1275 First Street NE, Suite 1200
Washington, DC 20002

Tel: 202-408-1080
Fax: 202-408-1056

center@cbpp.org
www.cbpp.org

May 12, 2022

Changes in SNAP Benefit Levels and Food Spending and Diet Quality: Simulations from the National Household Food Acquisition and Purchase Survey

By Michele Ver Ploeg and Chen Zhen[1]

Introduction

The Supplemental Nutrition Assistance Program (SNAP) provides eligible low-income individuals and families with monthly benefits to purchase food at participating food retailers. A vital part of the federal government's programs to improve health and economic security, SNAP's mission is to increase access to nutritious food and to improve the food security of families who experience hardship. In fiscal year 2021, over 41 million people participated in SNAP.[2]

Congress and the federal government have used increases in SNAP benefit levels as both a tool for providing relief to households experiencing hardship and a stabilizer to the economy during the pandemic. The Families First Coronavirus Response Act of 2020 allowed states to apply for waivers to temporarily adjust their operations to help manage their workloads and help participants gain and maintain access to the program. This legislation also authorized states to provide Emergency Allotments (EA) that enhanced SNAP benefit levels by at least $95 per household per month.[3] In December 2020, the Consolidated Appropriations Act further increased the maximum SNAP benefit levels by 15 percent for all SNAP participants in all states and participating U.S. Territories, including those receiving the maximum benefit. The 15 percent increase was due to sunset in June 2021, but the American Rescue Plan, enacted in March 2021, extended the benefit increase through September 2021.

The SNAP benefit increases in 2020-2021 were initiated as temporary responses to the extreme hardship some families were facing due to the economic fallout of the pandemic. Similar temporary benefit increases (raising maximum SNAP benefits by 13.6 percent) were implemented in response to the Great Recession of 2007-2009. But the debate about whether SNAP benefits are adequate to eliminate food insecurity and to sustain a nutritious diet is ongoing. An expert panel of the Institute of Medicine recommended raising SNAP benefits permanently because the levels were inadequate to provide a healthy diet for all families across the country.[4] Many others have argued that the Thrifty Food Plan (TFP), a minimal cost, nutritious diet that serves as the basis for determining SNAP benefit levels, was not sufficient for improving food security and nutrition.[5] They argue that SNAP benefits were inadequate because they did not account for the time costs of meal preparation implicit in the assumptions of the TFP, the lack of adjustment for regional price differences, and the general belief that benefits were not high enough for households to buy sufficient amounts of food, specifically healthful foods.

In response to a congressional directive in the 2018 farm bill, in August 2021 the U.S. Department of Agriculture released a revised TFP for the first time since 2006.[6] Before this revision, the cost of the TFP had been adjusted only for inflation since the 1970s, resulting in a set of foods that no longer reflected current dietary guidance, food consumption patterns, and broader economic realities that time-strapped families face when trying to buy and prepare healthy food. The revised TFP raised the maximum SNAP benefit by 21 percent. On average, this results in a roughly 27 percent increase in SNAP benefits, or about $36 per person per month or $1.20 per day. The revised TFP and the increase in SNAP benefits in response to the pandemic have renewed policy interest in understanding how an increase in SNAP benefits may change food spending outcomes and diet quality.

Due to the time lag in data on food purchasing or consumption from federal surveys, analysis of the impacts of this recent change in SNAP benefits may not be possible for a year or more after the policy went into effect.[7] Simulations of the anticipated impacts can be useful in the interim to estimate the anticipated impacts or impacts of smaller or larger benefit increases. This brief simulates how three levels of SNAP average benefit increases — 20 percent, 27 percent, and 40 percent — could impact food spending and diet quality, as measured through food purchases, using the 2012 National Household Food Acquisition and Purchase Survey (FoodAPS). These data can be used to simulate food spending because they include detailed information on outcomes of interest — nutrient composition, expenditures, and quantities purchased for specific foods by households, instead of highly aggregated food categories — and on explanatory variables of interest such as SNAP participation and benefit amounts, which have been validated using administrative records.[8] These simulations can help policymakers understand how a benefit increase could impact the average SNAP participant's spending and diet quality. We specifically focus on the simulations of a 27 percent increase because it is most proximate to the average SNAP benefit increase of the revised, 2021 TFP. We provide estimates for the smaller increase of 20 percent, which would be roughly the average increase for a 15 percent increase in the maximum benefit level, and a greater level increase of 40 percent for context.

We first simulate the impact of benefit increases for all SNAP households, and then focus separately on SNAP households with children under age 18. We simulate the impact of benefit increases on food spending, both overall and separately for food at home (FAH) and food away from home (FAFH). To see how food spending on specific food groups may be altered, we also simulate the impact of benefit increases on diet quality as purchased (not consumed) using the Health Eating Index-2010 (HEI), a broad measure of how a diet stacks up to the Dietary Guidelines for Americans (scores range from 0 to 100, with higher scores indicating greater alignment with the 2010 Dietary Guidelines), and the HEI component density scores, which are based on density (of specific food groups or nutrients) per 1,000 calories.[9] We also simulated how the benefit increase would change the quantity of spending on six key nutrients — dietary fiber, folic acid, iron, magnesium, calcium, and potassium. These are household level measures of diet quality based on food purchases and acquisitions.

In this analysis we find that the 27 percent increase in average SNAP benefit levels would result in:

- Increased FAH spending by $5.30 per household per week, or about 7 percent;
- Larger food spending increases for FAH, compared with FAFH,[10] and for households with children;
- Small but statistically significant increases in the nutritional quality of food purchases, as measured by the total HEI score and fatty acids component density (improved ratio of healthier fats to less healthy fats),[11] for SNAP households overall and SNAP households with children;
- Increased total fruit and whole fruit component densities for households with children; and
- Statistically significant increases of about 6 percent over the baseline in dietary fiber and the five micronutrients, with slightly larger increases for households with children.

Results from simulations of the 20 percent and 40 percent increases in SNAP benefits were consistent with those of the 27 percent increase. Impacts of the 20 percent increase are slightly smaller in magnitude than the 27 percent increase, while impacts of the 40 percent increase are slightly larger in magnitude. For example, total HEI increased by 0.7 percent, 0.9 percent, and 1.2 percent for the 20 percent, 27 percent, and 40 percent SNAP benefit increases, respectively. The set of outcomes with statistically significant changes is the same across all three sets of simulations. In the rest of this report, we first give a brief conceptual summary of how SNAP benefit level increases may impact food spending overall, and for different types of foods. We then review some key studies that have estimated the impact of SNAP benefit increases on food spending and diet quality and that are most relevant to our simulations. The next section gives a brief overview of the demand system approach that we use as a base for the simulations, as well as a summary of data used, from the National Household Food Acquisition and Purchase Survey. Simulations results are then presented, both for all SNAP households and separately for SNAP households with children under age 18. We conclude with some broad context for the findings and study limitations.

