United States Department of Agriculture

Economic Research Service

Economic Information Bulletin Number 188

February 2018

Nutritional Quality of Foods Acquired by Americans: Findings From USDA's National Household Food Acquisition and Purchase Survey

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

United States Department of Agriculture

Economic Research Service
www.ers.usda.gov

Recommended citation format for this publication:

Lisa Mancino, Joanne Guthrie, Michele Ver Ploeg, and Biing-Hwan Lin. *Nutritional Quality of Foods Acquired by Americans: Findings From USDA's National Household Food Acquisition and Purchase Survey,* EIB-188, U.S. Department of Agriculture, Economic Research Service, February 2018.

United States Department of Agriculture

Economic Research Service

Economic Information Bulletin Number 188

February 2018

Nutritional Quality of Foods Acquired by Americans: Findings From USDA's National Household Food Acquisition and Purchase Survey

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

Abstract

We use data from the USDA's National Household and Food Acquisition and Purchase Survey to describe the nutritional quality of foods purchased and acquired by a nationally representative sample of Americans. We compare the nutritional quality of foods purchased and acquired by households that participate in USDA's Supplemental Nutrition Assistance Program (SNAP) to the foods of other low-income, SNAP-nonparticipating households and those of higher income households. We also compare the nutritional quality of foods purchased and acquired by households with low access to healthy food retailers to households with better access, for the population as a whole, and for the SNAP-participating and -nonparticipating subgroups previously described. Similarly, we compare nutritional quality of foods obtained from supermarkets and other grocery retailers to foods prepared away from home at restaurants, fast-food establishments, schools, and other sources for the whole population and for defined subgroups. We find that lower nutritional quality of household food acquisitions was associated with SNAP participation status and limited household access to healthy food retailers. More reliance on food prepared away from home was also associated with lower nutritional quality, especially for higher income households.

Keywords: FoodAPS, food purchasing, SNAP, food store access, food away from home, food at home, Healthy Eating Index-2010, nutrition quality

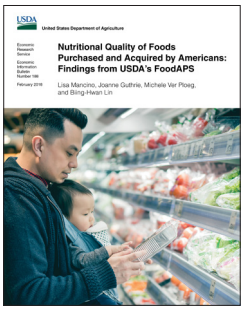
Acknowledgments

The authors thank peer reviewers Travis Smith, University of Georgia; Lorenzo Almada, Georgia State University; Andrea Carlson, USDA, ERS; and Michael Burke, USDA, Food and Nutrition Service, for their comments. Jean Buzby, Dave Smallwood, and Diansheng Dong, USDA, ERS, provided helpful guidance and review. Thanks also to Maria Williams and Ethiene Salgado-Rodriguez of ERS for editing and design assistance.

Contents

United States Department of Agriculture

A report summary from the Economic Research Service *February 2018*



Nutritional Quality of Foods Acquired by Americans: Findings From USDA's National Household Food Acquisition and Purchase Survey

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

What Is the Issue?

Health experts widely agree that Americans' high rates of obesity and diet-related illnesses—including cardiovascular disease and type 2 diabetes—are serious public health concerns. However, policymakers lack agreement on how best to tackle these issues. Because food choices shape dietary patterns over time, understanding the economic and environmental factors that drive these choices can help clarify directions for public education and policy efforts.

In this report, we examine the nutritional quality of foods purchased and acquired and how nutritional quality varies across population subgroups defined by income and by participation in USDA's Supplemental Nutrition Assistance Program (SNAP, formerly called the Food Stamp Program). We also examine differences in nutritional quality by households' access to food retailers, and differences by purchase source (e.g., supermarkets and other grocery sources versus restaurants and other sources primarily selling already prepared foods).

We assess the nutritional quality of households' acquired foods using the Healthy Eating Index-2010 (HEI-2010), a measure based on how well the mix of foods acquired compares to recommendations from the USDA's 2010 *Dietary Guidelines for Americans*. Looking at the foods that households acquired over 1 week, we break down dietary quality by the following subgroups: SNAP participants, low-income nonparticipants, and higher income nonparticipants; food sources (i.e., grocery stores, restaurants, school meal programs, etc.); and access to supermarkets, supercenters, or large grocery stores (by two separate measures—one at the neighborhood level and the other at the household level).

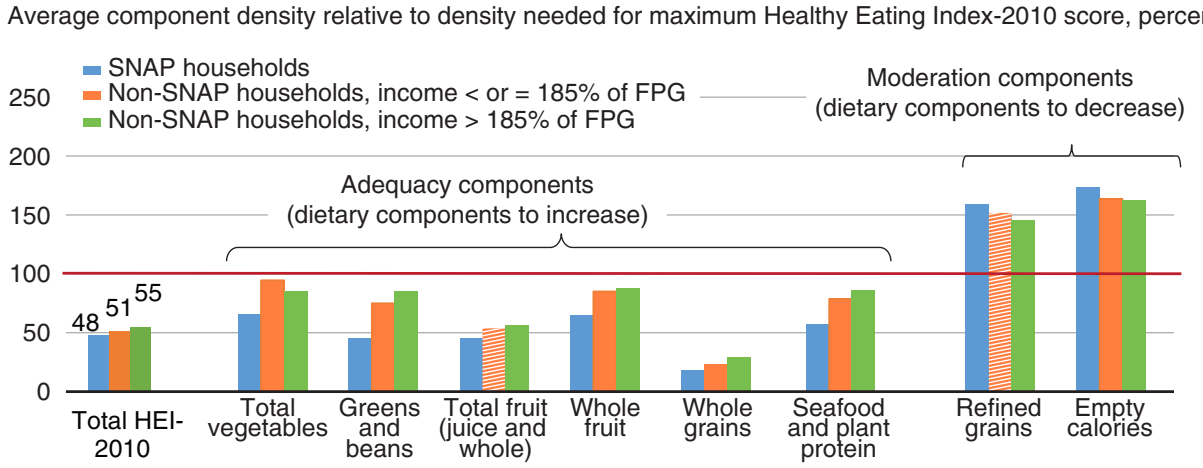
What Did the Study Find?

- The nutritional quality of foods purchased or otherwise acquired by the overall population scored 53 out of 100 points using USDA's HEI-2010 measure. National estimates of the HEI-2010 of foods consumed by Americans are also low, suggesting that the eating habits of Americans are far from those recommended by the *Dietary Guidelines for Americans* and that changes in food purchasing and acquisition patterns will be key to diet improvements.

- SNAP-participating households had lower HEI-2010 scores than both low-income nonparticipating and higher income households. However, these findings do not prove a causal link between SNAP participation and low diet quality because we did not control for the many ways SNAP-participating households differ from non-participating households, such as age, household composition, and education.

Figure

Nutritional quality of household food acquisitions by SNAP participation and income



Notes: Dashed bars indicate difference from SNAP-participating households is not statistically significant from those of SNAP-nonparticipating households at p <0.05. SNAP = Supplemental Nutrition Assistance Program. HEI-2010 = Healthy Eating Index-2010. FPG = Federal poverty guidelines.

Source: USDA, Economic Research Service (ERS) estimates using data from USDA's National Household Food Acquisition and Purchase Survey (FoodAPS).

- Households with low household-level access to food retail sources had lower HEI-2010 scores than households with better food store access. However, when analysis was limited to SNAP-participating households, total HEI-2010 scores and component densities (another metric relating to the *Dietary Guidelines for Americans*) did not differ by food store access.

- Across all income groups, acquisitions from food-away-from-home (FAFH) sources were of lower nutritional quality than those from food-at-home (FAH) sources, such as grocery stores, supermarkets, and supercenters. However, for higher income households, the difference in nutritional quality between FAFH and FAH was greater than it was for SNAP-participating households, possibly reflecting that higher income households acquired more FAFH from restaurants or fast-food sources (with relatively low nutritional quality); whereas SNAP-participating households acquired more of their FAFH from sources such as school meals or meals with friends and family (with relatively high nutritional quality).

How Was the Study Conducted?

This study was conducted using data from USDA's National Household Food Acquisition and Purchase Survey (FoodAPS)—a nationally representative survey of noninstitutionalized households in the continental United States. It oversamples four subpopulations: SNAP participants and nonparticipating households in three income levels—(1) less than the Federal poverty guidelines (FPG); (2) between 100 and less than 185 percent of the FPG; (3) and greater than or equal to 185 percent of the Federal poverty level. This survey collected detailed information on all foods purchased or otherwise acquired (school meals; food pantry donations; gardening, hunting, and other home food production; gifts or meals with friends or family, etc.). Analyses were conducted using survey-provided weights to generate representative estimates. We also accounted for survey design in our statistical comparisons across subpopulations.

Nutritional Quality of Foods Acquired by Americans: Findings From USDA's National Household Food Acquisition and Purchase Survey

Introduction

High rates of obesity and diet-related illnesses among Americans are widely recognized by health experts as serious public health concerns (Centers for Disease Control and Prevention, 2016). Unhealthy dietary patterns are strongly associated with cardiovascular disease and moderately associated with type 2 diabetes and early morbidity (Dietary Guidelines Advisory Committee, 2015). Unfortunately, there is little agreement on how best to tackle the issue. Because dietary patterns are simply the product of our food choices and purchases over time, understanding the economic and environmental factors that drive these choices is a necessary first step toward informing public nutrition education and policy efforts aimed at dietary improvement.

USDA's National Household Food Acquisition and Purchase Survey (FoodAPS) is the first survey to collect comprehensive data about food purchases and acquisitions from grocery stores, other food retailers, and from eating places, as well as the distances shoppers travel to shop for food and how they travel to get there. These data are collected from a national sample of households and include an over-sampling[1] of households that participate in USDA's Supplemental Nutrition Assistance Program (SNAP) and other low-income households. Data include detailed information about purchases and acquisitions of individual food items, including whether they are purchased from retail stores for home consumption or from commercial eating establishments, or whether they are acquired free of charge from food and nutrition assistance programs or food pantries or from friends and relatives. Extant data on the local food environment—food store access, food prices, and other neighborhood characteristics—are also matched to FoodAPS survey respondents. This wealth of information provides an unprecedented opportunity to construct a more detailed picture of Americans' food shopping habits and the factors that influence them, with a special emphasis on low-income Americans and those participating in SNAP.

Previous FoodAPS analyses have examined where people acquire food, how they travel to the stores, how far they travel, and how much they spend for each shopping trip at different venues (Ver Ploeg et al., 2015; Todd and Scharadin, 2016; Tiehen et al., 2017). Here, we extended those analyses to examine the nutritional quality of foods purchased and acquired and how nutritional quality varies across population subgroups defined by income and by participation in SNAP. We also examined differences in nutritional quality by households' access to food retailers, and differences by purchase source (e.g., supermarkets and other grocery sources versus restaurants and other sources primarily selling already prepared foods). Understanding whether and how nutritional quality varies by consumer characteristics, households' mix of at-home and away-from-home food sources, and

[1]The survey included a large number of SNAP participants and other low-income households, disproportionate to their population share (known as oversampling).

households' food environment has implications for increasing the effectiveness of nutrition education and other efforts to help Americans improve their diets and health and generate hypotheses for indepth analyses.

We used the USDA's Healthy Eating Index (HEI-2010) as our criterion for assessing nutritional quality. Composed of 12 components based on consumption of various foods or nutrients, the HEI-2010 is designed to assess how well dietary patterns align with Federal recommendations found in the *Dietary Guidelines for Americans.* Each component assigns a range of scores, and the 12 component scores sum to 100. Each component's score is determined by the amount of a food or nutrient per 1,000 calories from the component (called component density), which is then compared to the recommendations from the *Dietary Guidelines for Americans.* While this measure is typically used to measure individuals' dietary intakes, it has also been adapted to assess the nutritional quality of menus and the food supply (http://www.cnpp.usda.gov/healthyeatingindex). Here we applied it to assess the nutritional quality of foods purchased and acquired by households over a week. In all HEI-2010 calculations, we calculated household-level component densities and total HEI-2010 score and then estimate averages among population subgroups.

Multiple Factors Influence Food Choice

Numerous factors may pose barriers to healthy food choices. Among those of keen policy interest are household income; access to food retailers that offer a wide variety of healthy, affordable foods; and individuals' awareness of diet and health. SNAP provides low-income Americans with economic assistance to purchase a nutritionally adequate diet. It is the largest of the Federal food and nutrition assistance programs and served more than 44 million Americans each month in fiscal year 2016 (Oliveira, 2017). Evidence shows that SNAP benefits help alleviate poverty (Tiehen et al., 2012) and food insecurity among participating households (Mykerezi and Mills, 2011; Nord, 2013; Nord and Prell, 2011; Ratcliffe et al., 2011; and Yen et al., 2008). However, as with most Americans, the dietary patterns of SNAP participants show room for improvement, with adult participants typically under-consuming fruits, vegetables, whole grains, and other healthy foods, while consuming excess calories from solid fats and added sugars, which contribute to obesity (Mancino and Guthrie, 2014; Gregory et al., 2013).

There are reasons to suspect that lack of access to food retailers that sell a wide range of healthy and affordable foods may also contribute to lower diet quality and diet-related health. Research suggests that 88 percent of Americans drive their cars to shop for groceries. However, fewer lower income households (than higher income households) use their own cars to shop for groceries and a greater share ride with others, borrow someone else's car, or walk, bike, or take public transit. Further, the average consumer—even lacking a car—bypasses the nearest store to shop at another store (Ver Ploeg et al., 2015).

