young children (ages 2-4) for two time periods, 1988-94 and 1999-2002. Our contribution to the literature is a multiyear, multivariate perspective, examining trends in the association of food and nutrition assistance program participation and weight and adding the most recent data on body weight from the National Health and Nutrition Examination Survey (NHANES) to estimates from previous years.

We expected that if food and nutrition assistance program participation led to higher weights, this effect would be relatively consistent over time, as would differences in BMI or rates of overweight and obesity between participants and income-eligible nonparticipants. On the other hand, consistently lower weight among food and nutrition assistance program participants compared with eligible nonparticipants could indicate that the nutrition education and nutrient-targeted foods of the programs (specifically, the WIC program) may be effective in controlling weight gain. Or in the case of both WIC and food stamps, it might mean that those most undernourished (with lower body weights) self-select into the programs. Findings of an inconsistent relationship between program participation and weight status would indicate that the relationship is quite complex, or that other factors are more important than the participation-weight relationship in explaining increased weight.

[1]The terms "at risk of overweight" and "overweight" are used to describe children with BMI-for-age greater than or equal to the 85th percentile and greater than or equal to the 95th percentile, respectively, of age- and sex-specific growth charts.

How Could Participation in Food and Nutrition Assistance Programs Cause Weight Gain?

Food stamps and WIC are two of the Nation's primary programs for nutrition assistance to poor adults and children. The Food Stamp Program was designed to alleviate hunger, distributing Electronic Benefit Transfer (EBT) cards (replacing the original coupons) that can be used at grocery stores to purchase foods to be prepared at home. This is an entitlement program available to all households that meet eligibility requirements pertaining to income, work, and immigration status. Eligibility and benefits are based on household size, household assets, and gross and net income. In 2004, 24 million people received food stamp benefits, at an average cost of $86 per person and $200 per household each month.

While the Food Stamp Program serves people of all ages, the WIC program targets those from nutritionally vulnerable subgroups. WIC provides vouchers for foods, nutrition education, and health referrals to pregnant and postpartum women, infants, and children ages 1 through 4 who have incomes below 185 percent of the Federal poverty line (or are participating in Medicaid, the Food Stamp Program, or the Temporary Assistance for Needy Families program) and are nutritionally at risk. Participants can use the vouchers to purchase foods approved by the State WIC-administering agency, subject to Federal guidelines. WIC-approved foods contain specific nutrients that tend to be low in the diets of the populations served by the program (protein, calcium, iron, vitamin A, and vitamin C). The food package for children includes juice, cereal, milk, eggs, dried beans or peas, and peanut butter. The average cost per month of the food package for children was $39 in FY 2004 (USDA, 2006).

There are two main theories of how food stamp benefits could contribute to weight gain: (1) food stamps encourage beneficiaries to spend more money on food than they otherwise would (and presumably, to eat more); and (2) food stamp participation is linked to a cycle of deprivation followed by abundance and binge eating, which results in weight gain over time. With respect to the WIC program and children's weight, critics have argued that the food packages for children contain too many calories and are too high in cholesterol.

The first hypothesis of how food stamps could cause weight gain was put forth in a *Washington Post* op-ed column arguing that restricting the benefit to food purchases has resulted in overconsumption of food, resulting in obesity (Besharov, 2002). So while food stamp benefits may have the intended effect of reducing undernourishment or underweight for at least some participants, this hypothesis implies that the program benefits may also be pushing a portion of the participants into obesity. Citing evidence that offering benefits as cash induces smaller increases in food spending than offering coupons that can be spent only on food (Fox, Hamilton, and Lin, 2004, pp. 45-47), Besharov suggests food stamp benefits should be delivered as cash to combat obesity among program participants.

The food stamp cycle hypothesis posits that distributing food stamps only once a month results in alternate periods of under- and overconsumption, a pattern called the "food stamp cycle," which may result in weight gain (Townsend et al., 2001). This hypothesis is based on a paradoxical observation of a positive association between food insecurity and obesity. As food becomes scarce and food intake is restricted, a person may lose weight. Then, when food is abundant, the individual may overeat. This distorted eating pattern, with its periods of binge eating, can gradually lead to increased weight (Brownell et al., 1986; Coscina and Dixon, 1983; Franklin et al., 1948; Keys et al., 1950; Kochan et al., 1997; Lavery and Loewy, 1993; Polivy et al., 1994).

Restricted intake followed by binge eating may be tied to the monthly issue of food stamp benefits in the following manner: soon after the benefit is issued, food becomes sufficient and food-insecure households may overeat on highly palatable and rich foods; then, as the month progresses, participants draw their benefits down, begin to ration food spending, eat less, and lose weight. Through this cycle, it is possible that monthly issue of food stamps could result in weight gain.

The "food stamp cycle" hypothesis of weight gain has not been adequately tested (Townsend et al., 2001). There is evidence, however, that the frequency of food shopping, the types of stores visited (i.e., supermarket vs. non-supermarket), and spending on food varies over the food stamp benefit month (Wilde and Andrews, 2000; Wilde and Ranney, 2000). Evidence also suggests that food stamp participants reduce their food consumption toward the end of the monthly benefit cycle (Shapiro, 2005; Wilde and Ranney, 2000).

Other aspects of the Food Stamp Program could counterbalance weight gain. Since benefits can be used only for grocery store purchases, the program may encourage eating food at home instead of food away from home. Nutritional analysis shows that food away from home contains more fat and saturated fat and less calcium, fiber, and iron than food consumed at home (Lin and Frazao, 1997). Further, there is some evidence that greater frequency of eating breakfast and dinner away from home is associated with the prevalence of obesity (Ma et al., 2003). There is no research indicating that food stamps actually decrease the consumption of food away from home (the income effect of food stamps could result in an increase in eating out). There is some evidence that food stamp benefits impact nutrient intake, but that evidence is mixed. Devaney and Moffitt (1991) found that food stamps increase intake of total food energy, protein, and some micronutrients. Wilde, McNamara, and Ranney (2000) found that participants consumed more meats, added sugars, and total fats, but no more fruits, vegetables, grains, and dairy products.

WIC is designed to provide foods high in specific nutrients, nutrition education that stresses proper nutrition and positive changes in food habits, and health referrals for nutritionally at-risk individuals. One critique of the WIC program is that its food package for children provides too many calories and too much cholesterol (Besharov, 2002). WIC-approved foods for children ages 1-4 include juice, cereal, milk or cheese, eggs, and dried beans or peanut butter. While States have some leverage over the food packages, the

Federal Government sets a maximum on the monthly amount of each food that can be included in the package, limiting it to 288 fluid ounces of juice, 36 ounces of cereal, 24 quarts of milk (or cheese, substituted at the rate of 1 pound per 3 quarts of milk), 2 to 2 ½ dozen eggs, and 1 pound of dried beans or 1 pound of peanut butter.[2]

If the food packages are too heavy in calories and cholesterol, redesigning the packages could be considered. There is some policy movement in this direction. The USDA has proposed changes in response to the report of an Institute of Medicine (IOM) panel charged with reviewing the nutritional needs of WIC participants and prescribing changes to the food packages. Two of the recommendations of the IOM report would affect the food package for children: a reduction in the amount of juice in the children's food package and inclusion of a voucher for purchasing fresh fruits and vegetables (IOM, 2005).

[2]See http://www.fns.usda.gov/wic/benefitsandservices/foodpkgtable.htm

The Relationship Between Food and Nutrition Assistance Program Participation and Body Weight: Existing Evidence

Evidence regarding the relationship between weight status and participation in food and nutrition assistance programs should first be considered in light of evidence on the broader question of the relationship between income and weight status, which varies by sex, race, and ethnicity. For women, studies have shown a strong inverse relationship between socioeconomic status and body weight; for men, the direction and strength of the relationship is inconsistent (Sobal and Stunkard, 1989). However, recent evidence suggests that the relationship between income and obesity for women may not be as consistent as previously thought and may vary by race and ethnicity; likewise, the relationship for men varies across the income distribution and by race and ethnicity (Chang and Lauderdale, 2005).

For children, some studies show an inverse association between weight and socioeconomic status—that is, low-income children are more likely to be obese (Goodman, 1999; Strauss and Knight, 1999; Strauss and Pollack, 2001). However, the results of one study suggest overweight status may be less of a problem for children with the lowest incomes (those below poverty) and more of a problem for children from low-to-moderate income families (100-300 percent of Federal poverty guidelines) (Hofferth and Curtin, 2003).

Descriptive Evidence of the Association Between Food and Nutrition Assistance Program Participation and Weight

Among low-income individuals, are those who receive benefits from food stamps or WIC more likely to have weight problems than those who are eligible to receive benefits, but do not participate? Recent descriptive analysis of 1988-1994 cross-sectional data indicates that women who received food stamp benefits were more likely to be overweight and obese than those with similar incomes who chose not to participate in the program (Fox and Cole, 2004). These results are of considerable significance because women make up over two-thirds of the adults participating in the Food Stamp Program (USDA, 2005a). This study showed no difference in the weight of men who received food stamps compared with eligible nonparticipants and higher income men (Fox and Cole, 2004).