SNAP, Food Spending, and Diet Quality

SNAP is designed to boost food spending overall, and specifically spending on foods to be prepared or eaten at home (food at home, or FAH) since SNAP participants cannot use their benefits to purchase foods at restaurants or eating places (food away from home, or FAFH).[12] Since SNAP can only be spent on food, the amount SNAP households spend on food is greater than what they would spend if the benefit were provided as cash.[13] Still, when SNAP benefits increase, we do not expect that food spending will increase by the same amount; that means the marginal propensity to spend (MPS) on food from SNAP, or the additional amount of money a household spends on food from each dollar of SNAP benefits, is usually less than one. The reason is that receipt of additional SNAP benefits frees up money the household would have spent on food, without the SNAP benefit, for spending on other goods and necessities. Estimates of the MPS on food at home from SNAP vary substantially, ranging from 0.16 to 0.65.[14] However, even if the MPS for food from SNAP is relatively low, participating households will have increased food purchasing power. And providing resources in the form of SNAP, which can only be spent on food, increases food purchases more than providing cash, research has shown.

The impact of this increased purchasing power on diet quality depends on how households choose to spend their additional food dollars. Households could substitute for higher quality items (for example, higher quality cuts of meat or fresh produce instead of canned or frozen produce), or foods that save on preparation time (for example, bagged salads or prepared pasta dishes), or greater amounts of all foods. The fact that SNAP cannot be used for FAFH purchases (in other words, not at restaurants, cafeterias, or other food service providers) boosts food spending at FAH sources more than at these FAFH sources. This shift to FAH could increase diet quality since foods purchased or acquired from restaurants and eating places tend to be lower in nutritional quality than foods purchased at grocery stores and other food retailers.[15] All else equal, this aspect of SNAP likely encourages better nutrition among participants relative to nonparticipants.

Relevant Literature

A pair of studies that examined the SNAP benefit increases as part of the American Recovery and Reinvestment Act of 2009 (ARRA) in response to the Great Recession, and subsequent sunsetting of the increase, are relevant to our study.[16] These studies used the Food Security Supplement of the Current Population Survey (CPS-FSS) to compare changes in food security and food spending for SNAP households after a 13.6 percent increase in the maximum benefit (which translated into about a 20 percent increase in average benefits), implemented by ARRA, to those of households who were nearly eligible for SNAP but were not SNAP participants. The studies attributed differences in spending among these two groups before and after the benefit increases (and then again when the benefit increases were sunset) to the increase in benefit levels. When SNAP benefits increased, they found that food spending increased for all low-income households (all households with income less than 130 percent of federal poverty guidelines) by 5.4 percent, but they found a substantially larger increase among SNAP households at 9.1 percent compared with 3.4 percent for income eligible nonparticipants.[17] When SNAP benefit increases were gradually sunset as inflation eroded the benefit increase, they found that a reduction of SNAP benefits (by about half of the initial increase due to the ARRA expansions) reduced all food spending by 4.4 percent.[18] Taking both of these studies together, a 10 percent increase/decrease resulted in about a 3 to 6 percent change in food spending. Estimates of the increase in spending are smaller than estimates of the decrease in spending.

A similar study used the large SNAP benefit increases under the ARRA as a natural experiment to estimate the effect of increased SNAP benefits on FAH expenditures.[19] The authors drew their sample of SNAP participants and income-eligible nonparticipants from the 2007-2010 Consumer Expenditure Quarterly Interview Survey. They estimated the MPS on FAH out of SNAP benefits to be 0.48 — in other words, a $1.00 increase in SNAP benefits will lead to $0.48 more spending on food at home.

Another study analyzing the relationship between SNAP benefit levels and diet quality among SNAP participants used CPS data on FAH spending by participants of different income levels to simulate how food spending changes with an increase in SNAP benefit levels, controlling for household characteristics.[20] Using this method, the authors found a MPS from SNAP on FAH of $0.65, which is on the higher end of estimates for other studies. Using this MPS, they examined what would happen to FAH spending if SNAP benefits were increased by $30 per capita per month (just below the $36 per capita per month of the increases in SNAP benefits announced in 2021). They found that an additional $30 would increase FAH spending by $19.48 per capita per month, or about 11 percent above average baseline spending levels.

The second question we address is how the increase in benefit levels changes the healthfulness of purchased foods. In the U.S. people's diets do not align with recommendations for healthy eating. People across all income levels do not eat enough whole grains, vegetables, fruits, and dairy and consume too much sodium, refined grains, and empty calories — foods that contain little if any nutrients.[21] Broadly speaking, the healthfulness of foods consumed increases as income and education increase.[22] People with lower incomes, many of whom struggle to acquire an adequate supply of food, may face access and affordability barriers in obtaining healthful foods. In 2020, 10.5 percent of people in the U.S. were food insecure, meaning they had limited access to adequate food due to lack of money and other resources.[23]

If affordability is driving some of the differences in the healthfulness of food purchased by people with lower incomes and SNAP participants, we would expect that an increase in SNAP benefits would increase the healthfulness of these purchases. Evidence from Anderson and Butcher, using National Health and Nutrition Examination Survey data, show small but positive impacts of a $30 per capita SNAP benefit increase on quantities consumed of some key food groups — a 0.95 percent increase in milk; a 1.57 increase in legumes; a 0.4 percent increase in grains; a 0.64 percent increase in meat, poultry, fish mixtures; and a 1.48 percent increase in vegetables.[24] A USDA study estimated that a 10 percent increase in weekly food expenditures per household (roughly $5.91 per week in their sample) induced a 0.33 percent increase (or 0.17 point increase) in the Healthy Eating Index-2010.[25]

This study also estimated the impact of this increase on the HEI components and found that the 10 percent increase in food expenditures induces a 1.96 percent increase in the total fruit component, a 2.77 percent increase in whole fruit, a 0.88 percent increase in the vegetable component, a 1.85 percent increase in dark green and orange vegetables; no change in grains; and a decrease in energy density from sugars and desserts. Another study estimated the effect of participating in SNAP on diet quality using the HEI and its component scores to measure diet quality.[26] This study is different from ours and the studies previously reviewed in that it examined how SNAP participation in general impacts diet quality, not the impact of a marginal change in benefit levels on diet quality. It found that participation in SNAP induces a marginally lower (1.25 points, or about 2.5 percent) total HEI, once the estimates account for who decides to participate in SNAP. However, it also found that SNAP induces higher whole fruit, sodium, and saturated fat HEI component scores, and a lower dark green/orange vegetable score.

The studies cited earlier use observed associations between SNAP benefits and food spending (and consumption) to predict changes in food spending (and consumption) as benefit levels rise in the sample.[27] As an alternative to experimental or quasi-experimental studies, researchers have used econometric simulation to estimate the effect of changes to prices or income on food purchases and diet quality. We use a food demand system approach to estimate the impact of changing benefit levels on SNAP household purchasing patterns. In economics, consumer demand analysis involves formulating and estimating a demand system, or a set of equations, that describe how consumers allocate their total expenditures across goods (left-hand side of the equation), given the prices of goods, income, and consumer characteristics (right-hand side of the equation).[28] "System" refers to the holistic approach to examining the allocation of expenditures within a system of consumption goods in relation to price and income changes. A demand system model recognizes that demand for a particular good can change in response to a change in its price or in the household's income, but it also affects (and is affected by) the demand for other closely related goods. The values of the model parameters are derived from the data using statistical methods.[29] The statistical analysis models the impact of variations in food prices and disposable income in the FoodAPS data on consumer spending behavior on food and other goods. This approach recognizes consumer preferences vary across food groups.