These findings suggest that store characteristics and prices are more important than store proximity in determining where to shop. Lin et al. (2014) find that prices for broad categories of food were more important determinants of demand for healthy foods than store access for a sample of SNAP participants. Among these 13 broad food categories, store access mattered for only 1 food group—noncanned fruits and vegetables. Rahkovsky and Snyder (2015) find that living in low-income and low-store-access areas had only a small effect on the healthfulness of food purchases by a national sample. These effects did not change much when those in low-access areas drove farther to reach a supermarket, suggesting that other factors, such as income, education, prices, and preferences are bigger determinants of food choices than access.

Two studies have used a quasi-experimental design to study how food shopping and diet change when a new supermarket enters an underserved community. One study finds no change in consumption of fruits and vegetables and other important foods (Cummins et al., 2014). The other finds some aspects of dietary quality improved while others got worse, but that the changes in diet quality were not associated with regular use of the new store—the diets of residents who used the new store resembled those of residents who did not use the new store (Dubowitz et al., 2015). To improve understanding of the relationship among food store access, food purchase, and diet, we examined how both individual- and neighborhood-level measures of food store access relate to the types of stores visited and the nutritional quality of foods acquired.

Most consumers acquire foods from multiple sources—supermarkets, convenience stores, full-service and fast-food restaurants, and other sources. How nutritional quality relates to acquisition sources is of interest, particularly differences between foods prepared at home and those prepared away from home. Consumption of food prepared away from home (FAFH), especially fast food, has been frequently investigated as a contributor to obesity trends among children—perhaps, partly

because obesity rates have increased as consumers increased their reliance on FAFH. (See Mancino et al. (2014) for a summary.) As a share of total food expenditures, households' spending on FAFH increased from roughly 32 percent in 1980 to just over 43.7 percent in 2014[2] (ERS Food Expenditure Series, 2016).

FAFH, and fast food in particular, is often served in larger portions (Young and Nestle, 2002; Young and Nestle, 2003; Piernas and Popkin, 2011) and tends to have lower nutritional quality than foods prepared at home (FAH) (Lin and Guthrie, 2012). Packaged food purchased for home preparation has carried nutrition labeling since the mid-1990s, whereas at the time our data were collected, there was no Federal requirement for nutritional labeling for FAFH. Differences in the nutritional composition of FAFH and FAH may reflect information, preference, or availability factors.

[2]ERS provides two datasets of the FAFH share of food expenditure that are differentiated by the definition of FAFH food expenditures. The shares used here were derived by including away-from-home meals and snacks purchased by families and individuals and food furnished to employees. ERS's other dataset counts the expenditures from expense-account meals, food furnished to inmates and patients, and cash donated to schools and institutions toward FAFH expenditure; its share of total food dollars is estimated to be 48.5 percent in 2008 and 50.1 percent in 2014.

Data and Empirical Approach

The National Household Food Acquisition and Purchase Survey (FoodAPS) is a comprehensive, nationally representative survey of food purchases and acquisitions and shopping behaviors of U.S. households (USDA, ERS, 2015). The survey, fielded between April 2012 and January 2013, collected detailed information from household food purchases and acquisitions over a 7-day period, along with information about the sociodemographic characteristics, food shopping patterns, diet and health knowledge, and the economic well-being of sampled households.

The survey is designed to provide data on food spending and shopping decisions to inform key policy-relevant questions, such as the following: How do the food choices of households that receive SNAP benefits compare with food choices of other low-income households? What is the role of food store access on food shopping behavior and food choices? Does the correlation between access and choice of food outlet differ by income and SNAP participation? And do the effects of access or food outlet differ by SNAP participation and income? To address these questions, this report uses interview data along with event and item-level data on the types of food outlets visited during the survey week, the distances to food stores from the respondents' homes, and the nutrient content of food items acquired.

Survey Sample, Subgroups, and Outcome Measures

The primary respondent (PR) for each household—the main food shopper or meal planner—provided information about the household and individuals in the household through two in-person interviews, one conducted at the beginning of the 7-day data collection period and the other after its conclusion. During the first interview, the household PR was trained to record food acquisitions over the 7-day data collection period. In addition, each household member age 11 years and older was asked to track and report all of his or her food acquisitions during that period in specially prepared booklets. The PR was also asked to call the telephone center three times during the week to report events. The interviewer visited the home again for a final interview and also collected all food booklets. Most final interviews were conducted the day after the food reporting was completed. A total of 4,826 households completed the FoodAPS survey.

SNAP Participation

The sampling plan divided the population into subgroups based on income and SNAP participation status. FoodAPS oversampled SNAP and three nonparticipant groups defined by household income relative to the Federal poverty guidelines (FPG) for family size. SNAP participation status in the prior 30 days is determined by both survey responses and matches to administrative records.[3] To be consistent with previous reports using FoodAPS (Todd and Scharadin, 2016), we further divided nonparticipants into two groups based on their monthly household income relative to the FPG—those with income at or below 185 percent of the FPG and those with incomes above 185 percent.

[3]For respondents who consented to have SNAP administrative records matched to their survey responses (97.5 percent of the sample), the administrative record was used to determine participation status in the case of any discrepancy. For the 122 households that did not consent, the survey response was used to determine participation status. This means that some portion of these households may have been incorrectly classified as SNAP participants, which may lessen the accuracy of estimated differences between SNAP and non-SNAP households.

Food Sources

When FoodAPS respondents acquired food, they also recorded information about where the food was acquired. Place names and locations were then matched to information about retailers or restaurants in extant data sources, including directories of stores authorized to accept SNAP benefits and proprietary directories of food retailers and restaurants. We further differentiated by the variety of food products available or the types of food served. FAH sources were further broken down as follows: (1) large grocery stores;[4] (2) small and specialty stores (such as farmers markets, seafood or meat specialty stores and bakeries); (3) all other FAH-source stores (convenience stores, pharmacies, and dollar stores); (4) own production (gardening, hunting, and fishing); and (5) food banks and Meals on Wheels. Likewise, FAFH sources were further broken down, as follows: (1) restaurants and other eating places; (2) schools, daycare, and day camps; (3) family, friends, parties, and places of worship; and (4) work. (See Todd and Scharadin (2016) for expenditures and other details on the grouping of places into each category.)

Food Store Access

FoodAPS is designed in part to support research on how access to food stores with a wide variety of healthy food offerings relates to food choices and measures of food security, health, and obesity. The retailers that respondents identified as their usual shopping locations and the stores and restaurants respondents visited during the survey week were geocoded so that households' distances from these places could be used to understand how proximity affects store choice. Information about the availability of food retailers and restaurants, food prices, and other aspects of the food retail environment in the Primary and Secondary Sampling Units (PSUs and SSUs) of FoodAPS was also collected and attached to the main FoodAPS file through the FoodAPS Geography Component (FoodAPS-GC) study.[5] Information collected through the FoodAPS-GC includes the proximity and number of different types of retailers, access to these retailers, food category prices at the store level, as well as sociodemographic information on the areas and food-related policies, such as food tax and school nutrition policies.

This study used two measures of food store accessibility to study the relationship between access and the nutritional quality of food purchased and acquired. The first measure is a neighborhood food environment measure based on the low-income and low-access vehicle (LILA-vehicle) census tract measure from ERS's Food Access Research Atlas (ERS, 2017). For this measure, low-income census tracts are defined as tracts where at least 20 percent of the population has income at or below the Federal poverty guideline (FPG) or where the tract-level median income is at or below 80 percent of the State-level median income or at or below 80 percent of the larger Metropolitan Statistical Area's (MSA) median income if a tract is in an MSA. Low-access tracts are those where at least 100 households do not have a vehicle and are more than 0.5 miles from a store, or tracts where at least 500 people or one-third of the tract population is more than 20 miles from a store.

The second measure we used tries to depict how easy it is for a household to access stores that sell a wide range of healthy and affordable food and is based on the usual mode of transportation to the

[4]This category includes large grocery stores, supermarkets, supercenters, mass merchandisers, club stores, and commissaries. Not all mass merchandisers are supercenters. However, we were unable to differentiate supercenters from all other mass merchandisers in FoodAPS.

[5]The FoodAPS Geography Component was conducted through cooperative agreements with Tufts University and the University of Illinois, Urbana-Champaign.

primary food store or distance from the nearest supermarket or supercenter. As part of the initial interview, the PR listed the household's primary grocery store and its usual mode of transportation to that store. Those who used their own vehicles are likely to have the easiest access to stores. Those who lived less than a mile from the nearest supermarket or supercenter and walked or used public transportation were also likely to have easy access to healthy food stores. We hypothesized that shoppers who relied on someone else or who borrowed a car to access their primary store (dependent on others' schedules), as well as those who lived more than a mile away from the nearest supermarket or supercenter and walked, biked, or took public transportation, may have had more limited access to stores that sell healthy, affordable foods.

Nutritional Quality

The FoodAPS survey appended information on the micro- and macro-nutrient content as well as information from the Food Pattern Equivalent Database (FPED) values for each identifiable item reported in the FoodAPS survey. With these data, we were able to use a summary measure of nutritional quality of food acquisitions based on the Healthy Eating Index-2010 (HEI-2010), summarized at the household level over the survey week. The HEI-2010 measures nutritional quality in terms of conformance with Federal dietary guidance. The HEI-2010 score ranges from 0 to 100 and is based on 12 components, including 9 adequacy components (e.g., whole fruit, whole grains, and greens and beans) and 3 moderation components (empty calories, sodium, and refined grains) (table 1). Components are measured using a density approach to set standards, such as per 1,000 calories acquired or as a percent of calories acquired. The HEI-2010 captures the key recommendations of the 2010 *Dietary Guidelines for Americans.* While the metric was originally used to assess diet quality from 24-hour dietary interviews, it can be used to assess nutritional quality of the U.S. food supply as a whole or on multiple levels of the food distribution system—such as at the level of grocery store sales or individual meals (Strasser et al., 2015).

In addition to total HEI-2010 scores, we used the 12 components that underlie the HEI-2010 score. More precisely, we used the methodology described in Mancino et al. (2018) to impute quantities at the item level when that information was missing. Using reported and imputed quantities, we then calculated the 12 HEI-2010 component densities for each household and the resulting HEI-2010 score. HEI-2010 scores and component densities were calculated using the simple algorithm by applying sample weights and incorporating survey design to calculate the weighted average HEI scores for households within population subgroups. We also looked at differences in total calories acquired over the week. However, households vary in composition in ways that may affect their food needs—for example, two parents with a 5-year-old son may not need to buy as much food as they would were that son 15 years old. To adjust for this, we calculated the number of adult equivalents (AE) in each household by estimating each household member's estimated energy requirement per age and gender relative to the more general estimated energy requirement of 2,000 calories per day. To calculate calories per AE on FAFH acquisitions, we divided the total calories acquired at each event by the party size at that event. To calculate calories per AE on FAH acquisitions, we divided total weekly calories acquired from all FAH sources by the number of AEs in the household.

Table 1
Summary of USDA's Healthy Eating Index-2010 components

HEI-2010[1] component	Standard maximum score	Standard for minimum score	Maximum contribution to total HEI (points)
▲ Adequacy components (higher values increase total HEI score)			
Total vegetable[2]	≥ 1.1 cup equivalent/1,000 calories	0 cup equivalent/1,000 calories	5
Greens and beans[2]	≥ 0.2 cup equivalent/1,000 calories	0 cup equivalent/1,000 calories	5
Total fruit[3]	≥ 0.8 cup equivalent/1,000 calories	0 cup equivalent/1,000 calories	5
Whole fruit[4]	≥ 0.4 cup equivalent/1,000 calories	0 cup equivalent /1,000 calories	5
Whole grains	≥ 1.5 ounce equivalent/ 1,000 calories	0 ounce equivalent/1,000 calories	10
Dairy[5]	≥ 1.3 cup equivalent/ 1,000 calories	0 cup equivalent/1,000 calories	10
Total protein foods[6]	≥ 2.5 ounce equivalent/ 1,000 calories	0 ounce equivalent/1,000 calories	5
Seafood and plant protein[6,7]	≥ 0.8 ounce equivalent/ 1,000 calories	0 ounce equivalent/1,000 calories	5
Ratio of fats[8]	(PUFAs + MUFAs)/ SFAs ≥ 2.5	(PUFAs + MUFAs)/ SFAs ≤ 1.2	10
▼ Moderation components (higher values lower HEI score)			
Sodium	≤ 1.1 grams/1,000 kcal	≥ 2.0 grams/1,000 kcal	10
Refined grains	≤ 1.8 ounce equivalent/1,000 kcal	≥ 4.3 ounce equivalent/1,000 kcal	10
Empty calories[9]	≤ 19% of energy	≥ 50% of energy	20

Notes: HEI-2010 = Healthy Eating Index-2010.
[1]Intakes between the minimum and maximum standards are scored proportionately.
[2]Includes any beans and peas not counted under total protein foods.
[3]Includes 100-percent fruit juice.
[4]Includes all forms except juice.
[5]Includes all milk products, such as fluid milk, yogurt, and cheese, and fortified soy beverages.
[6]Beans and peas are included here (and not with vegetables) when the "total protein foods" standard is otherwise not met.
[7]Includes seafood, nuts, seeds, soy products (other than beverages) as well as beans and peas counted under total protein foods.
[8]Ratio of poly- and monounsaturated fatty acids (PUFAs and MUFAs) to saturated fatty acids (SFAs).
[9]Calories from solid fats, alcohol, and added sugars; threshold for counting alcohol is > 13 grams/1,000 calories.
Source: USDA, Center for Nutrition Policy and Promotion, Fact Sheet No. 2, February 2013.