Girls ages 12-19 who received food stamps were significantly more likely to be at risk of overweight or to be overweight than higher income girls of the same age, although there were no differences compared with eligible nonparticipants. For girls ages 5-11, food stamp participants were no more likely to be at risk of overweight or to be overweight than eligible nonparticipants or higher income girls. Similarly, school-age boys (ages 5-19) who received food stamps were no more likely to be at risk of overweight or to be overweight than eligible nonparticipants or higher income boys (Fox and Cole, 2004).

Descriptive statistics from the 1988-94 NHANES data correlating WIC to BMI and to the prevalence of being at risk of overweight or overweight showed no difference between WIC participants and eligible nonparticipants (Cole and Fox, 2004).

Studies Examining the Effect of Food and Nutrition Assistance Program Participation on Weight

Several studies have gone beyond simple descriptive evidence and attempted to isolate the effect of programs on weight. In this section, we first review studies on the relationship between food stamps and weight, and then studies on the relationship between WIC and weight.

Food Stamp Program Participation and Weight

Gibson (2003) used longitudinal data and individual fixed-effects models to examine the relationship between food stamp receipt and obesity. She found that current and long-term receipt was associated with obesity among low-income women, but not among low-income men. Noting the complex relationships among poverty, food insecurity, and obesity, Gibson acknowledged that not controlling for food insecurity (or other unobserved characteristics that may vary over time) could complicate the interpretation of the role played by food stamp participation. In addition, food stamp participation was treated as an exogenous independent variable. However, the decision to participate in the Food Stamp Program is a behavior prompted by personal circumstances, including food insecurity (Frongillo, 2003).

Meyerhoefer and Pylypchuk (2006) used 2 years of panel data from the Medical Expenditures Panel Survey, along with panel data techniques, to estimate the effect of food stamp participation on the probability of normal weight, overweight, or obesity. This study treated food stamp participation as endogenous and used State-level Food Stamp Program policies as instrumental variables to identify food stamp participation. Similar to the results from Gibson (2003), the study found that food stamp participation was positively associated with obesity status among women, but not among men. The study also found that the link between food stamp participation and obesity is greater for single women than for women in multiple-adult households.

Chen, Yen, and Eastwood (2005) estimated a simultaneous two-equation system with an endogenous regressor for food stamp participation and a second equation representing either a continuous BMI measure or an indicator for obesity. Their results are consistent with Gibson's—receipt of food stamps is positively associated with body weight and obesity among low-income women, but not among low-income men. Similarly to Gibson, the study by Chen et al. omitted food insecurity. It also analyzed only a single period of cross-sectional data.

Multivariate studies of the relationship between food stamp participation and weight predominantly show either no relationship between participation

and body weight or a negative relationship. Children of all ages made up the largest segment of Food Stamp participants—50 percent in FY 2005. Bhattacharya and Currie (2000) found no effect of food stamp participation on obesity for children ages 12-16. Gibson (2001) used longitudinal data and found that current receipt of food stamps reduced the risk of obesity for children ages 12-18, but this relationship was not significant when long-term receipt of food stamps was included in the model.[3] Jones et al. (2003) controlled for food security status in addition to other characteristics and found that receipt of food stamps was associated with lower risk of overweight for girls, but found no association for boys. Boumtje et al. (2005) examined the association between food stamp participation and weight status for school-age children. This study controlled for other social, economic, and demographic factors as well as lifestyle and dietary factors (for example, exercise behavior, consumption of foods from different food groups, and consumption of soft drinks). The study did not find a relationship between food stamp participation and weight status.

[3]Both the Bhattacharya and Currie (2000) and Gibson (2001) studies used adult standards to classify children as obese or non-obese.

Hofferth and Curtin (2003) found no relationship between food program participation (in either the Food Stamp Program or the National School Lunch Program) and the probability of being overweight for children with incomes below the poverty line. One study, which used longitudinal data to estimate the effect of long-term food stamp participation on overweight status, found a positive association, but only among girls ages 5-11 (Gibson, 2004). Moreover, this same study found a negative link between the probability of overweight status and food stamp participation for young boys (ages 5-11) and no relationship for older boys or girls (ages 12-18).

With the exception of Gibson (2004), none of these studies focusing on children attempted to control for any bias due to participant self-selection into the program. Gibson (2004) used fixed-effect models and longitudinal data to control for unobserved time-invariant characteristics that might be associated with program participation and weight.

No study has explicitly tested the food stamp cycle hypothesis. Analyzing single-period cross-sectional survey data, Townsend et al. (2001) identified positive associations between the incidence of obesity and mild food insecurity and food stamp participation. To go beyond the associations that Townsend uncovered, Jones and Frongillo (2006) employed longitudinal data. Longitudinal data have advantages in reducing effects of unmeasured factors, providing a clear temporal sequence, directly measuring change, and estimating dynamic relations of change with other factors (Frongillo and Rowe, 1999). Jones and Frongillo found that food stamp participation had a moderating effect on weight loss among persistently food insecure women. Women who were food insecure in both periods of observation lost weight on average, but those who enrolled for food stamp benefits had lower weight losses. This study found no interaction between food stamp participation and weight for women who were persistently food secure or whose food security status changed between observation periods.

WIC Participation and Weight

About half of all WIC participants are children between the ages of 1 and 4. Research on the relationship between WIC participation and children's weight indicates either no association or a negative one—that is, WIC participants are less likely to have overweight problems. One study examined trends in the prevalence of overweight among children who received WIC over the years 1992, 1994, 1996, and 1998 (USDA, 2001). This study found consistently increasing prevalence of overweight among WIC children across age, gender, and race/ethnicity. The study did not compare WIC children with eligible nonparticipants, but other studies have done so for single periods of time. A study by the Centers for Disease Control and Prevention that used 1988-1991 NHANES data found no difference for Black and White children in the weight status (weight-for-height Z-scores) between WIC participants and eligible nonparticipants (CDC, 1996). This study did, however, find that Mexican-American children who participated in WIC had significantly lower weight-for-height than Mexican-American children who were income-eligible for the program but did not participate. Using two-stage least-squares and State differences in Medicaid eligibility policies to control for participants self-selecting into the WIC program, Bitler and Currie (2004) estimated the effect of WIC on BMI, weight, and the probability of being at risk of overweight for children ages 4-6 who participated in WIC at age 4.[4] Results from this study showed that WIC participation "…reduces the child's BMI and weight" (p. 26).

[4]Medicaid participants are adjunctively eligible for WIC benefits (if they also meet nutritional risk criteria) even if their income is greater than 185 percent of Federal poverty guidelines.

It is plausible that WIC participation may help lower the risk of overweight among participants. The nutrition education component of the program could translate into healthier eating habits. In addition, it is possible that participants substitute WIC-approved foods that are high in nutrients for foods that are lower in nutrients and higher in fat or added sugars. The findings of one study examining consumption of WIC-approved foods are consistent with this idea. Oliveira and Chandran (2005) examined the consumption of WIC-approved foods among children ages 1 to 4 who participated in the program. They compared the amount of specific foods consumed by WIC participants with the amount consumed by eligible nonparticipants who lived in households with people who received WIC, with eligible nonparticipants who lived in households where no one received WIC, and with higher income children who were not eligible for WIC. Results of this study showed that WIC participants consumed more WIC-approved juice than both groups of eligible nonparticipants and higher income children (24-45 percent more). For WIC participants, juice seemed to substitute for consumption of other beverages such as soft drinks—participants consumed 17-26 percent less of other beverages than all three comparison groups. WIC participants also consumed 75 percent more WIC-approved cereal than the comparison groups. The study found no differences between WIC participants and nonparticipants in the consumption of other WIC-approved foods. Oliveira and Chandran also examined total calories consumed across the four groups and found no differences between WIC participants and both groups of eligible nonparticipants, although WIC participants did consume significantly more calories than higher income children.

Overall, the existing literature shows some support for the hypotheses that food and nutrition assistance program participation may contribute to weight status, but results are not consistent across demographic groups or programs. The literature on the effects of food stamp participation on body weight is fairly consistent in finding a relationship for women, but the evidence is weaker for men and children. Plausible explanations for why the effect may differ by sex have not been tested. Further, even among women, some evidence suggests the relationship is stronger for single women than for women in multiple-adult households. With respect to WIC, there is little evidence that participation in the program impacts body weight among children. In fact, the existing evidence leans toward the conclusion that WIC may reduce overweight problems.

The techniques used in several of the studies reviewed exploited panel data and accounted for selection bias with two-stage estimation strategies. These studies advanced the literature on the effects of food and nutrition assistance program participation on weight, but methodological issues and data limitations still complicate the question of whether causal conclusions can be drawn. Each study is subject to criticism that it has not accounted for unobservable characteristics that may vary over time. Such characteristics could be associated with food stamp participation and weight (Frongillo, 2003). For example, bouts of depression may be associated with increased reliance on food stamps and lead to increased food consumption. An unobserved time-varying characteristic that could be correlated with a child's weight could be the amount of adult supervision of the child. A recent USDA-commissioned literature review concluded that large data and methodological gaps need to be filled in order to assess the causal effect of program participation on obesity (USDA, 2005b).