The differences in preference lead to distinct purchase responses to food price changes and changes in disposable income. For example, due to budgetary constraints, a household who would otherwise prefer to purchase more vegetables may purchase other foods. Given more resources, such as an additional $1 per person in benefits per day, daily food spending might increase by 34 cents, of which 30 cents goes to FAH. Of the 30 cents of additional FAH spending, 4 cents might go to fruits and vegetables and the remainder to all other foods. Or, if the prices of one food group increase, relative to others, the approach models consumers' substitutions for other food groups. We then use the model to simulate what happens to purchase quantities, nutrient levels, and expenditures when SNAP benefit increases raise disposable income.

Approach

Our simulations of the impact of SNAP benefit increases use the results from a two-way Exact Affine Stone Index demand system estimated for the SNAP participant households from the FoodAPS.[30] The demand system includes 18 FAH groups differentiated by the U.S. Department of Agriculture's (USDA) Economic Research Services' Tier 1 food category and Guiding Star levels,[31] two FAFH groups differentiated by Guiding Star levels, and a numeraire good (or base good that allows for comparison) representing all other nondurable expenditures. The econometric approach accounts for truncated purchases at zero, price endogeneity, and the complex design of FoodAPS. Details for this demand system are provided in Zhen *et al.*[32] Using the demand estimates, we calibrate the MPS on FAH out of SNAP benefits implied by the demand system to 0.3, which is near the middle of the distribution of estimates from the literature and the same value used by USDA in its economic modeling.[33] Details of our simulation approach are discussed in Appendix 2.

FoodAPS is a nationally representative sample of U.S. households who recorded all the food acquisitions and purchases for a week from April 2012 to January 2013. The survey oversampled SNAP participants to improve the precision of estimates for this population, and we include 1,581 participant households who reported receiving SNAP at the time of the survey. Among these, 1,316 were households whose self-reported participation in SNAP was confirmed by SNAP administrative records; 239 households self-reported receipt of SNAP benefits but could not be matched with administrative records, and 26 did not give consent for administrative match. The administrative match to confirm SNAP participation is an advantage of the study, since most of the previous studies used data where SNAP receipt was underreported.[34] These SNAP households are the sample for our demand model estimation and our simulations. We should also note that our measures of diet quality and nutrient quantities are based on food spending, not actual food intake. Others have explained how to calculate HEI from food acquisitions and found that these estimates are generally consistent with those based on self-reported intake data.[35]

Results

The first set of simulations we present focuses on changes in food spending, both overall and separately for FAH and FAFH. The second set of simulations focuses on changes in diet quality, first by total HEI and HEI components, then for the quantity of six important diet nutrients — dietary fiber, folic acid, iron, magnesium, calcium, and potassium. In discussing both sets of simulation outcomes, we first discuss results for all SNAP households and then separately for SNAP households with children under age 18 (which compose 60 percent of the households in the sample).[36] Simulations of a 20 percent, 27 percent, and 40 percent average SNAP benefit increase are presented in the Appendix tables, but the text discussion focuses on the 27 percent benefit increase since that is equivalent to the implied benefit changes based on the new TFP. The 20 percent increase in average benefits is what would result from a 15 percent increase in the TFP. The 40 percent increase in average benefits is likely closer to what would result if basing SNAP benefits on the Low Food Cost Plan, a food plan similar to the TFP that meets the same dietary guidance and normal consumption patterns constraints as the TFP, but with a slightly higher budget, instead of the prior TFP.

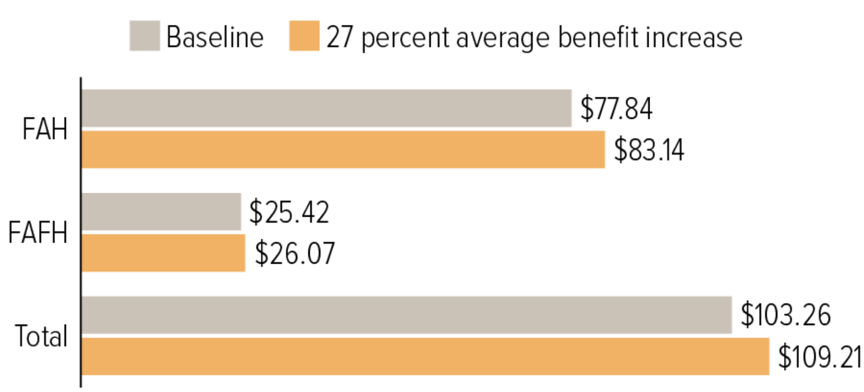
FAH, FAFH, and Total Food Spending Simulations

Figure 1 shows the baseline and simulated estimates of spending for FAH, FAFH, and total food spending for all SNAP households. Figure 2 does the same for SNAP households with children under age 18. (See Appendix Table 1.) The table shows the baseline spending levels in the first column and the estimated increase in spending for 20 percent, 27 percent, and 40 percent simulated increases in benefit amounts relative to the baseline along with the standard errors of these estimates.

FIGURE 1

Baseline and Simulated Increases in Weekly FAH, FAFH, and Total Food Spending, Based on a 27 Percent SNAP Benefit Increase

All SNAP households



Note: FAH = food at home. FAFH = food away from home.

Source: Simulations use FoodAPS data (April 2012 to January 2013) for 1,581 SNAP households.

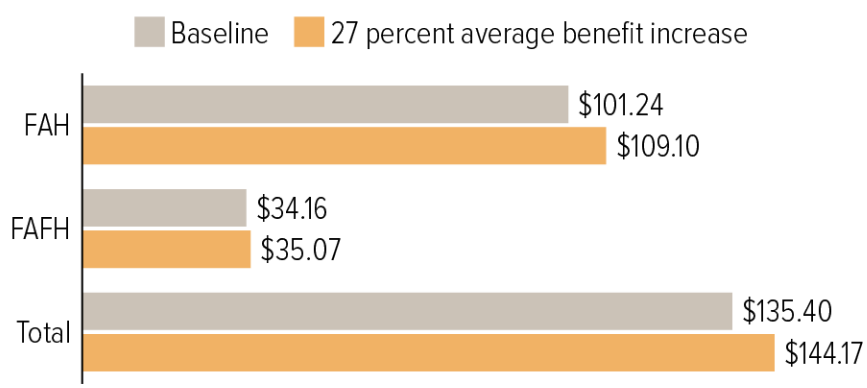
CENTER ON BUDGET AND POLICY PRIORITIES | CBPP.ORG

The revised TFP results in a roughly 27 percent benefit increase in average SNAP benefits — about $8.30 per person per week or $1.20 per day.[37] This simulation estimates that the average increase in weekly FAH spending per SNAP household is $5.30, or about 7 percent (on a baseline of just over $77 per week). (See Figures 1 and 2.) Most SNAP households are spending more on food than the amount of benefits they receive from SNAP. The simulated increase shifts some of that "out-of-pocket spending" to other goods, increasing SNAP participants' spending on all other goods, which likely alleviates some of the strains these families feel to meet their remaining needs.[38] The increased benefits also allow participants to shift some out-of-pocket food spending to FAFH. According to the simulations of the SNAP benefit increase, SNAP households' FAFH spending would also increase, but by a much smaller amount of $0.65 per week. Combined, the estimated increases in FAH ($5.30) and FAFH ($0.65) for total food spending, and the baselines for both, result in a 5.8 percent increase in total food spending.

FIGURE 2

Baseline and Simulated Increases in Weekly FAH, FAFH, and Total Food Spending, Based on a 27 Percent SNAP Benefit Increase

SNAP households with children under age 18



Note: FAH = food at home. FAFH = food away from home.