Findings

Summary statistics for the overall population and by subgroups used sampling weights that adjusted for probability of selection and survey design. We see that 69 percent of households fell into the higher income SNAP-nonparticipant category, 18 percent were lower income nonparticipants, and 14 percent were SNAP-participating households (table 2). We also find that 14 percent of households lived in low-income neighborhoods with low access to healthy, affordable food sources, and roughly 7 percent of households had low household-level access to these food sources. Although not shown in table 2, only 2 percent of households qualified for both categories—that is, had low household-level access *and* lived in low-income neighborhoods with low access. We find that 28 percent of all food acquisitions events were at larger grocery stores, superstores, or club stores. Another 27 percent of events occurred at FAFH outlets, such as full-service restaurants, fast-food outlets, or coffee shops.

For our first comparison of nutrition quality by demographic subgroups, we divided households into three separate categories based on SNAP participation and household income—current SNAP-participating households, SNAP-nonparticipants with household income at or below 185 percent of the Federal poverty guidelines, and SNAP-nonparticipants with household income above 185 percent of the Federal poverty guidelines. However, there were some significant differences between SNAP-participating households and nonparticipating households in terms of sociodemographic characteristics that also correlated with dietary patterns and health outcomes.

Compared to PRs in all other households, PRs in SNAP-participating households were younger, less educated, less likely to be married, and less likely to be Hispanic or White. Compared to all other households, SNAP-participating households had more members and had a harder time accessing large grocery stores (table 3). Compared to higher income SNAP-nonparticipating households, SNAP-participating households were more likely to live in urban neighborhoods and neighborhoods with low access to healthy-food retailers. While these differences can play a critical role in food choices and diet quality, it is critical to remember that all comparisons in this report simply suggest correlation, and none of our findings should be interpreted as indicating causal relationship between program participation and diet quality.

Table 4 shows that for the average household, the mean HEI-2010 score was 53.06 out of 100, which indicates a lot of room for improvement. Comparing households' component densities to the benchmark densities (the standards for maximum scores) in table 1, we find that households did not meet the benchmark for any adequacy components, except protein, and they exceeded the benchmark for all moderation components. For example, overall, the average cup of total fruit acquired per 1,000 calories was 0.44, while the benchmark density was 0.8 cup per 1,000 calories, suggesting that the fruit density would almost need to double to meet the recommended benchmark. More striking, to comply with recommendations, households would need nearly to quadruple the amount of whole grains acquired per 1,000 calories. In the category of moderation components, sodium densities were almost twice as high as benchmark recommendations, while refined grain densities and empty calories were roughly 1.5 times higher than benchmark recommendations.

Table 2

Definition and summary statistics of three primary categories: SNAP participation and income, food store environment and accessibility, and food source

Category	Variable name	Variable definition	Sample size (unit of observation)	Weighted share of observations (percent)
Income and program participation	SNAP HH	Household currently participates in SNAP.	1,581 (HH)	13.64
	Lower income Non-SNAP HH	Non-SNAP household, income less than or equal to 185 % of FPG.	1,197 (HH)	17.54
	Higher income Non -SNAP HH	Non-SNAP household, income above 185% of FPG.	2,048 (HH)	68.82
Food store environment and accessibility	Low, neighborhood measure	Low-income tracts where at least 100 households do not have a vehicle and are more than 0.5 miles from a supermarket, supercenter, or large grocery store, or tracts where at least 500 people or one-third of the tract population is more than 20 miles from one of these stores. Low-income defined as a poverty rate of at least 20% or median family income at or below 80% of the MSA or State median income.	860 (HH)	13.93
	Low, household measure	Household is more than a mile from nearest large grocery store and usual mode of transportation to primary grocery store is walking, busing, or public transportation or primary mode of transportation for grocery shopping is to borrow someone's car or get a ride.	483 (HH)	6.81
Food source	Large grocery stores	Large grocery store, super store, supermarkets, club stores, wholesaler, or military commissary	4120 (TE)	27.80
	Small and specialty stores	Medium grocery store, small grocery store, grocery store (not further specified), specialty store, delivery route, direct marketing farmer, farmers market, or food buying co-op	765 (TE)	5.80
	All other FAH-source stores	Combination grocery/other store, convenience store, dollar store, gas station/market, liquor store, pharmacy	2187 (TE)	13.50
	Own production	Fishing/hunting, home garden, or other garden	216 (TE)	1.90
	Food banks and Meals on Wheels	Food bank/pantry or Meals on Wheels	104 (TE)	0.50
	FAFH eating places	Restaurants, fast-food outlet, carry out, coffee shop, vending machine, etc.	3967 (TE)	27.10
	Schools	School	1041 (TE)	4.60
	Family, friends, etc.	Family, friend, cookout, party, place of worship	1684 (TE)	11.80
	Work	Includes any event reported at work	944 (TE)	7.10

Notes: SNAP = Supplemental Nutrition Assistance Program. FPG = Federal poverty guidelines. HH = household. TE = total events. FAH = food at home. FAFH = food away from home. MSA = Metropolitan Statistical Area.

Source: USDA, Economic Research Service (ERS) estimates using data from USDA's National Household Food Acquisition and Purchase Survey (FoodAPS).

Table 3
Summary statistics by SNAP participation and income

	SNAP-participating households	SNAP-nonparticipating, income < or =185% of FPG	SNAP-nonparticipating, income > 185% of FPG
	Mean (SE)		
Income relative to FPG (percent)	128 (0.06)	123 (0.02)	498*** (0.16)
Age (years)	45.91 (1.00)	52.93*** (1.11)	49.75*** (0.39)
White, non-Hispanic (percent)	46 (0.02)	61*** (0.03)	77*** (0.01)
Black, non-Hispanic (percent)	28 (0.03)	17*** (0.02)	9*** (0.01)
Hispanic (percent)	24 (0.02)	18 (0.02)	9*** (0.01)
Other (percent)	5 (0.01)	6 (0.01)	7 (0.00)
High school education (percent)	62 (0.02)	51*** (0.02)	25*** (0.02)
College or more (percent)	8 (0.01)	15*** (0.02)	42*** (0.02)
Married (percent)	22 (0.02)	30** (0.02)	52*** (0.02)
Number of household members	2.90 (0.06)	2.17*** (0.07)	2.39*** (0.02)
Number of household children	1.04 (0.04)	0.54*** (0.04)	0.52*** (0.01)
Urban (percent)	72 (0.033)	67 (0.046)	65** (0.031)
Low access, neighborhood (percent)	24 (0.041)	21 (0.034)	10*** (0.021)
Low access, personal (percent)	22 (0.020)	13*** (0.015)	2*** (0.003)

Notes: Standard deviations (SE, in parentheses, estimated via jacknife repeated replication); weighted means reported; **, *** = statistically different from SNAP-participating households with $p < 0.05$ and $p < 0.01$, respectively. SNAP = Supplemental Nutrition Assistance Program. FPG = Federal poverty guidelines.
Source: USDA, Economic Research Service (ERS) estimates using data from USDA's National Household Food Acquisition and Purchase Survey (FoodAPS).

Table 4

Summary of nutritional quality and component densities of households' food acquisitions, overall and by SNAP participation and income

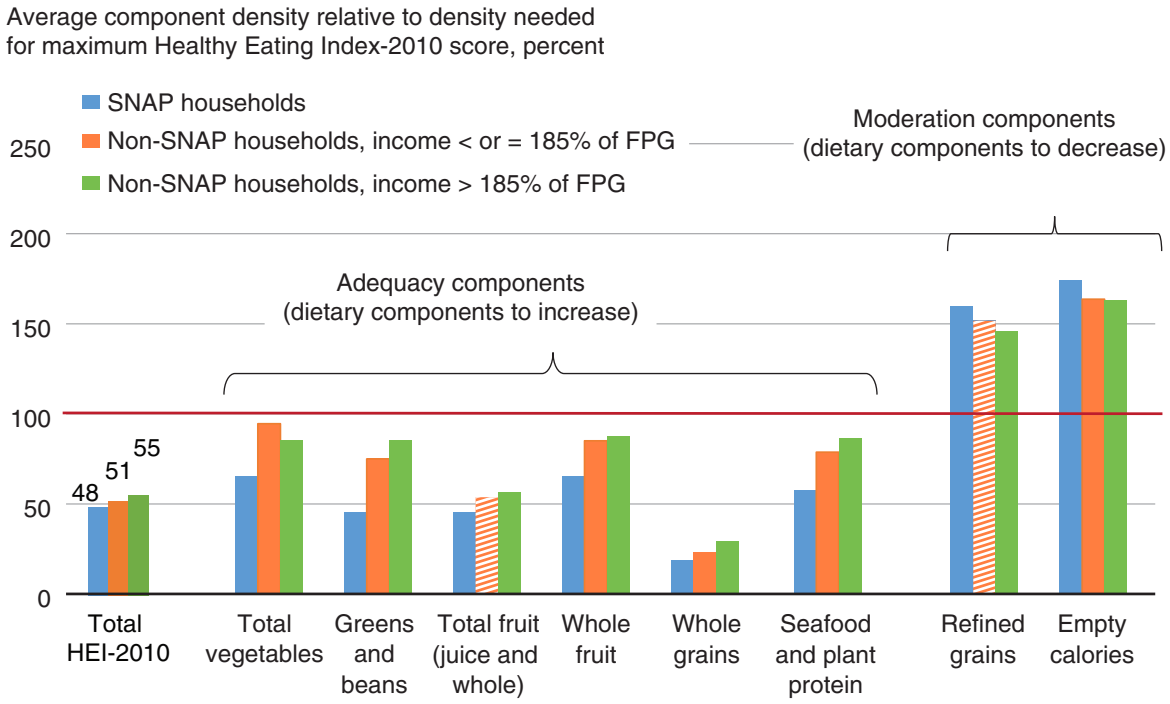
Nutritional measure (criteria for maximum score per 1,000 calories)	All FoodAPS households	SNAP-participating households	SNAP nonparticipating households, income < or =185% of FPG	SNAP nonparticipating households, income> 185% of FPG
	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)
Total HEI-2010 (100)	53.06 (0.40)	47.84 (0.49)	51.20*** (0.65)	54.53*** (0.51)
Component densities				
Total vegetables (>=1.1 cups)	0.93 (0.04)	0.72 (0.03)	1.04** (0.13)	0.94*** (0.03)
Greens and beans (>= 0.2 cups)	0.16 (0.01)	0.09 (0.01)	0.15** (0.02)	0.17*** (0.01)
Total fruit (>= 0.8 cups)	0.44 (0.01)	0.36 (0.02)	0.43 (0.03)	0.45*** (0.02)
Whole fruit (>=0.4 cups)	0.34 (0.01)	0.26 (0.02)	0.34** (0.03)	0.35*** (0.01)
Whole grains (>= 1.5 oz)	0.40 (0.02)	0.28 (0.02)	0.35** (0.03)	0.44*** (0.02)
Dairy (>= 0.8 oz)	0.80 (0.01)	0.79 (0.03)	0.76 (0.02)	0.81 (0.02)
Total protein foods (>= 2.5 oz)	2.78 (0.06)	2.79 (0.08)	2.98 (0.19)	2.72 (0.05)
Seafood and plant protein (>= 0.8 oz)	0.65 (0.03)	0.46 (0.04)	0.63** (0.06)	0.69*** (0.03)
Fatty acids ratio (>= 2.5)	1.96 (0.02)	1.93 (0.03)	2.01 (0.05)	1.95 (0.02)
Sodium (<=1.1 gram)	2.06 (0.26)	1.68 (0.04)	1.98 (0.16)	2.16 (0.37)
Refined grains (<=1.8 oz)	2.67 (0.03)	2.87 (0.08)	2.73 (0.10)	2.62** (0.04)
Empty calories (<=19%)	31.25 (0.31)	33.05 (0.31)	31.09** (0.59)	30.94*** (0.40)
Weekly calories				
Calories per adult equivalent, including zeros	21,829.91 (528.53)	21,398.13 (822.55)	19,611.38 (820.70)	22,481.07 (715.92)
Calories per adult equivalent, excluding zeros	22,173.19 (522.80)	22,447.64 (785.12)	20,007.69** (782.40)	22,666.53 (714.42)
Non-zero observations	4,724	1,518	1,177	2,029
Total observations	4,826	1,581	1,197	2,048

Notes: Units of component density differ by row, with each row's heading and target amount setting the unit for that row. Standard deviations (SE, in parentheses, estimated via jackknife repeated replication); weighted means reported; **, *** = statistically different from SNAP-participating households with $p < 0.05$ and $p < 0.01$, respectively. Healthy Eating Index-2010 (HEI-2010) scores and component densities were estimated using the simple mean approach. SNAP = Supplemental Nutrition Assistance Program. FPG = Federal poverty guidelines.