Is There a Consistent Relationship Between Food and Nutrition Assistance Program Participation and Weight? A New Look

Our approach was to step back and take a broad, multiyear perspective in examining the association between participation in either the Food Stamp Program or WIC and weight status among adults and children. We used multiple periods of cross-sectional data and multivariate analysis to examine whether there is a consistent relationship between participation and weight. We assessed whether food and nutrition assistance program participants are consistently heavier than eligible nonparticipants and higher income nonparticipants over time, or if the relationship has varied over time, specifically covering the time period when overweight problems for the United States as a whole have increased. If food stamp participation or WIC participation causes overweight problems, then we would expect differences between participants and eligible nonparticipants to be reasonably consistent over time.

While the bulk of the economics literature has focused on explaining why the aggregate U.S. population has gotten heavier, less attention has been paid to trends among specific socioeconomic subgroups. The epidemiology and health literature, on the other hand, shows considerable variation in the relationships between weight status and race, ethnicity, sex, and socioeconomic status (Flegal et al., 2002; Wardle, 2002; Zhang and Wang, 2004). Further, research on the relationship between Food Stamp Program participation and body weight that is summarized above has shown widely variant results by sex. Thus, we also separately examined the relationship between food and nutrition assistance program participation and weight across race, ethnicity, and sex. Results showing that food and nutrition assistance program participants are consistently heavier and more likely to be overweight and obese over time and across race, ethnicity, and sex could lend credibility to criticisms of the programs.

Data for this analysis came from the 1976-80, 1988-94, and 1999-2002 National Health and Nutrition Examination Surveys (NHANES), conducted by the Centers for Disease Control and Prevention (CDC). These surveys are representative of the civilian, noninstitutionalized population of the United States and are collected using a stratified, multistage probability sampling design. Detailed information of the plan and operation of each survey have been described elsewhere (McDowell et al., 1981; CDC, 1994; CDC, 2004a).

We used multiple regression analysis to examine the association between participation in the Food Stamp Program and weight status over each of the three NHANES survey periods for adults and for school-age children (ages 5-19). For young children (ages 2-4), we examined the association between participation in the WIC program and weight status. WIC participation information was collected only in 1988-94 and 1999-2002, so we analyzed only data from these two surveys for children ages 2 to 4.

Measured weight and height were collected in each survey during the Medical Examination Center interview, with standardized protocol, for each person age 2 and older. We used a comprehensive set of variables to measure weight—both a continuous variable, BMI, and categorical variables that use BMI to classify adults as healthy weight, overweight, or obese and children as normal weight, at risk of overweight, or overweight.[5] The specific definitions used for each age group are provided in the Box.

Linear regression models were used to estimate the association between food stamp or WIC participation and an individual's BMI. Logit models were used to estimate the association between food stamp or WIC participation and the probability an individual was overweight or obese (or at risk of overweight or overweight for children). We did not attempt to control for selection bias or to make causal inferences. Rather, our approach was to examine the association over time for different demographic subgroups.

For both adults and school-age children, we fully interacted the regression models by sex, race, and ethnicity because the literature suggests the relationship between body weight and either food and nutrition assistance program participation or income varies by these demographic characteristics

[5]Adults and children who were underweight were excluded from the analysis.

Definitions of Body Mass Index and weight status

Body Mass Index (BMI) is calculated as an individual's weight in kilograms divided by the square of his or her height in meters. For adults, numerical thresholds of BMI distinguish healthy weight from underweight, overweight, and obese. For children and adolescents, sex-specific BMI-for-age thresholds, using the 2000 Centers for Disease Control and Prevention growth charts, distinguish healthy weight from underweight, at risk of overweight, and overweight.

Adults

Underweight = BMI below 18.5

Healthy weight = BMI at or above 18.5 but below 25

Overweight = BMI at or above 25 but below 30

Obese = BMI at or above 30

Children (ages 2 to 19)

Underweight = Below the 5th percentile of BMI-for-age

Healthy weight = At or above the 5th percentile but below the 85th percentile of BMI-for-age

At risk of overweight = At or above the 85th percentile but below the 95th percentile of BMI-for-age

Overweight = At or above the 95th percentile of BMI-for-age

(Gibson, 2003; Chang and Lauderdale, 2005; Lin, Huang, and French, 2004; Binkley, Eales, and Jekanowski, 2000). The NHANES sample size permitted us to make separate estimates for three racial-ethnic groups: non-Hispanic White, non-Hispanic Black, and Mexican-American.[6,7] Because NHANES sample sizes for young children are too small to estimate separate models by race/ethnicity, we instead estimated joint models for all young children ages 2-4 (separately by sex) and included dummy variable controls for race/ethnicity.[8] Further, too few young children are classified as overweight in the survey to support estimates of the association between WIC and body weight.

The key independent variables of interest are program participation status—receipt of food stamps or receipt of WIC benefits—and household income. Household income is represented by the Poverty Income Ratio (PIR), which is the ratio of household income to the Federal poverty threshold corresponding to the individual's family size for the year in which the individual was interviewed.[9]

For the analysis of food stamp participants, we divided our sample into four categories: individuals who reported they currently received food stamp benefits; those who were income-eligible but did not currently receive food stamps (PIR<=130 percent); those with moderate income (PIR between 130 and 300 percent); and those with higher income (PIR greater than 300 percent). Children in families with incomes below 185 percent of poverty are income-eligible to receive WIC; thus, for the analysis of WIC participants, we divided the sample into the following categories: those who reported receiving WIC benefits; those who were income-eligible but did not receive WIC (PIR<=185 percent); those with moderate income (PIR between 185 and 300 percent); and those with higher income (PIR greater than 300 percent). Dummy variables for each of these categories were included in each model. Food stamp participants were the excluded reference group for estimates for adult and school-age children, and WIC recipients were the excluded reference group for estimates for young children (ages 2-4).

The 1999-2002 NHANES data show significant underreporting of participation in the Food Stamp Program compared with administrative record totals. Weighted counts of the number of food stamp participants in the 1999-2002 survey account for only 60 percent of program administrative records averaged over the 4 years (Fox and Cole, 2005).[10] Underreporting of participation in public assistance programs is not unusual (see Hotz and Scholz, 2002), so it is likely some respondents do not report their participation. For the 1999-2002 NHANES, the problem may be confounded by a computer programming error that may have resulted in missing information on whether an individual was currently receiving food stamps, so that food stamp receipt could not be imputed (CDC, 2004b). Underreporting may also be a result of a change in the wording of the questions about food stamp participation (see appendix A). The end result of these problems is a significant underestimation of the number of child participants under the age of 20 (Cole and Fox, 2005). NHANES data show that almost 40 percent of food stamp participants are children, whereas administrative records from each

[6]Only limited ethnicity data were available for NHANES 1976-1980, so Hispanics cannot be separately identified. Therefore, estimates from 1976-1980 are for total Whites and total Blacks, while data from 1988-1994 and 1999-2002 provide estimates specific for non-Hispanic Whites and non-Hispanic Blacks. In addition, Blacks were oversampled in the 1988-1994 and 1999-2002 NHANES, but not in the 1976-1980 survey. The sample size for Blacks in 1976-1960 is thus much smaller than the ones in the other two survey periods. Mexican-Americans were also oversampled in 1988-1994 and 1999-2002, but not in 1976-80. As a result, the sample size for Mexican-Americans is insufficient to provide national estimates for those earlier years.

[7]The sample size is too small to estimate the prevalence of obesity among Mexican-American men in 1999-2002.

[8]Centers for Disease Control and Prevention growth charts for height and weight, which are used to calculate BMI for children, only cover children ages 2-19. Thus, we included no children under the age of 2 in our analysis.

[9]The poverty thresholds are updated every year for inflation using the Consumer Price Index for All Urban Consumers (CPI-U). The poverty threshold for a family of 2 adults and 2 children was $19,157 in 2004.

[10]Estimates of total food stamp participants from NHANES data from 1988-94 almost precisely matched administrative totals averaged over 7 years.

year, averaged over the 4 years between 1999-2002, show that 51 percent of the participants are children (authors' calculations).

In addition to the question about individual receipt of food stamp benefits, the NHANES asked whether anyone in the household had received food stamps in the past 12 months. We used responses to this question to indicate whether a child was a food stamp participant—that is, if a child resided in a household with at least one food stamp participant, we assumed that the child was receiving food stamps. Appendix table 1 shows that the household level variable increases the number of children classified as food stamp participants. This household level measure of food stamp participation could result in erroneous classifications of individuals as food stamp participants, because it is possible that some households that receive food stamps have members who are ineligible for food stamps (e.g., immigrant parents of native children). However, administrative records show that of the 10 percent of food stamp households that contain nonparticipating members, only 20 percent of nonparticipating members are children (Fox and Cole, 2005). Thus, we expected few erroneous classifications using the household-level variable as a better measure of food stamp participation for children than the individual level variable.[11]

NHANES estimates of the number of children participating in WIC are closer to administrative totals. In 1988-94, the NHANES underestimated WIC children by about 20 percent, while in 1999-2002 the survey overestimates them by 13 percent. These differences in survey vs. administrative reports of WIC participation from the NHANES are similar in absolute value compared with reporting rates for other social welfare programs that have been measured in other large social and economic surveys (Bitler, Currie and Sholz, 2004; Povlinka, 1998).