Source: Simulations use FoodAPS data (April 2012 to January 2013) for 915 SNAP households with children under age 18.

CENTER ON BUDGET AND POLICY PRIORITIES | CBPP.ORG

Figures 1 and 2 show that food spending increases are larger as a percentage of the baseline for households with children, relative to SNAP households without children. FAH spending for households with children increased by 7.8 percent ($7.86 per household per week on a base of $101.24) and by 2.7 percent for FAFH spending ($0.91 on a base of $34.16).

Healthy Eating Index and Component Density Score Simulations

We also estimated the impact of a simulated 27 percent SNAP benefit increase on diet quality, as measured through the Healthy Eating Index-2010 (HEI) overall score and density (quantities per 1,000 kilocalories, or kcal) for the HEI component food groups. The HEI has 12 component scores for broad food groups, which are assessed by the amount of a food or nutrient per 1,000 kilocalories in the total diet, relative to the recommendations from the DGA. Nine of the components are for foods whose recommended consumption level should increase, and three for which moderation of consumption is recommended, although we break this last one down into two categories — one for added sugars and one for solid fats.

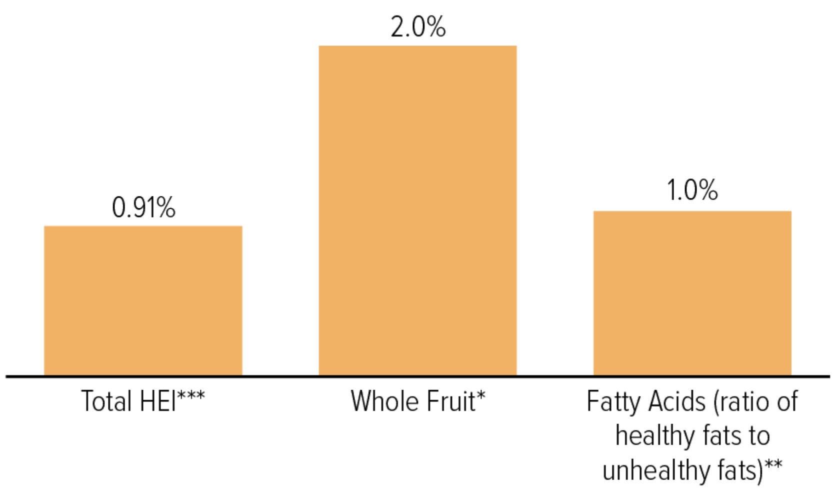
As mentioned above, these estimates of HEI and component densities are based on purchased foods, not actual intake. Figures 3 and 4 show the percentage increase in the total HEI score and the components for which simulations showed statistically significant increases for all SNAP households and SNAP households with children. The full set of simulation estimates for all HEI components and for the 20 percent, 27 percent, and 40 percent benefit increases for all SNAP households are available in Appendix Tables 2 and 3 for SNAP households with children under age 18.

For all SNAP households, simulated increases in benefits have a positive and statistically significant, but small impact on the total HEI score. We estimate that the 27 percent increase in benefits will increase HEI by 0.44 percentage points, or about a 0.9 percent increase in the total HEI. The only component density with a statistically significant change is the fatty acids component (improved ratio of healthy fats to unhealthy fats), which increases almost 1 percent over the baseline. There is a marginally statistically significant increase of 2 percent in the whole fruit component. These findings are consistent with a 2010 USDA study, which simulated how a 10 percent benefit increase in SNAP would impact HEI and found a 0.33 percent increase in the total HEI.[39] Their study also estimated significant increases in the total fruit, whole fruit, total vegetable, and dark green and orange vegetable component density scores.

FIGURE 3

Percent Increase in Total HEI, Whole Fruit, and Fatty Acid Scores, Simulated From a 27 Percent SNAP Benefit Increase

All SNAP households



Notes: *, **, *** indicate the relationship is significant for a two-sided test at the 0.10, 0.05, 0.01 level or better, respectively. The Healthy Eating Index (HEI) is a measure of diet quality that assesses how well a set of foods aligns with dietary guidelines. Simulation is based on foods purchased by 1,571 SNAP households. The total HEI and each of the two component scores showed statistically significant increases in the simulations.

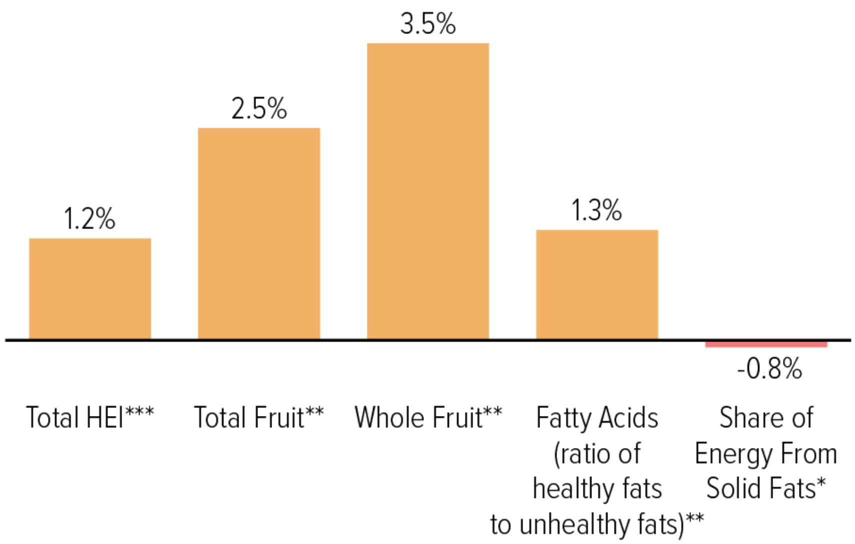
Source: Simulations use FoodAPS data (April 2012 to January 2013) for 1,581 SNAP households.

CENTER ON BUDGET AND POLICY PRIORITIES | CBPP.ORG

FIGURE 4

Percent Increase in Total HEI, Whole Fruit, and Fatty Acid Scores, Simulated From a 27 Percent SNAP Benefit Increase

SNAP households with children under age 18



Notes: *, **, *** indicate the relationship is significant for a two-sided test at the 0.10, 0.05, 0.01 level or better, respectively. The Healthy Eating Index (HEI) is a measure of diet quality that assesses how well a set of foods aligns with dietary guidelines. Simulations are based on 915 SNAP households with children under age 18. The total HEI and each of the two component scores showed statistically significant increases in the simulations.

Source: Simulations use FoodAPS data (April 2012 to January 2013) for 915 SNAP households with children under age 18.

CENTER ON BUDGET AND POLICY PRIORITIES | CBPP.ORG

For SNAP households with children, we simulate that the 27 percent increase in benefits will raise the HEI of purchased food by 0.59 points, or 1.2 percent above the baseline. This increase is statistically significant. We also estimate increases in the whole fruit, total fruit, and fatty acid component density scores. Both fruit density increases are larger than increases for the total HEI — a 3.5 percent increase for whole fruit and a 2.5 percent increase for total fruit. For moderation components, the simulations show a slight, marginally statistically significant increase in energy from solid fats. Changes to other component densities are not statistically significant.