Source: USDA, Economic Research Service (ERS) estimates using data from ERS's National Household Food Acquisition and Purchase Survey (FoodAPS).

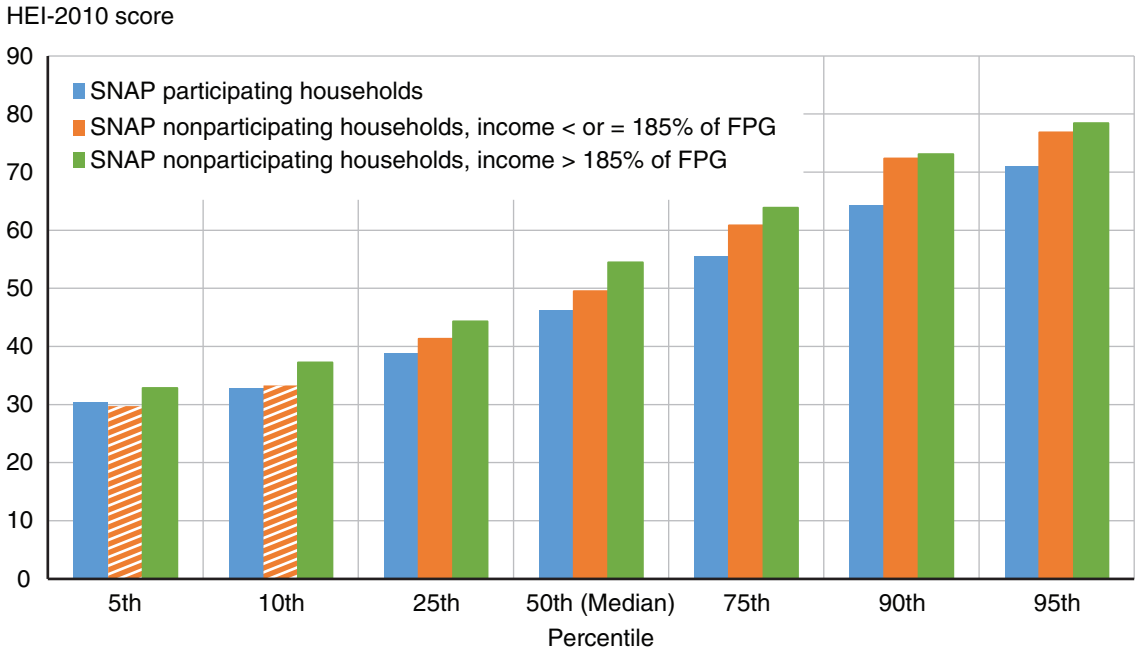
SNAP-participating households scored lower on total HEI-2010 than both lower and higher income nonparticipating households. Compared to lower income nonparticipants, SNAP-participating households acquired 31 percent fewer total vegetables, 40 percent fewer dark green vegetables and beans, 24 percent fewer whole fruits, 20 percent fewer whole grains, and 27 percent fewer seafood and plant proteins for every 1,000 calories acquired. They also acquired almost 6 percent (33.05/31.09) more empty calories as a share of total calories. However, there were no differences between SNAP-participating and lower income nonparticipating households in the moderation component scores for fatty acids, sodium, and refined grains. Compared to higher income nonparticipating households, SNAP-participating households acquired 23 percent less total vegetables, 47 percent less dark green vegetables and beans, 20 percent less total fruits, 26 percent less whole fruits, 36 percent less whole grains, 33 percent less seafood and plant proteins, and 10 percent more refined grains. They also acquired 7 percent more empty calories than higher income nonparticipating households as a share of total calories acquired. For added context, we show these differences in total HEI-2010 and component densities (fig. 1). We also compare the distribution of HEI-2010 scores among our three SNAP-participating and -nonparticipating income groups (fig. 2), yielding findings that parallel those of figure 1: at all points along the distribution, SNAP-participating households scored significantly lower than either group of nonparticipating households at the median, as well as the 25th, 75th, and 95th percentile. At the 5th percentile, SNAP-participating households scored lower than higher income SNAP nonparticipants (though not lower than lower income nonparticipants).

Figure 1
Nutritional quality of household food acquisitions by SNAP participation and income



Notes: Dashed bars indicate difference from SNAP-participating households is not statistically significant at $p < 0.05$. Healthy Eating Index-2010 (HEI -2010) scores and component densities were estimated using the simple mean approach. All estimates use sample weights and control for survey design. SNAP = Supplemental Nutrition Assistance Program. FPG = Federal poverty guidelines.
Source: USDA, Economic Research Service (ERS) estimates using data from USDA's National Household Food Acquisition and Purchase Survey (FoodAPS).

Figure 2
Distribution of HEI-2010 scores by SNAP participation and income, estimated at the 5th, 10th, 25th, 50th, 75th, 90th, and 95th percentiles



Notes: Each bar represents the average HEI-2010 score, by SNAP participation and income, at the 5th, 10th, 25th, 50th, 75th, 90th and 95th percentiles. Dashed bars indicate difference from SNAP-participating households is not statistically significant at $p < 0.05$. Healthy Eating Index-2010 (HEI-2010) scores and component densities were estimated using the simple mean approach. All estimates use sample weights and control for survey design. SNAP = Supplemental Nutrition Assistance Program. FPG = Federal poverty guidelines.
Source: USDA, Economic Research Service (ERS) estimates using data from ERS's National Household Food Acquisition and Purchase Study (FoodAPS).

It should be noted that the average nutritional quality of FoodAPS households' purchases resembles the average nutritional quality of food intake as estimated from the National Health and Nutrition Examination Survey (NHANES) (Mancino et al., 2018; Dietary Guidelines Advisory Committee, 2015). For example, ERS analysis of NHANES 2003-10 data shows that Americans, on average, consume too little fruit, vegetables, whole grains, and seafood and plant proteins and consume an excess of sodium, refined grains, and empty calories (Mancino and Guthrie, 2014). The resemblance between NHANES and FoodAPS findings extends beyond the general population to the subgroups. Like FoodAPS, NHANES data also show that diet quality among SNAP participants is lower than among nonparticipants.

We also compared total calories acquired over the 1-week acquisition period using two measures of calories: calories per AE among all households (including those households that did not make any food purchases or acquisitions) and calories per AE among only those households that reported an acquisition. Among those that had at least one food acquisition, lower income SNAP-nonparticipating households acquired fewer calories per AE than SNAP-participating households (table 4). This finding may reflect the fact that SNAP-participating households are younger and, therefore, require more calories than other households. It may also reflect that—because SNAP-participating households receive their monthly benefits as a lump sum—they are more likely than nonparticipating households to make one big, monthly shopping trip, rather than more frequent, smaller trips. Average calories per AE, among households that had at least one food acquisition,

were similar for households from all three subgroups: SNAP-participating and both the low- and high-income nonparticipating groups. However, Todd and Scharadin (2016) find that, in terms of food expenditures, SNAP households spent less than either group of nonparticipants—spending roughly $7 less per person per week than lower income nonparticipants and $36 less than higher income nonparticipants. Together, these findings suggest that SNAP-participating households stretch their food budgets by acquiring calories at a lower cost than SNAP-nonparticipating households.

Table 5 compares differences in nutritional quality by neighborhood food environment and household-level access to food stores. First, we compared nutritional quality by the neighborhood food environment, which is our census tract measure of low-income and low-access tracts. Households in low-income neighborhoods with low access to healthy-food retailers scored lower on total HEI-2010—about 4 percent lower than households without low access. For every 1,000 calories acquired, they also obtained 18 percent fewer total vegetables, 31 percent fewer greens and beans, and 9 percent less dairy compared to households with better access. Next, we compared nutritional quality across household-level measures of access to food stores, where a household was considered to have low access if it was more than a mile from the nearest grocery store and the primary mode of transportation for shopping was walking, public transportation, or a borrowed car. For this measure, low-access households had 9 percent lower HEI-2010 scores and acquired 31 percent less dark green vegetables and beans, 39 percent less whole grains, 20 percent less dairy, and 21 percent less seafood and plant proteins than households that could more easily reach a food outlet. There were no differences in acquisitions of total fruit and whole fruit across households with different store access for either access measure, contrary to concerns that acquiring fruits and vegetables would be more challenging to neighborhoods and households that lacked access to sources of healthy food. Moderation component scores by both measures of access were also similar for households with and without low access to large grocery stores.

Table 6 compares acquisitions by food store access among the three income/SNAP-participating/-nonparticipating subgroups. Compared to higher income households, SNAP-participating households were more likely to live in low-income, low-access tracts. Only 1 in 10 higher income households lived in low-income, low-access tract, versus 1 in 4 SNAP households. The share of households in a low-access tract did not differ between SNAP-participating and lower income nonparticipating households. Using our household-level measure of food store access, we see that SNAP-participating households were more likely than either income group of SNAP nonparticipants to report low access—22 percent of SNAP-participating households reported low household-level access, versus 13 percent of lower income nonparticipants and 2 percent of higher income nonparticipants. We find that SNAP-participating households living in neighborhoods with better food store access acquired 50 percent more whole grains per 1,000 calories than SNAP-participating households in neighborhoods with low store access. No other differences in component scores existed for households with different neighborhood levels of store access. Further, on all of our measures of nutritional quality, SNAP-participating households with low household-level access to food stores did not differ from SNAP-participating households with better access. The few differences in the dietary quality of food acquisitions by food store access among SNAP-participating households suggest that the overall differences in table 5 may have been largely driven by the nutrition differences in acquisitions between SNAP-participating households and -nonparticipating households.

Table 5

Summary of nutritional quality and component densities by food access, for all populations

	Neighborhood access		Household access	
	Low access	Not low access	Low access	Not low access
	Mean (SE)			
Total HEI-2010 (100)	51.32 (1.01)	53.34** (0.43)	48.43 (0.95)	53.39*** (0.43)
Component densities				
Total vegetables (>=1.1 cups)	0.78 (0.03)	0.95** (0.04)	0.86 (0.07)	0.93 (0.04)
Greens and beans (>= 0.2 cups)	0.11 (0.02)	0.16** (0.01)	0.11 (0.01)	0.16*** (0.01)
Total fruit (>= 0.8 cups)	0.42 (0.03)	0.44 (0.02)	0.39 (0.05)	0.44 (0.01)
Whole fruit (>=0.4 cups)	0.32 (0.03)	0.34 (0.02)	0.28 (0.05)	0.34 (0.01)
Whole grains (>= 1.5 oz)	0.38 (0.04)	0.40 (0.02)	0.25 (0.03)	0.41*** (0.02)
Dairy (>= 0.8 oz)	0.74 (0.04)	0.81** (0.01)	0.65 (0.04)	0.81*** (0.01)
Total protein foods (>= 2.5 oz)	2.77 (0.15)	2.78 (0.06)	2.72 (0.13)	2.78 (0.06)
Seafood and plant protein (>= 0.8 oz)	0.59 (0.07)	0.66 (0.03)	0.52 (0.06)	0.66** (0.03)
Fatty acids ratio (>= 2.5)	2.05 (0.06)	1.95 (0.02)	1.97 (0.07)	1.96 (0.02)
Sodium (<=1.1 gram)	3.05 (1.07)	1.91 (0.20)	1.72 (0.10)	2.09 (0.28)
Refined grains (<=1.8 oz)	2.77 (0.08)	2.66 (0.04)	3.03 (0.15)	2.65 (0.03)
Empty calories (<=19%)	31.76 (0.72)	31.17 (0.36)	32.31 (0.77)	31.17 (0.35)
Weekly calories				
Calories per adult equivalent, including zeros	21,506.27 (1,573.42)	21,882.30 (605.96)	21,549.84 (1,121.20)	21,850.37 (557.25)
Calories per adult equivalent, excluding zeros	22,472.59 (1,518.18)	22,126.30 (590.09)	22,315.01 (1,096.92)	22,163.05 (549.14)
Non-zero observations	831	3,893	466	4,258
Total observations	860	3,966	483	4,343

Notes: Units of component density differ by row, with each row's heading and target amount setting the unit for that row. Standard errors (SE, estimated in parentheses via jackknife repeated replication); weighted means reported; **, *** = statistically significantly different from low-access households with $p < 0.05$ and $p < 0.01$, respectively. Healthy Eating Index-2010 (HEI-2010) scores and component densities were estimated using the simple mean approach. SNAP = Supplemental Nutrition Assistance Program.
Source: USDA, Economic Research Service (ERS) estimates using data from ERS's National Household Food Acquisition and Purchase Survey (FoodAPS).