For adults and school-age children, regressions also control for the individual's age and its square. Past studies have documented a nonlinear relationship between body weight and age (Kuchler and Lin, 2002). No quadratic term for age was included in regressions for young children. For the adult analysis, we restricted our sample to nonpregnant adults age 20 and above.

All the statistical analyses were conducted using software from SAS (SAS Institute, Cary, NC) and SUDAAN (RTI, Research Triangle Park, NC). Sample weights were used to account for differential probabilities of selection, noncoverage, and nonresponse to the examination. All variance calculations incorporated the sample weights and accounted for the complex sample design.

Use of a single period of cross-sectional data relies on a rich set of covariates on individuals and modeling techniques to parcel out variation in the population—a task that is more difficult in studying an outcome like BMI, which is the result of long-term energy balance, genetics, and cultural and environmental conditions. A benefit of using multiple cross-sections of data is that we can examine the weight trends of groups over time—crucially, over a time period when overweight and obesity rates in the entire U.S. population have been on the rise. Examining multiple demographic groups with multiple periods of data allowed us to examine whether increases in

[11]We report estimates of the relationship between body weight and food stamp participation using the individual level measure of food stamp participation for children in tables A2 (school-age girls) and A3 (school-age boys).

BMI have been limited to specific groups or whether the BMI increases have been more general. However, our method did not enable us to fully model the complex and dynamic relationship between food and nutrition assistance program participation and BMI.

In addition to the selection bias problems mentioned above, the composition of groups of individuals based on income and participation status may have changed over the time periods in the study, and our results may simply reflect these compositional changes rather than a change in the relationship between food and nutrition assistance program participation and weight. These compositional changes could be related to weight. For example, if people with relatively lower food deprivation and relatively greater body weight stopped receiving food stamps between the last two survey periods (1988-94 and 1999-2002), and only the most food-deprived and thinnest continued to participate, our results could simply reflect these changes.

Food Stamp Program rules did not change greatly over the study period, although rule changes accompanying the Personal Responsibility and Work Opportunity Reconciliation Act of 1996 (Welfare Reform) are notable exceptions. Changes to the Food Stamp Program included disqualification of most permanent resident immigrants if they had lived in the United States for less than 10 years and changes in how able-bodied adults were treated. However, eligibility was restored for children, elderly, and disabled immigrants in 1998, and eventually, in 2003, for all legal immigrants who had lived in the country for at least 5 years. These reforms seem to have had an additional effect on food stamp participation, as caseloads have changed in ways that were unexpected, given the economic conditions since 1996 (Cunnyngham, 2002; Figlio, Gundersen, and Ziliak, 2000; Gleason et al., 2001; Klerman and Danielson, forthcoming; Kornfeld, 2002). Of course, other economic and demographic factors could also have changed the composition of our subgroups of participants and nonparticipants over these years.

The Relationship Between Food and Nutrition Assistance Program Participation and Body Weight Varies Over Time and Across Subgroups

Table 1 shows the breakdown of our sample into different race/ethnicity and gender groups, while tables 2 through 7 give the study results for those groups. In each case, we show only coefficient and standard error estimates for the program participation/income variables. For each table, program participants are the reference group (food stamp participants for adults and school-age children and WIC participants for young children). Table 2 shows the results for adult women, table 3 for adult men, table 4 for school-age girls, and table 5 for school-age boys. Table 6 shows BMI estimation results for young boys and girls, and table 7 shows logit estimation results for the probability of at-risk-of-overweight for young boys and girls.

Table 1
Sample size by sex and race/ethnicity

	1976-80[1]	1988-94	1999-2002
Sample size		*Number*	
Women			
Non-Hispanic White	4,870	3,598	2,563
Non-Hispanic Black	649	2,423	810
Mexican-American[2]	n/a	2,056	998
Men			
Non-Hispanic White	4,654	3,227	1,933
Non-Hispanic Black	562	2,067	707
Mexican-American[2]	n/a	2,233	910
Boys ages 5-19			
Non-Hispanic White	2,016	909	847
Non-Hispanic Black	368	1,235	934
Mexican-American[2]	n/a	1,228	1,067
Girls ages 5-19			
Non-Hispanic White	1,869	987	844
Non-Hispanic Black	410	1,249	946
Mexican-American[2]	n/a	1,255	1,132
Boys ages 2-4	n/a	1,374	506
Girls ages 2-4	n/a	1,407	473

[1]Limited ethnicity data was available for NHANES 1976-1980, so Hispanics cannot be separately identified. Therefore, estimates from 1976-1980 are for total Whites and total Blacks, while data from 1988-1994 and 1999-2002 provide estimates specific for non-Hispanic Whites and non-Hispanic Blacks.
[2]The NHANES surveys oversampled Mexican-Americans in 1988-1994 and 1999-2002, but not in 1976-80. Thus, the study focused on Mexican Americans instead of other Hispanic ethnic groups. However, the sample size for Mexican-Americans is insufficient to provide national estimates for 1976-1980.

Women Food Stamp Participants vs. Nonparticipants

In contrast to previous years, recent data show few differences in weight between food stamp participants and nonparticipants among women. The trend is most striking for non-Hispanic White women.

For non-Hispanic White women, data from both 1976-80 and 1988-94 show that among these women, income-eligible nonparticipants had lower BMIs and were less likely to be overweight and obese than food stamp participants (although in some cases the significance was marginal). Further, higher income non-Hispanic White women also had lower BMI and were less likely to be overweight or obese than food stamp participants in earlier surveys. However, by 1999-2002, these differences had almost entirely disappeared. Only higher income women had lower BMIs and were less likely to be overweight and obese than food stamp participants.

For non-Hispanic Black women, the association between food stamp participation and weight has historically been weaker. For these women, there are few differences in BMI and the likelihood of overweight and obesity between food stamp participants and income-eligible nonparticipants for the three survey periods. The only differences observed throughout the study period were in 1988-94 between food stamp participants and their higher income counterparts, who had lower BMI and were less likely to be overweight and obese than food stamp participants. But these differences disappeared in the most recent survey years.

Results for Mexican-American women also show that income-eligible nonparticipant women are catching up to food stamp participants in weight. In 1988-94, Mexican-American women who received food stamps had greater BMI and were more likely to be obese than income-eligible nonparticipants and those in most higher income groups. By 1999-2002, all differences in body weight between food stamp participants and other Mexican-American women had disappeared.

To illustrate how nonparticipating groups have caught up with food stamp participants in body weight, figure 1 plots the mean predicted BMI of non-Hispanic White women over time and by participation and income status. Predicted BMI for each group is calculated using estimated coefficients reported in table 2 (along with the coefficient estimates for an intercept and the age and age-squared variables), and assumes the women are age 40. Figure 1 shows the dispersion of mean levels of predicted BMI across participation and income groups in 1976-1980 and 1988-1994. For each of these two survey periods, the mean BMI of food stamp participants was above those of all nonparticipants. Between 1988-1994 and 1999-2002, the mean BMI level of food stamp participants remained steady. However, mean predicted BMI for eligible nonparticipants and moderate-income women increased greatly, catching up to the level of food stamp participants. The mean predicted BMI of higher income women has also steadily increased, but is still below the level of food stamp participants.

Table 2

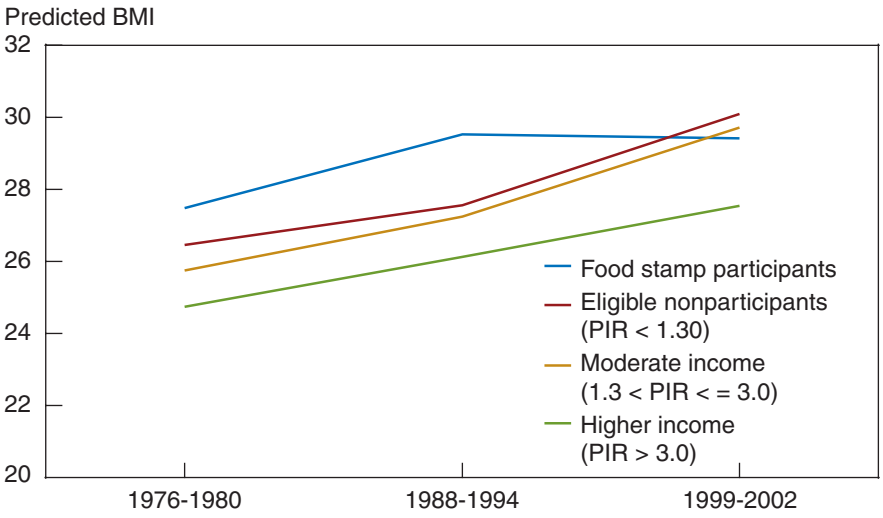
Adult women: Trends in the association between body weight and food stamp participation, eligibility, and income status