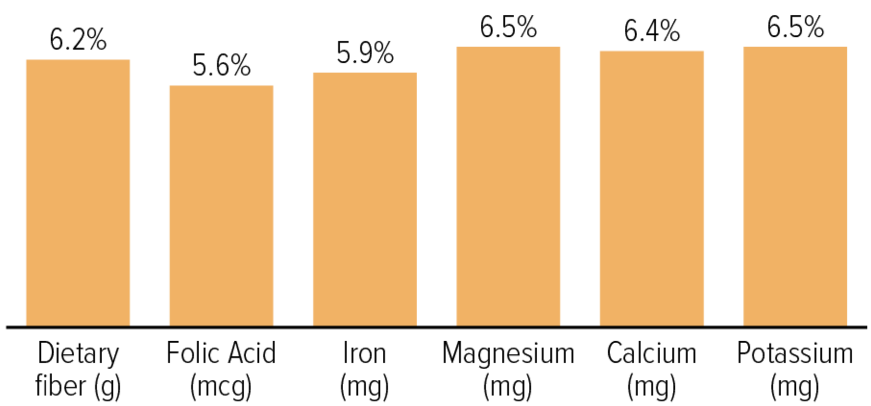
Changes in Nutrient Quantities Purchased

We also simulate how the SNAP benefit increases impact the acquired quantities of several key nutrients — dietary fiber, folic acid, iron, magnesium, calcium, and potassium (Appendix Tables 4 and 5). Figure 5 shows the simulated percent increases in quantities of these nutrients purchased for all SNAP households. The 27 percent increase is estimated to increase the amounts of key nutrients purchased by 6 to 7 percent above their respective baseline amounts. Each increase is statistically significant. The largest percent increases are for magnesium, potassium, and calcium. Figure 6 shows the same simulated increases for SNAP households with children. Again, the percent increases are slightly larger for these families relative to all SNAP households, ranging from a 6.5 percent increase in folic acid to a 7.7 percent increase in potassium.

FIGURE 5

Percent Increase in Quantity of Nutrients Simulated From a 27 Percent SNAP Benefit Increase

All SNAP households



Notes: Baseline nutrients per adult male equivalent (AME) are based on 1,581 SNAP households, including those with zero dietary energy purchased or acquired during the survey week. AME estimates account for the number of adults and children of different ages relative to the level of calories needed to maintain caloric balance, assuming moderate levels of activity using the Dietary Guidelines for Americans, 2020. We based estimates of calories on requirements for a moderately active adult male and adjust these needs for the age and sex of other household members using the 2020 Dietary Guidelines for Americans because it is the basis for the revised Thrifty Food Plan.

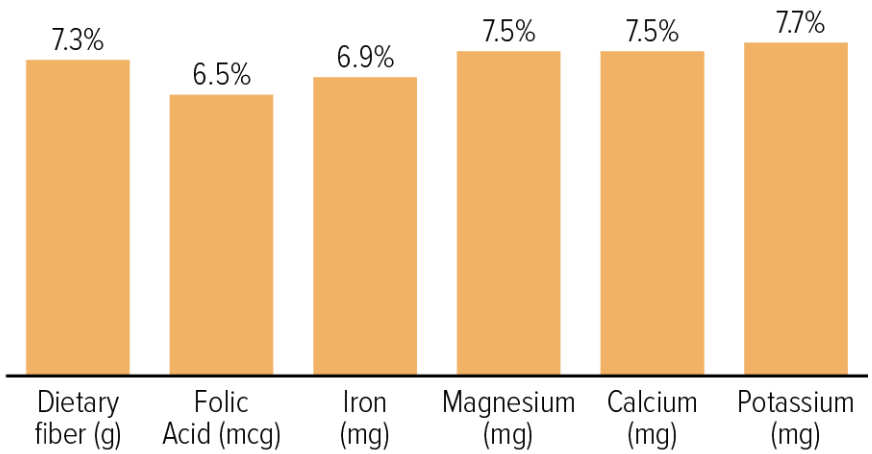
Source: Food APS data were collected from April 2012 to January 2013, before the revised dietary guidelines were published.

CENTER ON BUDGET AND POLICY PRIORITIES | CBPP.ORG

FIGURE 6

Percent Increase in Quantity of Nutrients Simulated From a 27 Percent SNAP Benefit Increase

SNAP households with children under age 18



Notes: Baseline nutrients per adult male equivalent (AME) are based on 915 SNAP households, including those with zero dietary energy purchased or acquired during the survey week. AME estimates account for the number of adults and children of different ages relative to the level of calories needed to maintain caloric balance, assuming moderate levels of activity using the Dietary Guidelines for Americans, 2020. We based estimates of calories on requirements for a moderately active adult male and adjust these needs for the age and sex of other household members using the 2020 Dietary Guidelines for Americans because it is the basis for the revised Thrifty Food Plan.

Source: FoodAPS data were collected from April 2012 to January 2013, before the revised dietary guidelines were published.

CENTER ON BUDGET AND POLICY PRIORITIES | CBPP.ORG

Summary and Discussion

We estimate that a 27 percent SNAP benefit average increase results in FAH spending increases of $5.30 for SNAP households per week (or about 7 percent above baseline weekly spending for all SNAP households) and 8 percent for SNAP households with children under age 18. We also find that the increase in SNAP benefits has a modest impact on diet quality as measured by the HEI and its component densities (acquisitions per 1,000 kcal). We also find increases in whole fruit and fatty acid densities for all SNAP households, and increases in whole fruit, total fruit, and fatty acid densities for SNAP households with children. Our estimates also show that the quantities of several key nutrients are simulated to increase by around 6 percent for all SNAP households and 7 percent for SNAP households with children.

SNAP benefit levels based on the revised TFP went into effect in October of 2021. Our simulations are based on benefit levels before the temporary increases to SNAP benefits as part of COVID-19 relief measures implemented in 2020 and 2021. Further, most SNAP households also received sizable temporary cash benefits from the American Rescue Plan's expanded Child Tax Credit, which was in effect until the end of 2021. Thus, SNAP households with children also experienced significant increases in the cash available for food or other goods, at least initially when the increase in the TFP was implemented. We are not able to simulate these increases with our data.

Since our simulations are based on acquisitions of foods and not actual intake, our measures of diet quality do not account for any food that is wasted, or which members of a household consume the food.[40] Recent estimates show that about 30 percent of household food is wasted, although waste is lower among SNAP households and lower-income households.[41]

FoodAPS is the best source of data for estimating food demand because it collects price and quantity information on foods acquired by a sample of households that is representative of SNAP and lower-income populations and because, for most SNAP households, it matches administrative data on receipt of SNAP benefits. However, FoodAPS is almost a decade old and only representative of a one-week period during 2012 to 2013. While we find that estimates of food spending and acquisition of key nutrients are precisely estimated, estimates of changes to HEI and its components are less precisely estimated.

The primary goal of SNAP is to improve food security among lower-income households. The simulation results presented here do not assess the extent to which SNAP benefit increases improve food security. SNAP benefit increases are very likely to improve food security, but we leave it to other studies to estimate this.