Table 6

Summary of nutritional quality and component densities by food access, for SNAP participation and income

	SNAP-participating households			
	Neighborhood access		Household access	
	Low access	Not low access	Low access	Not low access
	Mean (SE)			
Total HEI-2010 (100)	46.26 (0.97)	48.30 (0.52)	47.22 (1.28)	48.01 (0.51)
Component densities				
Total vegetables (>=1.1 cups)	0.73 (0.09)	0.72 (0.03)	0.81 (0.11)	0.70 (0.03)
Greens and beans (>= 0.2 cups)	0.09 (0.02)	0.10 (0.01)	0.11 (0.03)	0.09 (0.01)
Total fruit (>= 0.8 cups)	0.40 (0.06)	0.34 (0.03)	0.29 (0.05)	0.37 (0.03)
Whole fruit (>=0.4 cups)	0.31 (0.06)	0.24 (0.02)	0.20 (0.04)	0.27 (0.02)
Whole grains (>= 1.5 oz)	0.20 (0.03)	0.30*** (0.03)	0.26 (0.05)	0.28 (0.03)
Dairy (>= 0.8 oz)	0.75 (0.04)	0.80 (0.03)	0.69 (0.06)	0.82 (0.03)
Total protein foods (>= 2.5 oz)	2.91 (0.20)	2.76 (0.08)	2.83 (0.17)	2.78 (0.08)
Seafood and plant protein (>= 0.8 oz)	0.41 (0.10)	0.48 (0.04)	0.39 (0.05)	0.48 (0.05)
Fatty acids ratio (>= 2.5)	1.97 (0.05)	1.92 (0.04)	2.00 (0.05)	1.91 (0.03)
Sodium (<=1.1 gram)	1.73 (0.10)	1.66 (0.05)	1.66 (0.09)	1.68 (0.05)
Refined grains (<=1.8 oz)	3.19 (0.27)	2.77 (0.06)	3.20 (0.29)	2.77 (0.07)
Empty calories (<=19%)	32.44 (0.88)	33.23 (0.43)	31.90 (1.14)	33.37 (0.39)
Weekly calories				
Calories per adult equivalent, including zeros	18,654.87 (1,352.57)	22,263.03 (1,034.67)	24,334.53 (2,525.61)	20,575.55 (627.03)
Calories per adult equivalent, excluding zeros	20,679.54 (1,343.80)	22,966.40 (1,032.39)	25,797.42 (2,550.22)	21,521.77 (630.94)
Non-zero observations	363	1,155	292	1,226
Total observations	383	1,198	307	1,274

- *continued*

Table 6

Summary of nutritional quality and component densities by food access, for SNAP participation and income - *continued*

	SNAP-nonparticipating households, income < or = 185% of FPG			
	Neighborhood access		Household access	
	Low access	Not low access	Low access	Not low access
	Mean (SE)			
Total HEI-2010 (100)	50.34 (1.84)	51.43 (0.69)	47.09 (1.73)	51.80** (0.71)
Component densities				
Total vegetables (>=1.1 cups)	0.77 (0.07)	1.11 (0.17)	0.81 (0.09)	1.07 (0.15)
Greens and beans (>= 0.2 cups)	0.12 (0.02)	0.16 (0.03)	0.11 (0.02)	0.16 (0.03)
Total fruit (>= 0.8 cups)	0.42 (0.05)	0.44 (0.04)	0.36 (0.08)	0.44 (0.04)
Whole fruit (>=0.4 cups)	0.34 (0.04)	0.34 (0.04)	0.26 (0.06)	0.35 (0.04)
Whole grains (>= 1.5 oz)	0.28 (0.05)	0.37 (0.03)	0.28 (0.06)	0.36 (0.03)
Dairy (>= 0.8 oz)	0.74 (0.07)	0.76 (0.03)	0.58 (0.10)	0.78 (0.03)
Total protein foods (>= 2.5 oz)	2.94 (0.20)	2.99 (0.23)	2.82 (0.28)	3.00 (0.22)
Seafood and plant protein (>= 0.8 oz)	0.71 (0.17)	0.61 (0.05)	0.69 (0.18)	0.62 (0.07)
Fatty acids ratio (>= 2.5)	2.04 (0.11)	2.00 (0.05)	1.96 (0.16)	2.01 (0.05)
Sodium (<=1.1 gram)	2.28 (0.55)	1.90 (0.13)	1.97 (0.29)	1.98 (0.18)
Refined grains (<=1.8 oz)	2.65 (0.20)	2.75 (0.12)	2.97 (0.26)	2.69 (0.10)
Empty calories (<=19%)	32.07 (1.15)	30.83 (0.67)	34.46 (1.98)	30.60 (0.60)
Weekly calories				
Calories per adult equivalent, including zeros	19,835.89 (1,708.26)	19,551.64 (870.71)	20,616.07 (2,131.56)	19,463.98 (827.23)
Calories per adult equivalent, excluding zeros	20,162.63 (1,690.19)	19,966.27 (835.65)	21,223.04 (1,969.32)	19,831.21 (821.23)
Non-zero observations	235	942	118	1,059
Total observations	240	957	120	1,077

- *continued*

Table 6

Summary of nutritional quality and component densities by food access, for SNAP participation and income - *continued*

	SNAP-nonparticipating households, income > 185% of FPG			
	Neighborhood access		Household access	
	Low access	Not low access	Low access	Not low access
	Mean (SE)			
Total HEI-2010 (100)	54.06 (1.29)	54.58 (0.54)	52.43 (2.61)	54.58 (0.53)
Component densities				
Total vegetables (>=1.1 cups)	0.81 (0.04)	0.96*** (0.03)	1.02 (0.19)	0.94 (0.03)
Greens and beans (>= 0.2 cups)	0.12 (0.02)	0.18 (0.02)	0.11 (0.03)	0.17 (0.01)
Total fruit (>= 0.8 cups)	0.43 (0.04)	0.46 (0.02)	0.62 (0.18)	0.45 (0.02)
Whole fruit (>=0.4 cups)	0.32 (0.04)	0.36 (0.01)	0.45 (0.20)	0.35 (0.01)
Whole grains (>= 1.5 oz)	0.51 (0.08)	0.43 (0.02)	0.22 (0.05)	0.44*** (0.02)
Dairy (>= 0.8 oz)	0.73 (0.05)	0.82 (0.02)	0.68 (0.12)	0.81 (0.02)
Total protein foods (>= 2.5 oz)	2.62 (0.22)	2.73 (0.05)	2.40 (0.33)	2.73 (0.05)
Seafood and plant protein (>= 0.8 oz)	0.60 (0.09)	0.70 (0.03)	0.51 (0.06)	0.69** (0.03)
Fatty acids ratio (>= 2.5)	2.08 (0.07)	1.94 (0.02)	1.91 (0.12)	1.95 (0.02)
Sodium (<=1.1 gram)	4.05 (2.08)	1.95 (0.28)	1.46 (0.16)	2.18 (0.38)
Refined grains (<=1.8 oz)	2.64 (0.11)	2.62 (0.04)	2.78 (0.24)	2.62 (0.04)
Empty calories (<=19%)	31.30 (1.04)	30.91 (0.44)	30.07 (2.39)	30.97 (0.44)
Weekly calories				
Calories per adult equivalent, including zeros	23,725.61 (2,376.68)	22,340.70 (759.93)	17,613.04 (1,561.54)	22,595.34 (738.82)
Calories per adult equivalent, excluding zeros	24,495.63 (2,355.57)	22,465.60 (751.38)	17,613.04 (1,561.54)	22,786.16*** (736.53)
Non-zero observations	233	1,796	56	1,973
Total observations	237	1,811	56	1,992

Notes: Units of component density differ by row, with each row's heading and target amount setting the unit for that row. Standard errors (SE, in parentheses, estimated via jackknife repeated replication); weighted means reported; **, *** = statistically significantly different from low-access households with $p < 0.05$ and $p < 0.01$, respectively. Healthy Eating Index-2010 (HEI-2010) scores and component densities were estimated using the simple mean approach. FPG = Federal poverty guidelines. SNAP = Supplemental Nutrition Assistance Program.

Source: USDA, Economic Research Service (ERS) estimates using data from USDA's National Household Food Acquisition and Purchase Survey (FoodAPS).

Because food away from home (FAFH) continues to play a significant role in Americans' dietary patterns, we look at the correlation between food outlets and the nutritional quality of foods acquired (table 7).[6] Not surprisingly, FAFH made up a smaller share of total calories acquired (5,391 calories per week) than food at home (FAH) (16,439 calories). Also, as expected, FAFH scores were lower on a number of measures of nutritional quality. Compared to FAH, FAFH acquisitions were 15 percent lower in their total HEI-2010 score. For every 1,000 calories acquired, FAFH acquisitions were almost 67 percent lower than FAH in total fruit, 71 percent lower in whole fruit, 76 percent lower in whole grains, 15 percent lower in dairy, 25 percent lower in protein from seafood and plants, and 38 percent higher in refined grains. FAFH acquisitions were also 27 percent higher in total protein and 8 percent lower in empty calories. The finding about empty calories is somewhat counterintuitive, but may reflect that shoppers are more likely to buy some items, such as sugar, soda, or wine, in larger quantities when shopping for FAH than when acquiring FAFH, and many of these items would contribute to empty calories.

Table 8 makes these same comparisons of acquisition sources (FAH versus FAFH) for SNAP-participating households separately from lower and higher income nonparticipating households. The findings for SNAP-participating households closely mirrored those of the overall population, except the dairy component density. The component density of acquired dairy differed between FAH and FAFH for SNAP-nonparticipating households but did not differ among SNAP-participating households.

For more specific information on acquisition sources, we sorted each event into one of nine subcategories: large grocery stores; small and specialty stores; all other FAH-source stores; own production; food banks and Meals on Wheels; restaurants and other eating places; schools; family, friends, etc.; and work. In terms of total calories per AE, large grocery stores clearly made up the majority of acquisitions—just over 65 percent of calories per AE, including households with no acquisitions. The next largest category, restaurants and other eating places (FAFH), made up 17 percent of all acquisitions. The third largest category, all other FAH-source stores (food outlets such as convenience stores, dollar stores, and gas station) made up 7 percent of all calories acquired (fig. 3).

[6]FAFH acquisitions reported in FoodAPS were more similar to FAFH acquisitions reported in consumption surveys (than FAH acquisitions in FoodAPS were to FAH acquisitions reported in consumption surveys). FAFH items were more likely than FAH to be consumed at the event at which they were acquired, and they were acquired in the same form in which they were consumed. For this reason, the HEI-2010 score for FAFH acquisitions more likely reflected the nutritional quality of FAFH consumption. In contrast, HEI-2010 scores for FAH acquisitions were less likely to reflect the nutritional quality of consumption because some acquisitions could not have been consumed over the survey week. They may also have undergone changes through cooking or by adding ingredients that were acquired prior to the survey week, such as oil, sugar, or salt.

Table 7

Summary of nutritional quality and component densities of food at home and food away from home, for all populations

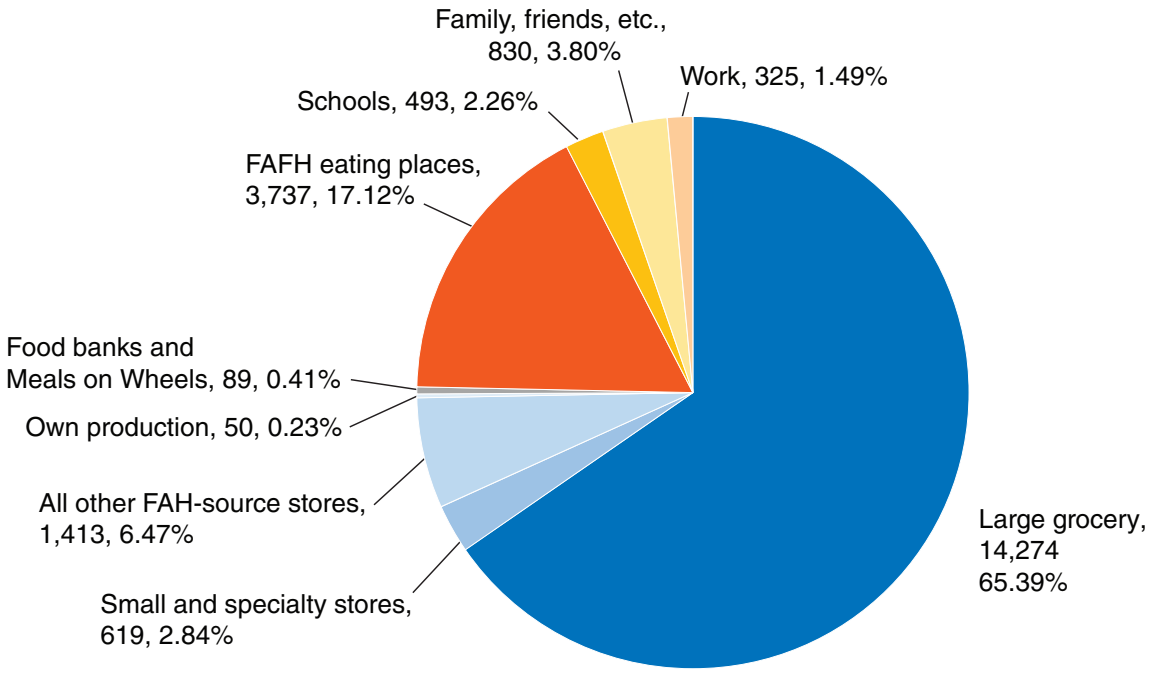
	Food at home	Food away from home
	Mean (SE)	
Total HEI-2010 (100)	52.01 (0.46)	44.16*** (0.35)
Component densities		
Total vegetables (>=1.1 cups)	1.04 (0.06)	0.97 (0.03)
Greens and beans (>= 0.2 cups)	0.17 (0.02)	0.19 (0.01)
Total fruit (>= 0.8 cups)	0.56 (0.02)	0.19*** (0.01)
Whole fruit (>=0.4 cups)	0.45 (0.02)	0.13*** (0.01)
Whole grains (>= 1.5 oz)	0.49 (0.02)	0.12*** (0.01)
Dairy (>= 0.8 oz)	0.82 (0.02)	0.70*** (0.01)
Total protein foods (>= 2.5 oz)	2.51 (0.06)	3.18*** (0.04)
Seafood and plant protein (>= 0.8 oz)	0.69 (0.03)	0.52*** (0.03)
Fatty acids ratio (>= 2.5)	2.00 (0.02)	2.01 (0.03)
Sodium (<=1.1 gram)	2.09 (0.33)	1.76 (0.01)
Refined grains (<=1.8 oz)	2.35 (0.04)	3.25*** (0.04)
Empty calories (<=19%)	31.75 (0.44)	29.35*** (0.29)
Weekly calories		
Calories per adult equivalent, including zeros	16,439.17 (531.62)	5,390.74*** (124.24)
Calories per adult equivalent, excluding zeros	17,555.42 (539.37)	5,935.15*** (119.91)
Non-zero observations	4,470	4,308
Total observations	4,826	4,826

Notes: Units of component density differ by row, with each row's heading and target amount setting the unit for that row. Standard errors (SE, in parentheses, estimated via jackknife repeated replication); weighted means reported; **, *** = statistically significantly different from food at home with $p < 0.05$ and $p < 0.01$, respectively. Healthy Eating Index-2010 (HEI -2010) scores and component densities were estimated using the simple mean approach.