	BMI			Probability of overweight			Probability of obesity		
	1976-80	1988-94	1999-2002	1976-80	1988-94	1999-2002	1976-80	1988-94	1999-2002
Non-Hispanic White									
Eligible nonparticipants	-1.02*	-1.97***	0.67	-0.36**	-0.36*	-0.19	-0.33*	-0.77***	-0.13
(PIR <130%)	(0.58)	(0.76)	(0.81)	(0.18)	(0.20)	(0.39)	(0.17)	(0.24)	(0.37)
Moderate income	-1.73***	-2.28***	0.30	-0.46***	-0.62***	-0.04	-0.63***	-0.84***	-0.28
(130% < PIR < 300%)	(0.58)	(0.86)	(1.19)	(0.17)	(0.20)	(0.38)	(0.15)	(0.28)	(0.35)
Higher income	-2.74***	-3.40***	-1.87*	-0.86***	-0.87***	-0.59	-1.03***	-1.17***	-0.87**
(PIR > 300%)	(0.51)	(0.75)	(1.09)	(0.16)	(0.19)	(0.39)	(0.15)	(0.22)	(0.35)
Non-Hispanic Black									
Eligible nonparticipants	-0.28	0.04	-0.26	0.11	-0.15	0.25	-0.11	0.03	0.02
(PIR <130%)	(1.03)	(0.55)	(1.01)	(0.40)	(0.16)	(0.25)	(0.29)	(0.16)	(0.28)
Moderate income	-0.93	-0.49	0.29	-0.04	-0.17	0.57*	-0.35	-0.07	0.16
(130% < PIR < 300%)	(0.92)	(0.44)	(1.01)	(0.33)	(0.14)	(0.30)	(0.21)	(0.13)	(0.30)
Higher income	-1.23	-1.89**	-1.34	-0.34	-0.42***	-0.09	-0.59**	-0.39**	-0.29
(PIR > 300%)	(1.12)	(0.49)	(1.02)	(0.41)	(0.16)	(0.29)	(0.28)	(0.16)	(0.33)
Mexican-American									
Eligible nonparticipants		-1.11**	0.24		-0.24	0.36		-0.37**	-0.10
(PIR <130%)		(0.48)	(0.97)		(0.22)	(0.34)		(0.18)	(0.31)
Moderate income		-0.90*	-0.64		-0.43**	-0.12		-0.27*	-0.43
(130% < PIR < 300%)		(0.46)	(0.96)		(0.21)	(0.30)		(0.16)	(0.37)
Higher income		-1.69**	-1.04		-0.64***	-0.16		-0.47**	-0.49
(PIR > 300%)		(0.69)	(0.81)		(0.24)	(0.23)		(0.22)	(0.34)

PIR = Poverty Income Ratio, the ratio of household income to the Federal poverty threshold.
Food stamp participants are the reference group for each regression. Regressions also include an intercept and controls for age and age-squared. Variance calculations incorporate the sample weights and account for the complex sample design. Standard errors are reported in parentheses. BMI coefficients are OLS estimates, while overweight/obesity coefficients are logit estimates.
*, **, and *** indicate the coefficient is statistically different from zero with 90%, 95%, and 99% confidence, respectively.

Figure 1

Among Non-Hispanic White women, the body mass index (BMI) of food stamp recipients has remained steady since 1988, while increasing for other groups

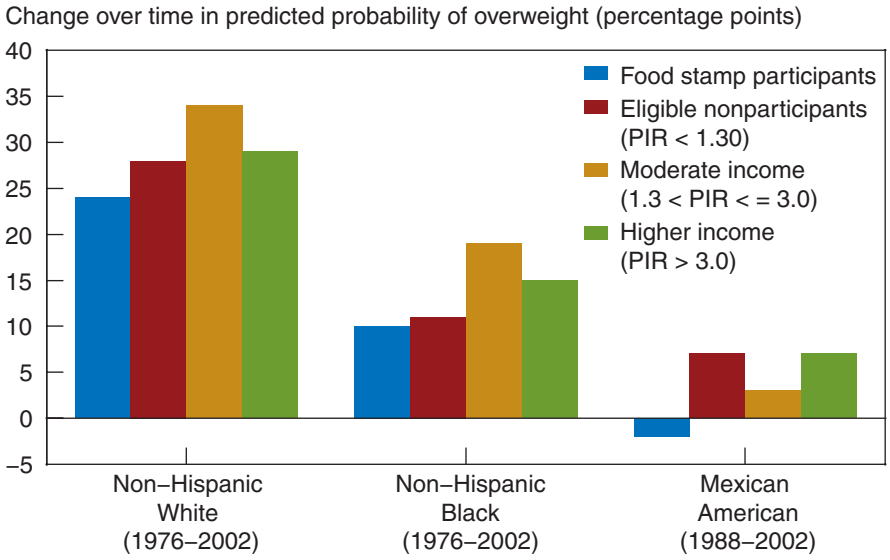


Predicted BMI calculated using regression coefficients assuming age 40. PIR is the ratio of income to the Federal poverty threshold.

Source: Economic Research Service/USDA, using data from National Health and Nutrition Examination Surveys.

Figure 2

Among women, the likelihood of becoming overweight grew the least for food stamp recipients



Predicted BMI calculated using regression coefficients assuming age 40. PIR is the ratio of income to the Federal poverty threshold.

Source: Economic Research Service/USDA, using data from National Health and Nutrition Examination Surveys.

We calculated the mean probability of overweight for each program participation and income group and for each racial/ethnic group and survey period. Figure 2 shows the change in these means between the first survey period (1976-1980) and the last survey period (1999-2002).

For non-Hispanic White and Black women, the greatest increase in the mean probability of overweight occurred among moderate-income women. Food stamp participants showed the smallest increases in the mean predicted probability of overweight.

Male Food Stamp Participants vs. Nonparticipants

Among men, weight differences across income and program participation status have diminished.

Table 3 shows coefficient and standard error estimates for men by race and ethnicity over the three survey periods. For non-Hispanic White men, food stamp participants were similar to income-eligible nonparticipants in terms of BMI for each survey year, except in 1999-2002, when nonparticipants had greater BMI than food stamp participants. When we examine the probability of overweight, we find that in 1988-1994, non-Hispanic White men who received food stamps were significantly less likely to be overweight than eligible nonparticipants and those with incomes above the eligibility limits. However, these differences were no longer present in 1999-2002. No differences in the probability of obesity across income and program participation subgroups were found across all three survey periods for non-Hispanic White men.

Table 3

Adult men: Trends in the association between body weight and food stamp participation, eligibility, and income status

	BMI			Probability of overweight			Probability of obesity		
	1976-80	1988-94	1999-2002	1976-80	1988-94	1999-2002	1976-80	1988-94	1999-2002
Non-Hispanic White									
Eligible nonparticipants	0.30	0.91	3.08**	0.15	0.60**	0.87	0.25	0.16	0.95
(PIR <130%)	(0.46)	(0.63)	(1.38)	(0.18)	(0.31)	(0.55)	(0.30)	(0.29)	(0.59)
Moderate income	0.55	1.39*	2.13	0.29	0.90***	0.97	0.24	0.20	0.72
(130% < PIR < 300%)	(0.36)	(0.72)	(1.49)	(0.19)	(0.33)	0.61)	(0.25)	(0.27)	(0.61)
Higher income	0.41	0.48	1.87	0.28	0.71**	0.99	-0.09	-0.34	0.51
(PIR > 300%)	(0.36)	(0.66)	(1.50)	(0.19)	(0.29)	(0.62)	(0.25)	(0.30)	(0.61)
Non-Hispanic Black									
Eligible nonparticipants	-0.29	0.36	-0.22	-0.50	0.35**	-0.10	-0.42	-0.07	-0.21
(PIR <130%)	(0.92)	(0.48)	(1.46)	(0.35)	(0.17)	(0.53)	(0.52)	(0.21)	(0.59)
Moderate income	0.16	1.08**	0.34	0.16	0.65***	0.09	-0.06	0.36*	-0.09
(130% < PIR < 300%)	(0.62)	(0.45)	(1.75)	(0.30)	(0.15)	(0.56)	(0.38)	(0.19)	(0.66)
Higher income	-0.31	1.35***	1.44	0.17	0.87***	0.46	-0.98**	00.29	0.27
(PIR > 300%)	(0.64)	(0.40)	(1.62)	(0.40)	(0.16)	(0.56)	(0.46)	(0.19)	(0.62)
Mexican-American									
Eligible nonparticipants		-0.99**	1.33		-0.13	-0.04		-0.61***	n/a
(PIR <130%)		(0.41)	(0.83)		(0.22)	(0.78)		(0.19)	
Moderate income		-0.64	1.52		-0.07	-0.16		-0.38**	n/a
(130% < PIR < 300%)		(0.44)	(0.95)		(0.14)	(0.89)		(0.18)	
High income		-0.46	1.94**		-0.06	-0.28		-0.10	n/a
(PIR > 300%)		(0.49)	(0.89)		(0.16)	(0.82)		(0.20)	

PIR = Poverty Income Ratio, the ratio of household income to the Federal poverty threshold.
Food stamp participants are the reference group for each regression. Regressions also include an intercept and controls for age and age-squared. Variance calculations incorporate the sample weights and account for the complex sample design. Standard errors are reported in parentheses. BMI coefficients are OLS estimates, while overweight/obesity coefficients are logit estimates.
*, **, and *** indicate the coefficient is statistically different from zero with 90%, 95%, and 99% confidence, respectively.