Summary of Simulations of a 27 Percent SNAP Benefit Increase

Overall	• FAH spending increases are larger than increases in FAFH spending. • The SNAP benefit increase is simulated to increase the overall Healthy Eating Index (HEI) scores modestly, by 0.44 points or 1 percent. The size of the increase is small but statistically significant, and in line with other studies that show small changes in the HEI in response to changes in SNAP benefits. • Simulations also show a statistically significant but small increase in the whole fruit and fatty acids components of HEI, both of which are indicators of improvement in diet quality. • Simulations of changes in quantities of six nutrients purchased show roughly 6 percent increases in spending on each nutrient. • Almost all simulations show larger changes for households with children.
Food at Home (FAH) and Food Away from Home (FAFH)	• The 27 percent increase in SNAP benefits, which roughly corresponds to the increase in SNAP benefit levels based on the revised TFP effective October 2021, is simulated to increase FAH spending among SNAP households by $5.30 per week or about 6.8 percent above baseline levels. There is a modest estimated increase in FAFH spending of $0.65 per week or 2.5 percent above the baseline.
Healthy Eating Index (HEI)	• The total HEI increases by 0.44 points or 1 percent and is statistically significant. • Whole fruit density increases by 1.5 percent and is statistically significant. • There was a positive and statistically significant increase in the fatty acids density score (ratio of healthy fats to unhealthy fats). • For households with children, the increases in the whole and total fruit components and fatty acids components are larger and all are statistically significant (3.5 percent and 2.5 percent, respectively). • For households with children, there is also a decrease in the score for solid fats as a share of energy intake, indicating a worsening of this component of the HEI score.
Nutrients	• Simulations of the amount of dietary fiber, folic acid, magnesium, iron, calcium, and potassium purchased show statistically significant increases in each of these nutrients in the range of 6 percent.

Appendix 1

Tables 1-5

APPENDIX TABLE 1

Baseline and Simulated Average Changes in Food Spending for a Range of Increases in Benefit Levels, Among All SNAP Households

Spending Outcome	Baseline	Percent Increase in SNAP Benefit Level		
		20%	27%	40%
All SNAP Households				
Weekly Food at Home ($)	77.84	3.92***	5.30***	7.85***
(s.e)		*(0.62)*	*(0.84)*	*(1.25)*
Weekly Food Away from Home ($)	25.42	0.48***	0.65***	0.96***
(s.e)		*(0.14)*	*(0.19)*	*(0.29)*
SNAP Households With Children				
Weekly Food at Home ($)	101.24	5.82***	7.85***	11.64***
(s.e)		*(1.05)*	*(1.42)*	*(2.11)*
Weekly Food Away from Home ($)	34.16	0.68***	0.91***	1.35***
(s.e)		*(0.24)*	*(0.32)*	*(0.47)*

Notes: Standard errors are in parentheses. *** indicates p < 0.01; ** p < 0.05; * p < 0.10. Baseline estimates are based on 1,581 SNAP households including those with zero FAH and FAFH spending for the survey week. The average SNAP benefit is $100.42/person per month. Average household size is 2.90 persons. For households with children, baseline estimates are based on 915 SNAP households. For these households, the average SNAP benefit is $93.24/person per month and the average household size is 4.30 persons. Estimates include those with zero FAH and FAFH spending for the survey week.

APPENDIX TABLE 2

Baseline and Simulated Average Changes in Overall Diet Quality and Nutrient Density, All SNAP Households

Measures	Baseline	Simulated SNAP Benefit Increase		
		20%	27%	40%
HEI Total Score	47.85	0.34***	0.44***	0.58**
(s.e)		*(0.13)*	*(0.17)*	*(0.23)*
Adequacy Component Densities				
Total Fruit (cup eq./1,000 kcal)	0.3557	0.0042	0.0053	0.0072
(s.e)		*(0.0027)*	*(0.0034)*	*(0.0047)*
Whole Fruit (cup eq./1,000 kcal)	0.2554	0.0040*	0.0051*	0.0067*
(s.e)		*(0.0023)*	*(0.0029)*	*(0.0040)*

APPENDIX TABLE 2

Baseline and Simulated Average Changes in Overall Diet Quality and Nutrient Density, All SNAP Households

Measures	Baseline	Simulated SNAP Benefit Increase		
		20%	27%	40%
Total Vegetables (cup eq./1,000 kcal)	0.7228	0.0000	0.0002	0.0006
(s.e)		*(0.0045)*	*(0.0059)*	*(0.0082)*
Dark Greens & Beans (cup eq./1,000 kcal)	0.0936	-0.0005	-0.0005	-0.0006
(s.e)		*(0.0009)*	*(0.0012)*	*(0.0016)*
Total Dairy (cup eq./1,000 kcal)	0.7906	0.0001	0.0000	-0.0003
(s.e)		*(0.0051)*	*(0.0066)*	*(0.0091)*
Whole Grains (oz eq./1,000 kcal)	0.2755	-0.0010	-0.0013	-0.0017
(s.e)		*(0.0019)*	*(0.0025)*	*(0.0035)*
Protein Foods (oz eq./1,000 kcal)	2.7918	-0.0126	-0.0161	-0.0216
(s.e)		*(0.0094)*	*(0.0121)*	*(0.0169)*
Seafood and Plant Protein (oz eq./1,000 kcal)	0.4617	0.0009	0.0009	0.0008
(s.e)		*(0.0034)*	*(0.0043)*	*(0.0058)*
Fatty Acids[a]	1.9314	0.0147**	0.0187**	0.0254**
(s.e)		*(0.0071)*	*(0.0091)*	*(0.0124)*
Moderation Component Densities				
Refined Grains (oz eq./1,000 kcal)	2.8670	-0.0126	-0.0160	-0.0216
(s.e)		*(0.0106)*	*(0.0137)*	*(0.0196)*
Sodium (g/1,000 kcal)	1.6759	-0.0035	-0.0044	-0.0058
(s.e)		*(0.0035)*	*(0.0045)*	*(0.0062)*
Share of Energy from Added Sugars (percentage point)	15.6772	-0.0905	-0.1163	-0.1596
(s.e)		*(0.0610)*	*(0.0780)*	*(0.1075)*
Share of Energy from Solid Fats (percentage point)	17.2695	-0.0720	-0.0919	-0.1244
(s.e)		*(0.0480)*	*(0.0615)*	*(0.0851)*

[a] Ratio of total monounsaturated and polyunsaturated fatty acids to total saturated fatty acids.

Notes: Adequacy components represent the food groups and dietary elements that dietary guidelines encourage. Moderation components represent the food groups and dietary elements for which there are recommended limits to consumption. Standard errors are in parentheses. *** indicates p < 0.01; ** p < 0.05; * p < 0.10. Baseline HEI and density measures are based on 1,517 SNAP households who purchased or acquired > 0 dietary energy.