Source: USDA, Economic Research Service (ERS) estimates using data from USDA's National Household Food Acquisition and Purchase Survey (FoodAPS).

Figure 3

Distribution of household calories and shares of calories across food outlets for total population



Notes: Weighted means reported. FAH = food at home. FAFH = food away from home.
Source: USDA, Economic Research Service (ERS) estimates using data from USDA's National Household Food Acquisition and Purchase Survey (FoodAPS).

Table 8

Summary of nutritional quality of food at home and food away from home, by SNAP participation and household income

	SNAP-participating households		SNAP-nonparticipating households, income < or = 185% of FPG		SNAP-nonparticipating households, income > 185% of FPG	
	Food at home	Food away from home	Food at home	Food away from home	Food at home	Food away from home
	Mean (SE)					
Total HEI-2010 (100)	45.77 (0.55)	41.77*** (0.63)	49.89 (0.79)	42.12*** (0.54)	53.74 (0.65)	45.07*** (0.42)
Component densities						
Total vegetables (>=1.1 cups)	0.77 (0.08)	0.75 (0.03)	1.31 (0.23)	1.02 (0.11)	1.03 (0.04)	0.99 (0.04)
Greens and beans (>= 0.2 cups)	0.09 (0.01)	0.11 (0.01)	0.24 (0.11)	0.14 (0.01)	0.16 (0.02)	0.22*** (0.02)
Total fruit (>= 0.8 cups)	0.42 (0.04)	0.24*** (0.03)	0.53 (0.05)	0.19*** (0.02)	0.60 (0.03)	0.19*** (0.02)
Whole fruit (>=0.4 cups)	0.31 (0.04)	0.16*** (0.02)	0.43 (0.05)	0.12*** (0.02)	0.48 (0.03)	0.13*** (0.01)
Whole grains (>= 1.5 oz)	0.31 (0.03)	0.11*** (0.01)	0.41 (0.03)	0.11*** (0.02)	0.55 (0.03)	0.13*** (0.01)
Dairy (>= 0.8 oz)	0.76 (0.03)	0.75 (0.03)	0.78 (0.03)	0.66*** (0.03)	0.84 (0.03)	0.70*** (0.01)
Total protein foods (>= 2.5 oz)	2.50 (0.10)	3.11*** (0.08)	2.67 (0.21)	3.19 (0.11)	2.47 (0.06)	3.19*** (0.05)
Seafood and plant protein (>= 0.8 oz)	0.45 (0.05)	0.34 (0.03)	0.65 (0.07)	0.48 (0.07)	0.74 (0.04)	0.56*** (0.04)
Fatty acids ratio (>= 2.5)	1.91 (0.04)	1.90 (0.03)	2.05 (0.05)	1.99 (0.05)	2.00 (0.03)	2.03 (0.04)
Sodium (<=1.1 gram)	1.60 (0.06)	1.67 (0.03)	1.93 (0.20)	1.77 (0.05)	2.22 (0.47)	1.78 (0.02)
Refined grains (<=1.8 oz)	2.56 (0.10)	3.19*** (0.09)	2.44 (0.12)	3.13*** (0.11)	2.29 (0.06)	3.29*** (0.05)
Empty calories (<=19%)	34.29 (0.54)	29.49*** (0.85)	30.89 (0.69)	29.38** (0.61)	31.49 (0.56)	29.32*** (0.36)
Weekly calories						
Calories per adult equivalent, including zeros	16,331.20 (798.08)	5,066.93*** (202.18)	15,464.26 (878.93)	4,147.12*** (256.20)	16,709.11 (747.80)	5,771.96*** (150.29)
Calories per adult equivalent, excluding zeros	17,992.19 (759.51)	5,968.87*** (220.05)	16,595.01 (831.30)	4,857.65*** (290.97)	17,714.02 (753.65)	6,180.18*** (144.35)
Non-zero observations	1,441	1,345	1,110	1,054	1,919	1,909
Total observations	1,581	1,581	1,197	1,197	2,048	2,048

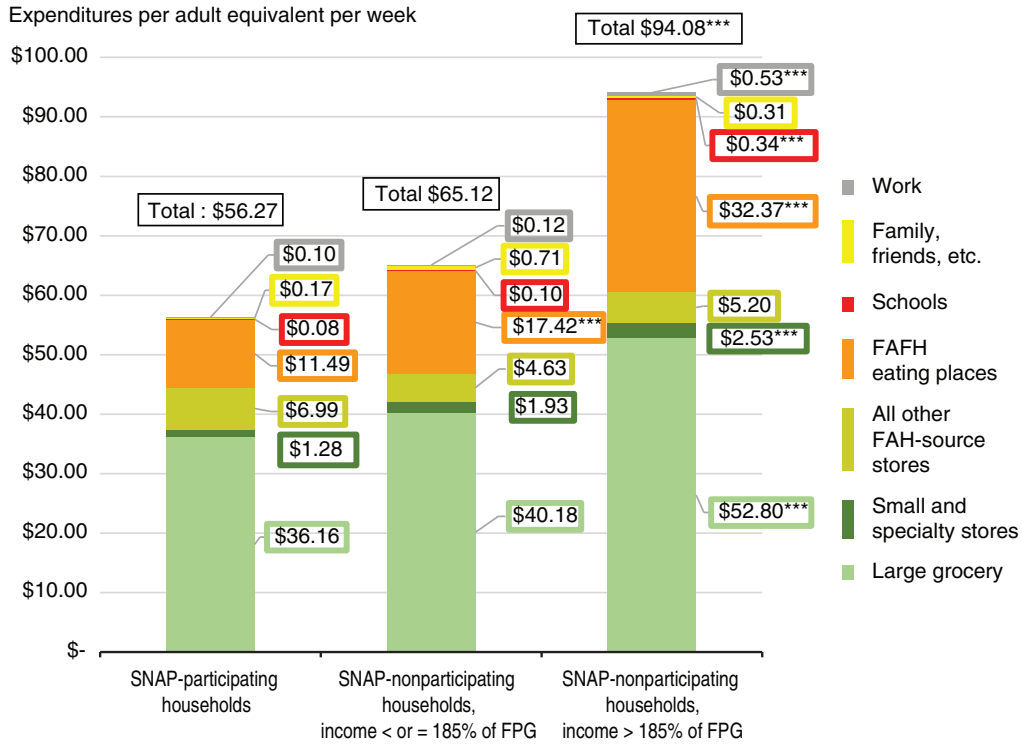
Notes: Units of component density differ by row, with each row's heading and target amount setting the unit for that row. Standard errors (SE, in parentheses, estimated via jackknife repeated replication); weighted means reported; **, *** = statistically significantly different from Food at Home with $p < 0.05$ and $p < 0.01$. HEI-2010 scores and component densities were estimated using the simple mean approach. FPG = Federal poverty guidelines. SNAP = Supplemental Nutrition Assistance Program.

Source: USDA, Economic Research Service (ERS) estimates using data from USDA's National Household Food Acquisition and Purchase Survey (FoodAPS).

Looking at differences in expenditures among these same food outlets and the three income/SNAP-participating/-nonparticipating subgroups, we find that higher income SNAP nonparticipants spent more overall (about $94 per AE per week) than SNAP participants ($56 per AE per week); spent more at large grocery stores, small and specialty stores, restaurants and other FAFH eating places, schools, and work; and spent less at all other FAH-source stores. Compared to lower income nonparticipating households, there were no significant differences in total weekly expenditures per AE, but SNAP-participating households spent a smaller share at restaurants and other FAFH eating places (fig. 4).[7]

Differences in weekly caloric intake tell a slightly different story (fig. 5). Paralleling the general differences in expenditure patterns between higher income nonparticipants and SNAP participants, SNAP-participating households acquired fewer calories per AE than higher income nonparticipating households from restaurants and other eating places while acquiring more calories from all other FAH-source stores. Compared to lower income nonparticipants, SNAP-participating households acquired about 300 fewer calories per week per AE from restaurants and other eating places.

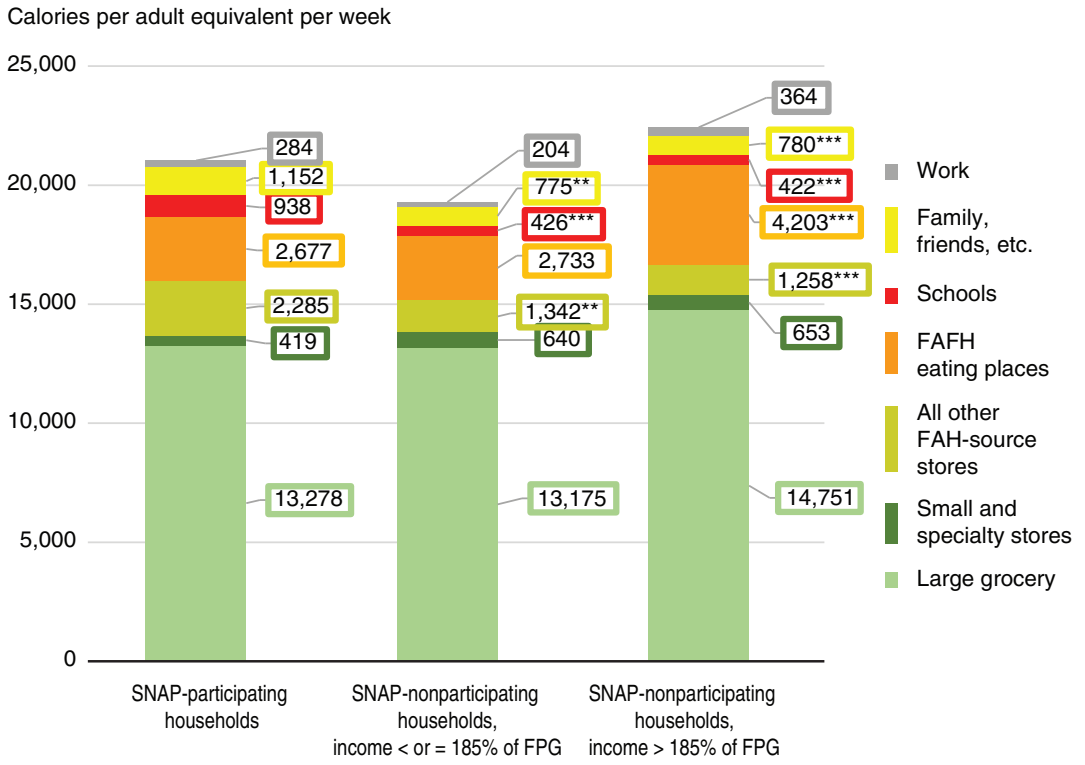
Figure 4
Distribution of household expenditures across food outlets, for SNAP participation and income



Notes: SNAP = Supplemental Nutrition Assistance Program. FAH = food at home. FAFH = food away from home. Weighted means reported; **, *** = statistically different from SNAP-participating households with $p < 0.05$ and $p < 0.01$, respectively. Results from the "Own production" and "Other assistance" not reported because sample size < 50. FPG = Federal poverty guidelines.
Source: USDA, Economic Research Service (ERS) estimates using data from USDA's National Household Food Acquisition and Purchase Survey (FoodAPS).

[7]These expenditures were based on event-level expenditures, so may have included some nonfood items. On examining item-level expenditures, we find the same magnitude and significance of differences between SNAP-participating and lower income nonparticipating households. However, the item-level expenditures were a lower bound because there were more missing values and they did not include tax or tip.

Figure 5
Distribution of household calories across food outlets, for SNAP participation and income



Notes: SNAP = Supplemental Nutrition Assistance Program. FAH = food at home. FAFH = food away from home. Weighted means reported; **, *** = statistically significantly different from SNAP-participating households with $p < 0.05$ and $p < 0.01$, respectively. FPG = Federal poverty guidelines. Results from the "Own production" and "Other assistance" not reported because sample size is less than 50.
Source: USDA, Economic Research Service (ERS) estimates using data from USDA's National Household Food Acquisition and Purchase Survey (FoodAPS).