For non-Hispanic Black men, differences between food stamp participants and higher income groups disappeared between 1988-94 and 1999-2002. Both moderate-income and higher income non-Hispanic Black men had a greater BMI and were significantly more likely to be overweight than food stamp participants in 1988-94. However, recent data show that non-Hispanic Black men who received food stamp benefits may be catching up in body weight to higher income Black men. The 1999-2002 data show no differences in BMI or the probability of overweight between food stamp participants and other income groups.

Trends in the association between weight and food stamp participation and income for Mexican-American men are different from those of non-Hispanic Black and White men. In 1988-94, food stamp receivers had significantly greater BMI and were significantly more apt to be obese than income-eligible nonparticipants. However, data for Mexican-American men from 1999-2002 show no difference in BMI for food stamp participants and eligible nonparticipants.

School-age Girl Participants vs. Nonparticipants

There is no consistent relationship between food stamp participation and weight for school-age girls.

Table 4 shows the coefficient estimates of BMI and the probabilities of being at risk of overweight or being overweight among school-age girls, after controlling for age, age-squared, food stamp participation, and income. We show only coefficient estimates for the program participation and income variables—in each case, food stamp participants are the reference group. Results are presented separately by race and ethnicity.

Data from 1976-80 and 1988-94 showed that non-Hispanic White girls who received food stamps had significantly greater BMI and were significantly more likely to be overweight than some higher income groups. Specifically, in 1976-80, moderate- and higher income non-Hispanic White girls were less likely to be overweight than non-Hispanic White girls who received food stamp benefits. In 1988-94, only higher income non-Hispanic White girls differed in weight from food stamp participants—they had lower BMI than food stamp participants and were less likely to be at risk of overweight or to be overweight, although the coefficient estimates for these two outcomes are only marginally significant. By 1999-2002, no differences remained between non-Hispanic White girls who received food stamp benefits and nonparticipants of any income.

Results for non-Hispanic Black girls showed few differences in weight status between food stamp program participants and eligible nonparticipants and higher income girls. In the first two survey periods, the only differences

Table 4

Girls ages 5-19: Trends in the association between body weight and food stamp participation, eligibility, and income

	BMI			Probability of being at risk of overweight			Probability of being overweight		
	1976-80	1988-94	1999-2002	1976-80	1988-94	1999-2002	1976-80	1988-94	1999-2002
Non-Hispanic White									
PIR <130%	-0.21	-0.74	0.86	-0.22	-0.34	0.73**	-0.39	-0.27	0.20
	(0.50)	(0.79)	(0.80)	(0.33)	(0.39)	(0.35)	(0.44)	(0.44)	(0.41)
130% < PIR < 300%	-0.46	-0.96	-0.20	-0.39	-0.39	0.27	-0.68**	-0.34	-0.19
	(0.40)	(0.70)	(0.67)	(0.27)	(0.37)	(0.34)	(0.30)	(0.42)	(0.39)
PIR > 300%	-0.57	-1.42**	-0.06	-0.34	-0.58*	0.33	-0.97***	-0.84*	-0.04
	(0.46)	(0.61)	(0.67)	(0.29)	(0.32)	(0.34)	(0.35)	(0.43)	(0.39)
Non-Hispanic Black									
PIR <130%	1.41	0.64	-0.38	0.36	0.34*	-0.17	0.62	0.35	-0.05
	(0.86)	(0.41)	(0.54)	(0.43)	(0.19)	(0.21)	(0.43)	(0.23)	(0.21)
130% < PIR < 300%	0.35	0.45	-0.89***	-0.03	0.14	-0.16	0.11	0.52**	-0.33
	(0.77)	(0.33)	(0.33)	(0.59)	(0.16)	(0.17)	(0.59)	(0.24)	(0.20)
PIR > 300%	-0.18	0.25	0.53	-0.28	0.23	0.19	-0.33	0.32	0.36*
	(0.54)	(0.47)	(0.50)	(0.75)	(0.25)	(0.22)	(0.81)	(0.30)	(0.22)
Mexican-American									
PIR <130%		0.21	-0.30		0.15	-0.03		-0.04	0.09
		(0.33)	(0.59)		(0.17)	(0.25)		(0.22)	(0.29)
130% < PIR < 300%		0.85*	-0.50		0.37	-0.21		0.56	0.00
		(0.48)	(0.55)		(0.24)	(0.18)		(0.36)	(0.26)
PIR > 300%		0.10	-1.65***		0.08	-0.47**		0.23	-0.64*
		(0.46)	(0.58)		(0.22)	(0.22)		(0.38)	(0.35)

PIR = Poverty Income Ratio, the ratio of household income to the Federal poverty threshold.
Food stamp participants are the reference group for each regression. Regressions also include an intercept and controls for age and age-squared. Variance calculations incorporate the sample weights and account for the complex sample design. Standard errors are reported in parentheses. BMI coefficients are OLS estimates, while overweight/obesity coefficients are logit estimates.
*, **, and *** indicate the coefficient is statistically different from zero with 90%, 95%, and 99% confidence, respectively.

between food stamp participants and nonparticipants showed that participants were less likely to be overweight or at risk of overweight than eligible nonparticipants or higher income girls. In the most recent survey period, the directions of the associations changed slightly, but only two estimates are statistically significant. First, the BMI of moderate-income non-Hispanic Black girls is significantly lower than the BMI of food stamp participants. On the other hand, non-Hispanic Black girls from higher income homes are more likely to be overweight than food stamp participants, although this difference is only marginally significant.

For Mexican-American girls, both the 1988-94 and 1999-2002 data show that food stamp participants have the same weight status as eligible nonparticipants. However, unlike the 1988-94 data, recent data show that Mexican-American girls from the highest income bracket have lower BMI and are less likely to be at risk of overweight or to be overweight than Mexican-American girls who receive food stamps.

School-age Boy Participants vs. Nonparticipants

The study found little association between body weight and food stamp participation for school-age boys.

The results for boys are given in table 5. Food stamp participation does not appear to be related to weight status among non-Hispanic White boys. Throughout the three decades studied, food stamp participants had similar BMI and were as likely to be at risk of overweight or to be overweight as both eligible nonparticipants and higher income non-Hispanic White boys. The one divergence was in 1976-80, when non-Hispanic White boys who received food stamps had significantly *lower* BMI than non-Hispanic White boys with moderate income levels (PIR between 130-185 percent of poverty).

The story for non-Hispanic Black boys is somewhat different. In 1976-80, there were no differences in body weight measures among food stamp participants, eligible nonparticipants, and moderate-income nonparticipants. However, higher income non-Hispanic Black boys had greater BMI and were more likely to be at risk of overweight or to be overweight than food stamp participants. But beginning in 1988-1994 and continuing through 1999-2002, the differences between food stamp participants and higher income nonparticipants had disappeared. In the 1999-2002 survey data, the only difference in body weight measures between food stamp participants and all other nonparticipants is that eligible nonparticipants were marginally less likely to be at risk of overweight than food stamp participants. Otherwise, recent data show no differences in weight status among program participants and nonparticipants.

Our results show no associations between body weight and food stamp participation, eligibility, and income level for Mexican-American school-age boys. The 1999-2002 results are, however, sensitive to the use of the household-level food stamp participation variable. Appendix table 3 shows the results of similar estimations using the individual-level measures of current

Table 5

Boys ages 5-19: Trends in the association between body weight and food stamp participation, eligibility, and income

	BMI			Probability of being at risk of overweight			Probability of being overweight		
	1976-80	1988-94	1999-2002	1976-80	1988-94	1999-2002	1976-80	1988-94	1999-2002
Non-Hispanic White									
PIR <130%	0.16	0.45	-0.57	-0.02	0.27	0.01	0.71	-0.03	-0.29
	(0.29)	(0.64)	(0.55)	(0.26)	(0.32)	(0.37)	(0.46)	(0.52)	(0.45)
130% < PIR < 300%	0.36**	-0.24	-0.55	0.28	0.00	-0.17	0.38	-0.26	-0.19
	(0.18)	(0.64)	(0.59)	(0.25)	(0.37)	(0.33)	(0.44)	(0.44)	(0.47)
PIR > 300%	-0.14	-0.59	-0.85	-0.01	-0.40	-0.48	-0.11	-0.60	-0.42
	(0.21)	(0.60)	(0.57)	(0.28)	(0.34)	(0.32)	(0.51)	(0.38)	(0.42)
Non-Hispanic Black									
PIR <130%	0.10	0.43	-0.38	0.28	0.38	-0.34*	1.14	0.72**	0.22
	(0.49)	(0.55)	(0.29)	(0.39)	(0.27)	(0.18)	(0.75)	(0.32)	(0.26)
130% < PIR < 300%	0.08	-0.05	0.18	0.05	0.14	-0.01	0.69	0.10	0.08
	(0.36)	(0.31)	(0.42)	(0.37)	(0.15)	(0.21)	(0.68)	(0.24)	(0.25)
PIR > 300%	2.42**	0.23	0.29	1.67***	0.14	0.07	2.77**	0.17	0.28
	(1.04)	(0.41)	(0.57)	(0.55)	(0.21)	(0.20)	(1.16)	(0.34)	(0.32)
Mexican-American									
PIR <130%		0.05	-0.54		0.00	-0.14		0.40	-0.27
		(0.46)	(0.51)		(0.27)	(0.16)		(0.34)	(0.19)
130% < PIR < 300%		0.20	0.06		0.00	0.10		0.31	-0.03
		(0.53)	(0.57)		(0.25)	(0.19)		(0.29)	(0.23)
PIR > 300%		0.58	-0.66		0.32	0.04		0.73*	-0.24
		(0.52)	(0.52)		(0.26)	(0.21)		(0.38)	(0.29)