APPENDIX TABLE 3

Baseline and Simulated Changes in Overall Diet Quality and Nutrient Density, SNAP Households With Children Under Age 18

Measures	Baseline	Simulated SNAP Benefit Increase		
		20%	27%	40%
HEI Total Score	47.92	0.46 ***	0.59 ***	0.80***
(s.e)		*(0.16)*	*(0.20)*	*(0.27)*
Adequacy Component Densities				
Total Fruit (cup eq./1,000 kcal)	0.3465	0.0067**	0.0086**	0.0116**
(s.e)		*(0.0032)*	*(0.0041)*	*(0.0056)*
Whole Fruit (cup eq./1,000 kcal)	0.2316	0.0064**	0.0081**	0.0109**
(s.e)		*(0.0027)*	*(0.0034)*	*(0.0047)*
Total Vegetables (cup eq./1,000 kcal)	0.7043	0.0002	0.0004	0.0008
(s.e)		*(0.0045)*	*(0.0059)*	*(0.0084)*
Dark Greens & Beans (cup eq./1,000 kcal)	0.0875	-0.0004	-0.0004	-0.0003
(s.e)		*(0.0009)*	*(0.0012)*	*(0.0017)*
Total Dairy (cup eq./1,000 kcal)	0.8564	-0.0013	-0.0017	-0.0023
(s.e)		*(0.0057)*	*(0.0073)*	*(0.0101)*
Whole Grains (oz eq./1,000 kcal)	0.2720	-0.0011	-0.0015	-0.0020
(s.e)		*(0.0021)*	*(0.0027)*	*(0.0038)*
Protein Foods (oz eq./1,000 kcal)	2.5954	-0.0140	-0.0182	-0.0251
(s.e)		*(0.0101)*	*(0.0130)*	*(0.0179)*
Seafood and Plant Protein (oz eq./1,000 kcal)	0.3651	0.0022	0.0024	0.0028
(s.e)		*(0.0033)*	*(0.0043)*	*(0.0058)*
Fatty Acids[a]	1.8682	0.0183**	0.0234**	0.0318**
(s.e)		*(0.0087)*	*(0.0111)*	*(0.0152)*
Moderation Component Densities				
Refined Grains (oz eq./1,000 kcal)	2.8948	-0.0183	-0.0236	-0.0322
(s.e)		*(0.0121)*	*(0.0157)*	*(0.0228)*
Sodium (g/1,000 kcal)	1.6501	-0.0042	-0.0054	-0.0073
(s.e)		*(0.0043)*	*(0.0055)*	*(0.0075)*
Share of Energy from Added Sugars (percentage point)	16.8662	-0.1060	-0.1362	-0.1866
(s.e)		*(0.0726)*	*(0.0929)*	*(0.1272)*

APPENDIX TABLE 3

Baseline and Simulated Changes in Overall Diet Quality and Nutrient Density, SNAP Households With Children Under Age 18

Measures	Baseline	Simulated SNAP Benefit Increase		
		20%	27%	40%
Share of Energy from Solid Fats (percentage point)	17.0911	-0.1066*	-0.1363*	-0.1851*
(s.e)		*(0.0565)*	*(0.0720)*	*(0.0990)*

[a] Ratio of total monounsaturated and polyunsaturated fatty acids to total saturated fatty acids.
Notes: Adequacy components represent the food groups and dietary elements that dietary guidelines encourage. Moderation components represent the food groups and dietary elements for which there are recommended limits to consumption. Standard errors are in parentheses. *** indicates p < 0.01; ** p < 0.05; * p < 0.10. Baseline HEI and density measures are based on 893 SNAP households with children under age 18 who purchased or acquired > 0 dietary energy.

APPENDIX TABLE 4

Baseline and Simulated Changes in Key Nutrient Acquisition, All SNAP Households

Weekly Nutrients per Adult Male Equivalent	Baseline Amount	Simulated SNAP Benefit Increase		
		20%	27%	40%
Dietary Fiber (g)	145.2	6.7***	9.0***	13.3***
(s.e)		*(0.9)*	*(1.2)*	*(1.8)*
Folic Acid (mcg)	2219.1	92.1***	124.3***	184.2***
(s.e)		*(23.2)*	*(31.3)*	*(46.3)*
Iron (mg)	160.8	7.0***	9.4***	14.0***
(s.e)		*(1.0)*	*(1.4)*	*(2.0)*
Magnesium (mg)	2529.1	122.3***	165.0***	244.5***
(s.e)		*(17.3)*	*(23.4)*	*(34.6)*
Calcium	8749.2	417.5***	563.6***	835.0***
(s.e)		*(76.0)*	*(102.6)*	*(152.1)*
Potassium	25120.4	1202.7***	1623.6***	2405.3***
(s.e)		*(192.8)*	*(260.2)*	*(385.5)*

Notes: Standard errors are in parentheses. *** indicates p < 0.01. Baseline nutrients per adult male equivalent are based on 1,581 SNAP households, including those with zero dietary energy purchased or acquired during the survey week. We based estimates of calories on requirements for a moderately active adult male and adjust these needs for the age and sex of other household members using the 2020 Dietary Guidelines for Americans, because it is the basis for the revised TFP.

Source: FoodAPS data were collected from April 2012 to January 2013, before the revised dietary guidelines were published.

APPENDIX TABLE 5

Baseline and Simulated Changes in Key Nutrient Acquisition, SNAP Households With Children Under Age 18

Weekly Nutrients per Adult Male Equivalent	SNAP households with children under age 18			
	Baseline Amount	Simulated SNAP Benefit Increase		
		20%	27%	40%
Dietary Fiber (g)	126.9	6.9***	9.3***	13.8***
(s.e)		*(1.0)*	*(1.3)*	*(1.9)*
Folic Acid (mcg)	2103.5	101.0***	136.3***	201.9***
(s.e)		*(32.2)*	*(43.5)*	*(64.4)*
Iron (mg)	143.7	7.4***	9.9***	14.7***
(s.e)		*(1.2)*	*(1.6)*	*(2.3)*
Magnesium (mg)	2136.3	119.4***	161.1***	238.7***
(s.e)		*(18.9)*	*(25.5)*	*(37.8)*
Calcium	7654.7	426.9***	576.3***	853.8***
(s.e)		*(94.8)*	*(128.0)*	*(189.7)*
Potassium	20712.0	1179.3***	1592.0***	2358.6***
(s.e)		*(229.9)*	*(310.4)*	*(459.8)*

Notes: Standard errors are in parentheses. *** indicates $p < 0.01$. Baseline nutrients per adult-male equivalent are based on 915 SNAP households with children under age 18, including those with zero dietary energy purchased or acquired during the survey week. We based estimates of calories on requirements for a moderately active adult male and adjust these needs for the age and sex of other household members using the 2020 Dietary Guidelines for Americans, because it is the basis for the revised Thrifty Food Plan.

Source: FoodAPS data were collected from April 2012 to January 2013, before the revised dietary guidelines were published.

Appendix 2

Simulation of SNAP Benefit Increases

The demand system model produces a 21-by-1 vector of total expenditure elasticities of demand for the 20 food groups and the numeraire, among other outputs. Using information on the nutrient composition of the food groups, we derive the expenditure elasticities of nutrient demand. The food group and nutrient elasticities are used to simulate spending and nutrient changes, respectively. Let MPS_S and MPS_E be the MPS on FAH out of SNAP benefits and total expenditures, respectively. Our demand system estimates the average MPS_E to be 0.49 for SNAP participants. For MPS_S, we take the most recent estimate of 0.3 from Canning and Stacy (2019), which is in the middle of the distribution of MPS estimates in the literature that accounts for the endogenous selection of SNAP participation. The effect of a SNAP benefit increase of magnitude ΔS on food demand is simulated by increasing total expenditures in the demand system by $\frac{MPS_S \times \Delta S}{MPS_E}$, which is the amount needed to increase FAH spending by $MPS_S \times \Delta S$. This approach of simulating demand changes through a total expenditure change has the benefits of accounts for the endogeneity of SNAP benefits and the impact on FAFH.