However, while SNAP-participating households spent less per AE than either group of nonparticipants, they acquired per-AE calorie levels similar to those of higher income participants and slightly more than those of lower income nonparticipants, although the difference between SNAP-participating and nonparticipating lower income households was not significant. Similarly, while higher income nonparticipants spent more on school meals than SNAP-participating households did, SNAP-participating households acquired almost twice as many calories from school meals than higher income nonparticipating households. SNAP-participating households also acquired almost 400 more calories from family and friends than did higher income nonparticipating households. Compared to lower income nonparticipants, SNAP households acquired 500 more calories from schools.

For insight into how the choice of outlets within FAH and FAFH correlated with nutrition, we compared HEI-2010 scores and component densities for acquisitions from larger grocery stores, which made up the majority of calories acquired, to each of the other eight outlet types (table 9). These large grocery stores have been a focus of food access studies because they are often used as markers of healthy and affordable food. Research has also focused on whether the low prices and bulk quantities at very large supercenters have contributed to households' overconsumption of food in general and some foods in particular (Courtemanche and Carden, 2011; Volpe et al., 2013).

Overall, acquisitions from large grocery stores scored better in terms of nutritional quality, except for a few measures. For every 1,000 calories acquired, acquisitions from small and specialty stores contained more total vegetables, more greens and beans, more total fruit, more whole fruit, less sodium, fewer refined grains, and fewer empty calories than were contained in acquisitions from large grocery stores. This somewhat surprising finding may reflect the fact that specialty shops included farmers markets and ethnic grocers. Surprisingly, all other FAH-source stores scored better than large grocery stores on one measure—refined grains—which may reflect the possibility that people did not depend on convenience stores or dollar stores for major bread and bakery purchases. Another surprise is that large-grocery-store acquisitions contained fewer total vegetables than did acquisitions from restaurants and other eating places—a finding that may reflect consumers' common selection of potato products, such as French fries, when eating FAFH. However, the component density of dark green vegetables and beans was also higher in acquisitions from restaurants and other eating places than in those from large grocery stores. Another unexpected result reveals that as a share of total calories acquired, more empty calories were contained in acquisitions from large grocery stores than from restaurants and other eating places. Again, this likely reflects that shoppers bought certain items in larger amounts when shopping for FAH than when acquiring foods and beverages at a single event.

Finally, we look at differences in nutritional quality by outlet type for SNAP-participating households only (table 10) and find a few notable differences from the full sample. For one, acquisitions from small specialty stores were less strongly associated with higher nutritional quality for SNAP-participating households than for the full sample. Another notable difference between SNAP participants and the full sample was that, for SNAP participants, foods acquired from schools were more positively associated with many markers of high nutritional quality than were large grocery store acquisitions. For SNAP participants, HEI-2010 scores of school acquisitions were higher than those of their large grocery store acquisitions, and for every 1,000 calories acquired, SNAP participants' school meals provided more total fruit, whole fruit, and whole grains than their large-grocery-store acquisitions provided. For SNAP participants, school acquisitions also contained fewer empty calories than those from grocery stores. The finding may reflect the fact that children in SNAP-participating households were more likely to obtain USDA, National School Lunch Program meals, which needed to meet specific nutrition standards, while acquisitions for nonparticipants tended to include more foods from vending machines and à la carte items, which also tended to be of lower nutritional quality (Guthrie et al., 2013; Fox et al., 2009).

Table 9

Summary of nutritional quality and component densities by food outlet, for all populations

	Big grocery	Other grocery	All other FAH stores
		Mean (SE)	
Total HEI-2010 (100)	52.10 (0.41)	42.47*** (0.87)	36.60*** (0.84)
Component densities			
Total vegetables (>=1.1 cups)	0.84 (0.03)	4.23*** (0.63)	0.59*** (0.07)
Greens and beans (>= 0.2 cups)	0.15 (0.02)	0.60*** (0.15)	0.07*** (0.02)
Total fruit (>= 0.8 cups)	0.59 (0.02)	1.39*** (0.21)	0.37*** (0.05)
Whole fruit (>=0.4 cups)	0.46 (0.02)	1.36*** (0.22)	0.27*** (0.05)
Whole grains (>= 1.5 oz)	0.53 (0.02)	0.24*** (0.04)	0.27*** (0.06)
Dairy (>= 0.8 oz)	0.84 (0.02)	0.38*** (0.05)	0.93 (0.16)
Total protein foods (>= 2.5 oz)	2.60 (0.07)	2.18 (0.22)	1.33*** (0.09)
Seafood and plant protein (>= 0.8 oz)	0.65 (0.03)	0.56 (0.12)	0.55 (0.06)
Fatty acids ratio (>= 2.5)	2.01 (0.02)	2.52*** (0.11)	2.04 (0.08)
Sodium (<=1.1 gram)	2.16 (0.35)	1.15** (0.12)	1.95 (0.46)
Refined grains (<=1.8 oz)	2.38 (0.04)	1.82*** (0.14)	1.78*** (0.09)
Empty calories (<=19%)	31.57 (0.38)	22.84*** (1.94)	39.90*** (0.93)
Weekly calories			
Calories per adult equivalent, including zeros	14,273.96 (527.64)	619.01*** (119.21)	1,412.72*** (119.15)
Calories per adult equivalent, excluding zeros	16,446.03 (582.56)	3,440.21*** (497.70)	3,357.13*** (240.14)
Non-zero observations	4,120	765	2,187

- continued

Table 9
Summary of nutritional quality and component densities by food outlet, for all populations - *continued*

	Food away from home eating places	Schools	Family, friends, etc.	Work
	Mean (SE)			
Total HEI-2010 (100)	42.28*** (0.27)	46.71*** (0.83)	41.90*** (0.54)	38.02*** (0.88)
Component densities				
Total vegetables (>=1.1 cups)	0.96*** (0.03)	0.65*** (0.04)	1.36*** (0.16)	0.67** (0.08)
Greens and beans (>= 0.2 cups)	0.21** (0.02)	0.03*** (0.00)	0.21 (0.04)	0.17 (0.04)
Total fruit (>= 0.8 cups)	0.11*** (0.01)	0.78 (0.09)	0.48** (0.06)	0.31*** (0.05)
Whole fruit (>=0.4 cups)	0.06*** (0.01)	0.60 (0.08)	0.38 (0.06)	0.25*** (0.05)
Whole grains (>= 1.5 oz)	0.08*** (0.01)	0.41** (0.04)	0.14*** (0.02)	0.25*** (0.04)
Dairy (>= 0.8 oz)	0.71*** (0.01)	1.43*** (0.06)	0.45*** (0.02)	0.48*** (0.03)
Total protein foods (>= 2.5 oz)	3.22*** (0.04)	1.98*** (0.06)	3.10*** (0.07)	2.06*** (0.13)
Seafood and plant protein (>= 0.8 oz)	0.52*** (0.03)	0.32*** (0.03)	0.48*** (0.05)	0.41*** (0.06)
Fatty acids ratio (>= 2.5)	1.99 (0.02)	1.71*** (0.03)	2.21** (0.07)	2.49*** (0.07)
Sodium (<=1.1 gram)	1.76 (0.02)	1.64 (0.02)	1.68 (0.03)	1.72 (0.06)
Refined grains (<=1.8 oz)	3.26*** (0.04)	3.25*** (0.09)	2.92*** (0.08)	3.09*** (0.20)
Empty calories (<=19%)	30.18*** (0.32)	31.30 (0.88)	28.67*** (0.80)	31.15 (0.97)
Weekly calories				
Calories per adult equivalent, including zeros	3,737.04*** (88.76)	493.00*** (38.43)	830.04*** (51.84)	325.00*** (21.54)
Calories per adult equivalent, excluding zeros	4,406.94*** (96.67)	3,422.62*** (179.84)	2,259.40*** (104.29)	1,474.66*** (74.88)
Non-zero observations	3,967	1,041	1,684	944

Notes: Units of component density differ by row, with each row's heading and target amount setting the unit for that row. Standard errors (SE, in parentheses, estimated via jackknife repeated replication); weighted means reported; **, *** = statistically significantly different from large grocery stores with $p < 0.05$ and 0.01, respectively. Healthy Eating Index-2010 (HEI-2010) scores and component densities were estimated using the simple mean approach. FAH = food at home. Results from the "Own production" and "Other assistance" not reported because sample size is less than 50.
Source: USDA, Economic Research Service (ERS) estimates using data from USDA's National Household Food Acquisition and Purchase Study (FoodAPS).

Table 10

Summary of nutritional quality and component densities by food outlet, for SNAP participants

	Large grocery	Other grocery	All other FAH stores
		Mean (SE)	
Total HEI (100)	45.58 (0.72)	35.89*** (2.06)	34.57*** (1.15)
Component densities			
Total vegetables (>=1.1 cups)	0.62 (0.04)	2.68*** (0.71)	0.46 (0.07)
Greens and beans (>= 0.2 cups)	0.08 (0.01)	0.15 (0.08)	0.02*** (0.01)
Total fruit (>= 0.8 cups)	0.47 (0.05)	1.28 (0.55)	0.18*** (0.02)
Whole fruit (>=0.4 cups)	0.34 (0.04)	1.17 (0.55)	0.09*** (0.02)
Whole grains (>= 1.5 oz)	0.31 (0.03)	0.28 (0.13)	0.26 (0.07)
Dairy (>= 0.8 oz)	0.79 (0.03)	0.65 (0.26)	0.54*** (0.06)
Total protein foods (>= 2.5 oz)	2.68 (0.11)	2.02 (0.40)	1.48*** (0.16)
Seafood and plant protein (>= 0.8 oz)	0.49 (0.05)	0.27 (0.11)	0.39 (0.07)
Fatty acids ratio (>= 2.5)	1.91 (0.05)	1.66 (0.12)	2.09 (0.12)
Sodium (<=1.1 gram)	1.64 (0.06)	1.12 (0.27)	2.05 (0.73)
Refined grains (<=1.8 oz)	2.56 (0.12)	1.74** (0.31)	1.87*** (0.12)
Empty calories (<=19%)	33.64 (0.68)	22.51*** (3.66)	43.27*** (1.71)
Weekly calories			
Calories per adult equivalent, including zeros	13,278.17 (561.04)	419.39*** (129.20)	2,285.05*** (398.08)
Calories per adult equivalent, excluding zeros	15,991.27 (620.68)	3,060.13*** (978.24)	4,478.74*** (709.59)
Non-zero observations	1,325	220	811

- *continued*

Table 10

Summary of nutritional quality and component densities by food outlet, for SNAP participants - *continued*

	Food Away From Home eating places	Schools	Family, friends, etc.	Work
	Mean (SE)			
Total HEI-2010 (100)	39.35*** (0.54)	48.93*** (0.93)	39.41*** (1.29)	36.72*** (1.57)
Component densities				
Total vegetables (>=1.1 cups)	0.82*** (0.07)	0.56 (0.05)	0.80*** (0.07)	0.74 (0.16)
Greens and beans (>= 0.2 cups)	0.15 (0.04)	0.05** (0.01)	0.13 (0.03)	0.10 (0.02)
Total fruit (>= 0.8 cups)	0.10*** (0.01)	0.78*** (0.09)	0.40** (0.09)	0.14*** (0.03)
Whole fruit (>=0.4 cups)	0.06*** (0.01)	0.54** (0.06)	0.26 (0.09)	0.09*** (0.03)
Whole grains (>= 1.5 oz)	0.04*** (0.01)	0.41** (0.03)	0.16*** (0.03)	0.21 (0.10)
Dairy (>= 0.8 oz)	0.71*** (0.03)	1.62*** (0.06)	0.46*** (0.04)	0.58** (0.08)
Total protein foods (>= 2.5 oz)	3.03 (0.12)	2.21*** (0.08)	3.38*** (0.14)	2.28 (0.25)
Seafood and plant protein (>= 0.8 oz)	0.36 (0.05)	0.34*** (0.03)	0.27*** (0.05)	0.29 (0.09)
Fatty acids ratio (>= 2.5)	1.99 (0.03)	1.63*** (0.03)	2.02 (0.07)	2.24 (0.23)
Sodium (<=1.1 gram)	1.63 (0.04)	1.73 (0.03)	1.70 (0.06)	1.62 (0.12)
Refined grains (<=1.8 oz)	3.12*** (0.07)	3.49*** (0.11)	3.12*** (0.16)	2.87 (0.24)
Empty calories (<=19%)	31.02*** (0.81)	29.39*** (0.75)	27.70*** (1.30)	36.19 (3.23)
Weekly calories				
Calories per adult equivalent, including zeros	2,676.64*** (111.42)	937.64*** (94.35)	1,151.79*** (171.97)	283.89*** (54.72)
Calories per adult equivalent, excluding zeros	3,697.25*** (110.39)	4,679.27*** (337.12)	2,997.17*** (381.30)	2,156.16*** (322.22)
Non-zero observations	1,181	439	547	209

Notes: Units of component density differ by row, with each row's heading and target amount setting the unit for that row. Standard errors (SE, in parentheses, estimated via jackknife repeated replication); weighted means reported; **, *** = statistically significantly different from large grocery stores with $p < 0.05$ and 0.01, respectively. Healthy Eating Index-2010 (HEI-2010) scores and component densities were estimated using the simple mean approach. Results from the "Own production" and "Other assistance" not reported because sample size is less than 50.