PIR = Poverty Income Ratio, the ratio of household income to the Federal poverty threshold.
Food stamp participants are the reference group for each regression. Regressions also include an intercept and controls for age and age-squared. Variance calculations incorporate the sample weights and account for the complex sample design. Standard errors are reported in parentheses. BMI coefficients are OLS estimates, while overweight/obesity coefficients are logit estimates.
*, **, and *** indicate the coefficient is statistically different from zero with 90%, 95%, and 99% confidence, respectively.

food stamp receipt in 1999-2002. These estimates show that Mexican-American boys who received food stamps had greater BMI and were more likely to be at risk of overweight or to be overweight than eligible nonparticipants. They had greater BMI and were also more likely to be overweight than moderate and higher income Mexican-American boys.

Child Participants Ages 2-4 vs. Nonparticipants

Recent data show that children who receive WIC have similar weight to eligible nonparticipants.

Young children participating in WIC have BMI and probabilities of being at risk of overweight similar to those of eligible nonparticipants. This is true for both boys and girls and for both survey periods for which data are available. Coefficient estimates for models predicting BMI and the probability of risk of overweight for children ages 2 to 4 are given in tables 6 and 7.

The recent data show some differences between WIC participants and higher income children that were not present in 1988-94. In 1999-2002, boys from higher income families had significantly lower BMI and were significantly less likely to be at risk of overweight than WIC-participating

Table 6

Young children ages 2-4: Differences in BMI by race/ethnicity and program participation/income status

Independent variables	1988-94	1999-2002
Boys, ages 2-4		
Race/ethnicity (non-Hispanic White is reference)		
Non-Hispanic Black	0.09	-0.12
	(0.14)	(0.16)
Mexican-American	0.51***	0.26*
	(0.13)	(0.16)
Income/eligibility category		
(WIC recipients are the reference group)		
Eligible nonparticipants	-0.01	0.20
(PIR<=185%)	(0.17)	(0.22)
Moderate income	-0.00	0.02
(185% < PIR <= 300%)	(0.24)	(0.22)
High income	-0.20	-0.41***
(300% < PIR)	(0.23)	(0.15)
Girls, ages 2-4		
Race/ethnicity (non-Hispanic White is reference)		
Non-Hispanic Black	-0.06	0.01
	(0.12)	(0.17)
Mexican-American	0.43***	0.33
	(0.14)	(0.21)
Income/eligibility category		
(WIC recipients are the reference group)		
Eligible nonparticipants	0.11	0.03
(PIR<=185%)	(0.13)	(0.15)
Moderate income	0.07	0.08
(185% < PIR <= 300%)	(0.12)	(0.24)
Higher income	0.16	-0.04
(300% < PIR)	(0.17)	(0.26)

PIR = Poverty Income Ratio, the ratio of household income to the Federal poverty threshold.
Each model includes an intercept and the child's age. Children receiving WIC benefits are the reference group in each model. BMI coefficients are OLS estimates, while at-risk-of-overweight coefficients are logit estimates. Variance calculations incorporate the sample weights and account for the complex sample design. Standard errors are reported in parentheses.

* Indicates the coefficient is statistically significantly with 5% P-value < 10%.

** Indicates the coefficient is statistically significantly with 1% P-value<5%.

*** Indicates the coefficient is statistically significantly with P-value 1%.

boys. Girls show no differences in BMI across WIC participation and income status. In 1988-94, moderate-income girls were *more* likely than WIC participants to be at risk of overweight. However, this difference was not present in 1999-2002.

We do not have a large enough sample of 2- to 4-year-old children to make separate estimates by race/ethnicity, but we do include dummy variables for race/ethnicity in each equation. Mexican-American girls consistently have greater BMI and are more likely to be at risk of overweight than non-Hispanic White girls. This is true for both survey periods. BMI for non-Hispanic White and Black girls is similar for both survey periods. However, the most recent data show that non-Hispanic Black girls are significantly more likely to be at risk of overweight than non-Hispanic White girls.

Table 7

Young children ages 2-4: Logit coefficient estimates of the probability of at-risk of overweight

Independent variables	1988-94	1999-2002
Boys, ages 2-4		
Race/ethnicity (non-Hispanic White is reference)		
Non-Hispanic Black	0.26	-0.48
	(0.26)	(0.33)
Mexican-American	0.98***	-0.20
	(0.24)	(0.31)
Income/eligibility category		
(WIC recipients are the reference group)		
Eligible nonparticipants	-0.22	-0.07
(PIR<=185%)	(0.30)	(0.30)
Moderate income	-0.01	-0.12
(185% < PIR <= 300%)	(0.37)	(0.47)
High income	-0.32	-0.75**
(300% < PIR)	(0.42)	(0.33)
Girls, ages 2-4		
Race/ethnicity (non-Hispanic White is reference)		
Non-Hispanic Black	-0.04	0.66
	(0.20)	(0.32)
Mexican-American	0.65***	0.76
	(0.24)	(0.30)
Income/eligibility category		
(WIC recipients are the reference group)		
Eligible nonparticipants	0.42	0.36
(PIR<=185%)	(0.28)	(0.30)
Moderate income	0.55**	0.43
(185% < PIR <= 300%)	(0.25)	(0.53)
Higher income	0.17	0.61
(300% < PIR)	(0.39)	(0.47)

PIR = Poverty Income Ratio, the ratio of household income to the Federal poverty threshold.

Each model includes an intercept and the child's age. Children receiving WIC benefits are the reference group in each model. BMI coefficients are OLS estimates, while at-risk-of-overweight coefficients are logit estimates. Variance calculations incorporate the sample weights and account for the complex sample design. Standard errors are reported in parentheses.

* Indicates the coefficient is statistically significantly with 5% P-value < 10%.

** Indicates the coefficient is statistically significantly with 1% P-value<5%.

*** Indicates the coefficient is statistically significantly with P-value 1%.

While Mexican-American boys were more likely to be at risk of overweight and had higher BMI than non-Hispanic White boys in 1988-94, these differences were not present in 1999-2002. There were no differences between non-Hispanic Black and White boys in both weight status measures over both survey periods.

Conclusions

Our comparisons of adult food stamp participants with income-eligible nonparticipants using the most recent NHANES data show no significant relationship between food stamp participation and weight status. Consistent with other work (Chang and Lauderdale, 2005), we find that the problems of overweight and obesity are affecting an increasingly wider swath of the U.S. population. Rates of overweight and obesity among moderate and higher income women are catching up to those of lower income women who receive food stamps, a substantial turnaround from previous years. Rates of overweight status among lower income non-Hispanic Black and White men who receive food stamps appear to be approaching those of men with higher incomes.

We also find an inconsistent association between Food Stamp Program participation and weight for school-age children. Data from the late 70s through the mid 90s showed only a few differences in BMI and at-risk-of-overweight or overweight status for food stamp participants compared with eligible nonparticipants. Data from early years also showed that, among certain subgroups, food stamp participants were less likely to have weight problems. The most recent data also show no consistent relationship between weight and food stamp participation for most subgroups.

However, two results are noted with respect to children. First, the trend analysis for non-Hispanic Black boys shows that food stamp participants have caught up and passed eligible nonparticipants in their likelihood of being at risk of overweight, although there is no significant difference between non-Hispanic Black boys and boys with higher household income. Second, we note that 1999-2002 results for Mexican-American school-age children are particularly sensitive to the food stamp participation variable used. The sensitivity of these results suggests potential problems with using the 1999-2002 NHANES food stamp participation measures, particularly for this subgroup.

Our results also suggest that children who participate in WIC are no more likely to be at risk of overweight or have greater BMI than income-eligible nonparticipants. Further, the weight status of WIC participants is similar to that of higher income children with one exception: higher income (PIR>300 percent) boys are less likely to be at risk of overweight and have lower BMI than WIC participants. One area for concern among young children is that Mexican-American girls are more likely to be at risk of overweight than non-Hispanic White girls, regardless of their WIC participation and income status.