Source: USDA, Economic Research Service (ERS) estimates using data from USDA's National Household Food Acquisition and Purchase Study (FoodAPS).

Conclusion

This study provides descriptive information on food acquisition that supports and extends previous research based on food intake. Using the Healthy Eating Index-2010 (HEI-2010) to examine the nutritional quality of household purchases based on the self-reported data of USDA's National Household Food Acquisition and Purchase Survey (FoodAPS), we find results generally consistent with those based on the self-reported individual intake data of the National Health and Nutrition Examination Survey. This continuity supports the validity of FoodAPS nutritional data and their value for providing information on strategies to improve diet quality and health.

Our findings also underscore that fact that diets of most Americans have room for improvement. This finding holds true regardless of participation in food assistance programs, access to food stores, or sources of food acquisitions. Nevertheless, some issues are more urgent for some populations than for others. Compared to the SNAP-nonparticipating subgroups, SNAP-participating households purchased foods of lower quality overall. Similarly, compared to households with better access to stores selling healthy, affordable foods (using the household-level measure of access), households with lower access to these stores purchased foods of lower quality overall. Consistent with intake data, food prepared away from home (FAFH) was of lower nutritional quality for all populations. The difference between the nutritional quality of food prepared at home (FAH) and FAFH was particularly striking for higher income households.

The SNAP program aims to improve both the food security and diet quality of participating households, making this group of particular policy concern. SNAP-participating households purchased or otherwise acquired about as much food (measured in calories) as other households, but spent less. Besides facing tight budget constraints, SNAP households also tended to be younger, less educated, and more likely to be single parents. These multiple challenges complicate the task of making healthy, economical choices. SNAP-participating households acquired a larger share of their calories from FAH, which is typically less expensive and more nutritious than FAFH.

The fact that SNAP-participating households obtained more FAFH from school meals, which have nutrition standards, may explain why FAH and FAFH differed less in nutritional quality for SNAP-participating households than for higher income households. Their FAFH choices also were less expensive than those of other groups because larger proportions of SNAP participants' FAFH came from school meals and from friends and family. Devoting more of their food dollars to FAH probably helped SNAP-participating households to control food costs, but the nutritional quality of foods SNAP participants purchased from supermarkets was lower than that of other groups, suggesting the importance of helping SNAP participants improve the nutritional quality of their supermarket choices. Further investigation of SNAP households' food choices and the factors that influence them could inform SNAP-Ed, the Federal nutrition education program targeting SNAP participants and other low-income Americans.

When we look at results for all groups, use of either the neighborhood or household measure of food store access shows a correlation between better access and higher nutritional quality of purchases as measured by the HEI-2010. However, when only SNAP-participating households were considered, household food store access did not correlate with HEI-2010 scores. It may be that these measures of food store access identify households that are resource constrained in a manner that overlaps with SNAP participation, such that the food store access measure adds little information. Although food store access has been a key policy focus, the role it can play in improving the nutritional quality of

food purchases remains debatable and demands more investigation. Rahkovsky and Snyder (2015) and Handbury et al. (2016) find larger differences in healthfulness of food purchases due to income and education than to access. However, food store access has primarily been studied using food desert neighborhood-level measures that assume everyone in the neighborhood has the same level of access. Within a neighborhood, personal characteristics may influence access. Moreover, focusing only on low-income areas may overlook many households with poor access that live in middle—and higher income neighborhoods (Ver Ploeg et al., 2012).

Across all income/SNAP-participating/nonparticipating subgroups, foods acquired from restaurants and other eating places (excluding schools) were of lower nutritional quality than FAH acquisitions. The gap was largest for higher income households, which spent a larger share of their food dollars on FAFH. Higher income households relied more on restaurant and fast-food sources for their FAFH than did SNAP-participating households, for whom more FAFH came from school meals, which need to meet nutrition standards, and from meals with friends and family, which were probably more like FAH than FAFH. Higher income households may have been more able to relieve time constraints or satisfy preferences by choosing FAFH. SNAP-participating households that relied on school meals may have particularly benefited from the updated nutrition standards for school meals that have resulted in increasing offerings of fruits, dark green and other nutrient-dense vegetables, and whole grains. The SNAP program itself may have an unintended positive effect on nutritional quality of foods acquired because the use of SNAP benefits is limited to primarily FAH venues and foods not sold hot at point of purchase. While this requirement was originally enacted as a way to stretch food dollars, it may have also boosted nutritional quality of acquisitions by limiting benefit use to food sources that offer a wide array of healthy options.

Our study is descriptive and did not control for sociodemographic and other household characteristics (like education and age) and environmental factors, such as seasonal variation in food availability, which may have influenced the nutritional quality of foods acquired in the survey week. Future work will consider the healthfulness of food acquisitions in a multivariate framework. We observed these households' food acquisitions for 1 week, which may mean the observed acquisitions were not typical of usual acquisitions, especially if some households with poor store access were less frequent grocery shoppers. Finally, we did not actually observe consumption of foods but rather acquisitions, so we do not know whether households had stocks of foods to draw on during the survey week or whether they consumed the foods they acquired during the survey week.

References

Centers for Disease Control and Prevention. February 29, 2016. Prevention Status Reports.

Cummins, S., E. Flint, and S.A. Matthews. 2014. "New Neighborhood Grocery Store Increased Awareness of Food Access But Did Not Alter Dietary Habits Or Obesity," *Health Affairs* 33(2): 283-291.

Courtemanche, C. and A. Carden. 2011. "Supersizing Supercenters? The Impact of Walmart Supercenters on Body Mass Index and Obesity," *Journal of Urban Economics* 69(2):165-181.

Dietary Guidelines Advisory Committee. 2015. *Scientific Report of the 2015 Dietary Guidelines Advisory Committee (Advisory Report) to the Secretaries of the U.S. Departments of Health and Human Services (HHS) and Agriculture (USDA)*, HHS and USDA.

Dubowitz, T., M. Ghosh-Dastidar, D.A. Cohen, R. Beckman, E.D. Steiner, G.P. Hunter, K.R. Florez, C. Huang, C.A. Vaughan, J.C. Sloan, S.N. Zenk, S. Cummins and R.L. Collins. 2015. Diet and Perceptions Change with Supermarket Introduction in Food Desert, But Not Because of Supermarket Use. *Health Affairs.* 34(11):1,858-1,868.

Fox, M.K., A. Gordon, R. Nogales, and A. Wilson. 2009. "Availability and Consumption of Competitive Foods in US Public Schools," *Journal of the American Dietetic Association* 109(2):S57-S66.

Gregory, C, M. Ver Ploeg, M. Andrews and A. Coleman Jensen. 2013. *Supplemental Nutrition Assistance Program (SNAP) Participation Leads to Modest Changes in Diet Quality,* ERR-147*,* U.S. Department of Agriculture, Economic Research Service.

Guenther P.M., K.O.Casavale, J. Reedy, S.I. Kirkpatrick, H.A. Hiza, K.J. Kuczynski, L.L. Kahle, S.M. Krebs-Smith. 2013. "Update of Healthy Eating Index: HEI-2010," *Journal of the Academy of Nutrition and Dietetics* 113(4):569-80.

Guthrie, J. F., B-H Lin, and T.A. Smith. June 2016. "Linking Federal Food Intake Surveys Provides a More Accurate Look at Eating Out Trends." *Amber Waves* (data feature), U.S. Department of Agriculture, Economic Research Service.

Guthrie, J.F., C.B. Newman, K.X. Ralston, M.X. Press, and M.X. Ollinger. 2013. *Nutrition Standards for Competitive Foods in Schools: Implications for Foodservice Revenues*, EIB-114, U.S. Department of Agricuture.

Handbury, J., I. Rahkovsky, and M. Schnell. 2016. "Is The Focus on Food Deserts Fruitless? Retail Access and Food Purchases Across the Socioeconomic Spectrum," Wharton School, University of Pennsylvania, working paper.

Lin B-H, and Guthrie J.F. 2012. *Nutritional Quality of Food Prepared at Home and Away From Home, 1977-2008*, EIB-105. U.S. Department of Agriculture, Economic Research Service.

Lin, B.H., M. Ver Ploeg, P. Kasteridis, and S.T. Yen. 2014. "The Roles of Food Prices and Food Access in Determining Food Purchases of Low-income Households," *Journal of Policy Modeling.*

Mancino, L. and J. Guthrie. 2014. "SNAP Households Must Balance Multiple Priorities to Achieve a Healthful Diet," *Amber Waves*, U.S. Department of Agriculture, Economic Research Service.

Mancino, L., Todd, J.E., Guthrie, J., Lin, B-H. 2014. "Food Away From Home and Childhood Obesity," *Current Obesity Reports* 3(4):459-469.

Mancino, L., Todd, J.E., and Scharadin, B. 2018. "USDA's National Household Food Acquisition and Purchase Survey: Methodology for Imputing Missing Quantities To Calculate Healthy Eating Index-2010 Scores and Sort Foods Into ERS Food Groups". TB-1947, U.S. Department of Agriculture, Economic Research Service.

Mykerezi, E. and J. Mills. 2011. "The Impact of Food Stamp Program Participation on Household Food Insecurity," *American Journal of Agricultural Economics* 92(5):1,379-1,391.

Nord, M. 2013. *The Effects of the Decline in the Real Value of SNAP Benefits from 2009-2011,* ERR-151. U.S. Department of Agriculture, Economic Research Service.

Nord, M. and M. Prell. 2011. "Food Security Improved Following the 2009 ARRA Increase in SNAP Benefits Economic Research Report 116," U.S. Department of Agriculture, Economic Research Service.

Oliveira, V. 2016. *The Food Assistance Landscape: FY 2016 Annual Report*, EIB-169. U.S. Department of Agriculture, Economic Research Service.

Piernas C, B.M. Popkin. 2011. "Food Portion Patterns and Trends among U.S. Children and the Relationship to Total Eating Occasion Size, 1977–2006," *Journal of Nutrition* 141: 1,159–1,164.

Rahkovsky, I. and S. Snyder 2015. *Food Choices and Store Proximity*, ERR-195, U.S. Department of Agriculture, Economic Research Service.

Ratcliffe, C., S.M. McKiernan, and S. Zhang. 2011. "How Much Does the Supplemental Nutrition Assistance Program Reduce Food Insecurity?" *American Journal of Agricultural Economics* 93(4):1,082-1,098.

Strasser, J.H., J. Reedy, and S. Krebs-Smith. 2015. "Visualizing Diet Quality at Multiple Levels of the Food Stream," white paper, National Collaborative on Childhood Obesity Research.

Tiehen, L., D. Jolliffe, and C. Gundersen. 2012. *Alleviating Poverty in the United States: The Critical Role of SNAP Benefits,* ERR-132, U.S. Department of Agriculture, Economic Research Service.

Tiehen, L., C. Newman and J. Kirlin. 2017. *The Food-Spending Patterns of Households Participating in the Supplemental Nutrition Assistance Program: Findings From USDA"s FoodAPS*. Economic Information Brief 176, U.S. Department of Agriculture, Economic Research Service.

Todd, J. and B. Scharadin. 2016. *Where Households Get Food in a Typical Week: Findings From USDA's FoodAPS,* EIB-156, U.S. Department of Agriculture, Economic Research Service.

U.S. Department of Agriculture (USDA), Economic Research Service (ERS). 2015. National Household Food Acquisition and Purchase Survey (FoodAPS). (Data product.)

U.S. Department of Agriculture (USDA), Economic Research Service (ERS). 2016. Food Expenditures Series. (Data product.)

Ver Ploeg, M., L. Mancino, J. Todd, D.M. Clay and B. Scharadin. 2015. *Where Do Americans Usually Shop for Food and How Do They Travel To Get There? Initial Findings from the National Household Food Acquisition and Purchase Survey,* EIB-138, U.S. Department of Agriculture, Economic Research Service.

Ver Ploeg, M., V. Breneman, P. Dutko, R. Williams, S. Snyder, C. Dicken, and P. Kaufman. 2012. *Access to Affordable and Nutritious Food: Updated Estimates of Distance to Supermarkets Using 2010 Data,* ERR-143, U.S. Department of Agriculture, Economic Research Service.

Volpe, R., A. Okrent, E. Leibtag. 2013. The Effect of Supercenter-format Stores on the Healthfulness of Consumers' Grocery Purchases. *American Journal of Agricultural Economics*, 95(3): 568-589.

Yen, S., M. Andrews, Z. Chen, and D. Eastwood. 2008. "Food Stamp Program participation and food insecurity: An instrumental variables approach," *American Journal of Agricultural Economics* 90(1):117-132.

Young LR, M. Nestle. 2002. "The Contribution of Expanding Portion Sizes to the Obesity Epidemic," *American Journal of Public Health* 92:246-9.

Young LR, M. Nestle. 2003. Expanding portion sizes in the U.S. Marketplace: Implications for Nutrition Counseling," *Journal of American Dietetic Association.* 1O3(2):231-4.