While previous studies have somewhat consistently shown that food stamp participation is positively related to BMI and overweight/obesity among women, we find that recent data show few differences in BMI and the probabilities of overweight and obesity between food and nutrition assistance program participants and nonparticipants. Further, we find that this relationship has varied across race and ethnicity.

The bad news, however, is that mean BMI and probability of overweight and obesity are still very high among adult female food stamp participants. The gap between food stamp participants and nonparticipants has closed not because food stamp participants have lost weight, but because nonparticipants have caught up in weight with food stamp participants. As more and more Americans face the health risks of overweight and obesity, policymakers are beginning to consider possible policy interventions. The Food Stamp and WIC Programs are two policy tools that could be used to remedy weight problems for those who are eligible and choose to participate. Expanding nutrition education through the Food Stamp and WIC Programs, or providing incentives to buy more fruits and vegetables—such as the incentives recommended by the Institute for Medicine (2005) and proposed by the USDA for the WIC program—are changes that could be considered.

The rates of overweight and obesity in the United States have risen to levels that warrant comprehensive evaluation of the causes of this problem, along with consideration of possible policy interventions to combat it. Although the methods of our analysis do not allow us to rule out the possibility that food and nutrition assistance program participation contributes to overweight/obesity, our results cast doubt on the hypothesis that food and nutrition assistance programs are major contributors.

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Appendix: Alternative Estimates for School-age Children Using an Individual Food Stamp Participation Variable

The 1999-2002 NHANES survey asks a series of questions regarding a household's and individual sample member's participation in the Food Stamp Program. The questions cover the household's food stamp receipt in the past 12 months, individual sample member's food stamp receipt in the past 12 months, and individual sample member's receipt of food stamp benefits currently.

If underreporting were not a problem, we would prefer to use responses to the question about an individual sample member's current participation status, because the question covers the individual unit of observation and current, not past, benefit receipt. However, the total number of individuals receiving food stamps, as measured by the 1999-2002 NHANES survey, significantly underrepresents the total from administrative records. Weighted counts of individuals in the survey currently receiving food stamp benefits are only 59 percent of totals from administrative records from the Food Stamp Program, averaged over the 4 years of the survey, a problem that seems especially pronounced among children (Fox and Cole, 2005). Because of this underreporting, we have chosen to use the household-level measure of food stamp participation for school-age children.

In this appendix, we compare total counts of the number of children who receive food stamps across these two measures of food stamp participation (Appendix table1). We also provide estimates of BMI, and the probability of being at-risk of overweight and overweight as a function of food stamp participation, using the individual measure of Food Stamp Program participation (Appendix tables 2 and 3).

Appendix table 1

Household vs. individual food stamp participation counts for school-age children (ages 5-19), 1999-2002 NHANES

Household food stamp participants	Individual food stamp participation status		Percent of household participants who are not individual participants
	Participant	Nonparticipant	
Non-Hispanic White	32	92	74.2
Non-Hispanic Black	238	331	58.2
Mexican-American	72	232	76.3
TOTAL	342	655	

Note: Household food stamp participation is measured as receipt of food stamps in the last 12 months, while individual food stamp participation is current receipt. Further, all children reporting current individual participation lived in households that reported participation in the last 12 months (i.e., all household nonparticipants were individual nonparticipants).

Appendix table 2

Differences in BMI and the probability of being at risk of overweight and overweight—girls ages 5-19, individual food stamp participation measure

	BMI			Probability of being at risk of overweight			Probability of being overweight		
	1976-80	1988-94	1999-2002	1976-80	1988-94	1999-2002	1976-80	1988-94	1999-2002
Non-Hispanic White									
PIR <130%	-0.21	-0.74	-0.33	-0.22	-0.34	0.23	-0.39	-0.27	-0.53
	(0.50)	(0.79)	(1.20)	(0.33)	(0.39)	(0.57)	(0.44)	(0.44)	(0.64)
130% < PIR < 300%	-0.46	-0.96	-1.19	-0.39	-0.39	-0.13	-0.68**	-0.34	-0.87
	(0.40)	(0.70)	(1.18)	(0.27)	(0.37)	(0.55)	(0.30)	(0.42)	(0.62)
PIR > 300%	-0.57	-1.42**	-1.05	-0.34	-0.58*	-0.04	-0.97***	-0.84*	-0.71
	(0.46)	(0.61)	(1.16)	(0.29)	(0.32)	(0.55)	(0.35)	(0.43)	(0.58)
Non-Hispanic Black									
PIR <130%	1.41	0.64	0.03	0.36	0.34*	0.10	0.62	0.35	0.27
	(0.86)	(0.41)	(0.60)	(0.43)	(0.19)	(0.28)	(0.43)	(0.23)	(0.24)
130% < PIR < 300%	0.35	0.45	-0.73	-0.03	0.14	-0.04	0.11	0.52**	-0.06
	(0.77)	(0.33)	(0.59)	(0.59)	(0.16)	(0.22)	(0.59)	(0.24)	(0.26)
PIR > 300%	-0.18	0.25	0.72	-0.28	0.23	0.34	-0.33	0.32	0.56*
	(0.54)	(0.47)	(0.75)	(0.75)	(0.25)	(0.30)	(0.81)	(0.30)	(0.31)
Mexican-American									
PIR <130%		0.21	-0.29		0.15	-0.15		-0.04	0.55
		(0.33)	(1.36)		(0.17)	(0.48)		(0.22)	(0.48)
130% < PIR < 300%		0.85*	-0.49		0.37	-0.32		0.56	0.46
		(0.48)	(1.31)		(0.24)	(0.46)		(0.36)	(0.46)
PIR > 300%		0.10	-1.64		0.08	-0.56		0.23	-0.20
		(0.46)	(1.39)		(0.22)	(0.50)		(0.38)	(0.52)

PIR = Poverty Income Ratio, the ratio of household income to the Federal poverty threshold.

Food stamp participants are the reference group for each regression. Regressions also include an intercept and controls for age and age-squared. Variance calculations incorporate the sample weights and account for the complex sample design. Standard errors are reported in parentheses. BMI coefficients are OLS estimates, while at-risk-of-overweight/overweight coefficients are logit estimates.

*, **, and *** indicate the coefficient is statistically different from zero with 90%, 95%, and 99% confidence, respectively.

Appendix table 3

Differences in BMI and the probability of being at risk of overweight and overweight—boys ages 5-19, individual food stamp participation measure

	BMI			Probability of being at risk of overweight			Probability of being overweight		
	1976-80	1988-94	1999-2002	1976-80	1988-94	1999-2002	1976-80	1988-94	1999-2002
Non-Hispanic White									
PIR <130%	0.16	0.45	0.26	-0.02	0.27	1.04	0.71	-0.03	-0.07
	(0.29)	(0.64)	(1.10)	(0.26)	(0.32)	(0.70)	(0.46)	(0.52)	(0.74)
130% < PIR < 300%	0.36**	-0.24	0.13	0.28	0.00	0.87	0.38	-0.26	-0.07
	(0.18)	(0.64)	(1.09)	(0.25)	(0.37)	(0.70)	(0.44)	(0.44)	(0.71)
PIR > 300%	-0.14	-0.59	-0.17	-0.01	-0.40	0.55	-0.11	-0.60	-0.27
	(0.21)	(0.60)	(1.11)	(0.28)	(0.34)	(0.70)	(0.51)	(0.38)	(0.74)
Non-Hispanic Black									
PIR <130%	0.10	0.43	-0.24	0.28	0.38	-0.62***	1.14	0.72**	-0.06
	(0.49)	(0.55)	(0.29)	(0.39)	(0.27)	(0.18)	(0.75)	(0.32)	(0.27)
130% < PIR < 300%	0.08	-0.05	0.20	0.05	0.14	-0.35	0.69	0.10	-0.04
	(0.36)	(0.31)	(0.34)	(0.37)	(0.15)	(0.23)	(0.68)	(0.24)	(0.30)
PIR > 300%	2.42**	0.23	0.27	1.67***	0.14	-0.26	2.77**	0.17	0.18
	(1.04)	(0.41)	(0.49)	(0.55)	(0.21)	(0.21)	(1.16)	(0.34)	(0.31)
Mexican-American									
PIR <130%		0.05	-2.04**		0.00	-0.62**		0.40	-0.96***
		(0.46)	(0.96)		(0.27)	(0.31)		(0.34)	(0.26)
130% < PIR < 300%		0.20	-1.50		0.00	-0.40		0.31	-0.72**
		(0.53)	(1.06)		(0.25)	(0.32)		(0.29)	(0.34)
PIR > 300%		0.58	-2.19**		0.32	-0.44		0.73*	-0.94***
		(0.52)	(0.88)		(0.26)	(0.27)		(0.38)	(0.29)

PIR = Poverty Income Ratio, the ratio of household income to the Federal poverty threshold.

Food stamp participants are the reference group for each regression. Regressions also include an intercept and controls for age and age-squared. Variance calculations incorporate the sample weights and account for the complex sample design. Standard errors are reported in parentheses. BMI coefficients are OLS estimates, while overweight/obesity coefficients are logit estimates.

*, **, and *** indicate the coefficient is statistically different from zero with 90%, 95%, and 99% confidence, respectively.