APPENDIX TABLE 6

The Nine FAH Categories That Are Further Classified Into 18 Food Groups Based on the Guiding Star Rating

Food Category	Components	Notes
1. Grains	Whole grain breads, cereal, rice, pasta, and flours; non-whole-grain breads, cereal, rice, pasta, and flours	
2. Vegetables	Starchy vegetables; tomatoes; dark green vegetables, other red and orange vegetables; beans, lentils, and peas or legumes; other/mixed vegetables	Most 0-star vegetables are canned and have sodium.
3. Fruit	Whole fruit	Most canned fruit items (77.7 percent) do not receive a star because they have too much sugar and low levels of vitamins.
4. Milk Products	Whole milk, yogurt, and cream; low-fat and skim milk and low-fat yogurt; all cheese, including cheese soups and sauces	Because calcium is not a nutrient in Guiding Stars' algorithm, a lot of skim/low-fat milk products do not receive a star, either because they are sweetened or have too much fat by Guiding Stars' standard.
5. Meat and Proteins	Beef, pork, veal, lamb, and game; chicken, turkey, and game birds; fish and seafood; nuts, nut butters, and seeds; bacon, sausage, and lunch meats including spreads; egg and egg substitutes; tofu and meat substitutes	
6. Prepared Meals	Prepared meals, sides, and salads (ready to eat); prepared meals, sides, and salads (frozen); prepared meals, sides, and salads (canned); prepared meals, sides, and salads (packaged)	
7. Fats and Oils	Table fats, oils, and salad dressings; gravies, sauces, condiments, and spices	
8. Beverages	100 percent fruit and vegetable juices; beverages	A product must have some calories to be assigned a Guiding Stars rating, which is density-based. Sixty-five percent of diet drinks have some calories and receive zero stars. We put all diet drinks without any calories into the 0-star group. Less than 1 percent (0.8) of diet drinks have some calories and receive 1 star. No diet drinks receive more than 1 star. We put all bottled water into the 1-3 star group even though these items do not receive a star rating because they have no calories.
9. Snacks	Desserts, sweets, and candies; salty snacks	

Notes: Each of these nine groups is broken into a group with 0-star ratings and 1-3 star ratings. The demand system also included two FAFH categories (0-star and 1-3 star ratings).

[1] Michele Ver Ploeg is an economist who previously served as director of the Food Policy and Health Institute at George Washington University and as chief of the Food Assistance Branch at USDA's Economic Research Service. Chen Zhen is the Georgia Athletic Association professor in food choice, obesity, and health at the University of Georgia. The opinions and conclusions expressed in this report are solely those of the authors and should not be construed as representing the views of George Washington University, USDA, or the University of Georgia.

[2] "Summary of Annual Data, FY 2016-2020," Food and Nutrition Service, U.S. Department of Agriculture (USDA), February 2022, https://www.fns.usda.gov/pd/overview.

[3] All states have provided Emergency Allotments (EAs), which Congress authorized in March 2020, and all but a handful of states continue to provide them as of early 2022. USDA may approve states to provide EAs for as long as the federal government has declared a public health emergency and the state has issued an emergency or disaster declaration. The Trump Administration interpreted this provision of the law to allow benefit increases up to the maximum for household size and not beyond the maximum benefit level, meaning that households already receiving the maximum benefit or benefit amounts close to the maximum benefit level saw no or only a small increase in their benefit level. In April 2021, the Biden Administration reversed the interpretation of the EAs to allow states to provide enhanced benefits for all households, including those receiving the maximum benefit. See https://www.fns.usda.gov/snap/covid-19-emergency-allotments-guidance.

[4] Julie Caswell and Ann Yaktine, eds., "Supplemental Nutrition Assistance Program: Examining the Evidence to Define Benefit Adequacy," Institute of Medicine and National Research Council, Washington, D.C.: National Academies Press, 2013, https://nap.nationalacademies.org/catalog/13485/supplemental-nutrition-assistance-program-examining-the-evidence-to-define-benefit.

[5] See Steven Carlson, Joseph Llobrera, and Brynne Keith-Jennings, "More Adequate SNAP Benefits Would Help Millions of Participants Better Afford Food," CBPP, July 15, 2021, https://www.cbpp.org/research/food-assistance/more-adequate-snap-benefits-would-help-millions-of-participants-better; George Davis, "The American Rescue Plan Act Is a Great Start but More Increases in Supplemental Nutrition Assistance Program (SNAP) Benefits Are Likely Needed Due to Implicit Hidden Reductions," *Journal of Nutrition* 151(8): 2099-2104, 2021, https://doi.org/10.1093/jn/nxab125; and Adam Drewnowski and Petra Eichelsdoerfer. "Can Low-Income Americans Afford a Healthy Diet?" *Nutrition Today* 44(6): 246-249, 2010, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2847733/.

[6] USDA, "Thrifty Food Plan, 2021," August 2021, https://FNS.usda.gov/TFP.

[7] For example, the National Health and Nutrition Examination Survey, a Centers for Disease Control and Prevention survey with information on households' health and nutritional status, including grocery store spending (including food bought with SNAP) and food consumption, collects and releases data in two-year cycles. The next NHANES data release will be for 2021 and 2022, meaning data will not be available for analysis until 2023 at the earliest.

[8] Marie Clay *et al.*, "Comparing National Household Food Acquisition and Purchase Survey (FoodAPS) Data With Other National Food Surveys' Data," USDA Economic Research Service, July 2016, https://www.ers.usda.gov/webdocs/publications/79893/eib-157.pdf?v=5874.8.

[9] We use the HEI 2010 made available to users of the FoodAPS data, which were collected in 2012.

[10] Laura Tiehen, Constance Newman, and John Kirlin, "The Food-Spending Patterns of Households Participating in the Supplemental Nutrition Assistance Program: Findings From USDA's FoodAPS," USDA Economic Research Service, August 2017, https://www.ers.usda.gov/webdocs/publications/84780/eib-176.pdf?v=42962.

[11] An increase in the fatty acids component indicates an improvement in diet, reflecting dietary recommendations to replace or reduce saturated fats with mono- and polyunsaturated fatty acids.

[12] There are exceptions for the SNAP Restaurant Meals Program, which serves older adults and people who are disabled and/or homeless.

[13] Tim Beatty and Charlotte Tuttle, "Expenditure Response to Increases in In-kind Transfers: Evidence From The Supplemental Nutrition Assistance Program," *American Journal of Agricultural Economics,* 97:390-404, https://onlinelibrary.wiley.com/doi/10.1093/ajae/aau097.

[14] For a recent summary of these estimates, see Patrick Canning and Brian Stacy, "The Supplemental Nutrition Assistance Program (SNAP) and the Economy: New Estimates of the SNAP Multiplier," USDA Economic Research Service, July 2019, https://www.ers.usda.gov/webdocs/publications/93529/err-265.pdf?v=2113.9.

[15] Biing-Hwan Lin and Joanne Guthrie, "Nutritional Quality of Food Prepared at Home and Away From Home, 1977-2008," USDA Economic Research Service, December 2012, https://www.ers.usda.gov/webdocs/publications/43698/34513_eib-105.pdf?v=5799.4; 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," USDA Economic Research Service, 2018, https://www.ers.usda.gov/webdocs/publications/87531/eib-188.pdf?v=7762.6.

[16] Mark Nord and Mark Prell, "Food Security Improved Following the 2009 ARRA Increase in SNAP Benefits," USDA Economic Research Service, April 2011, https://www.ers.usda.gov/webdocs/publications/44837/7469_err116.pdf?v=7982.4; Mark Nord, "Effects of the Decline in the Real Value of SNAP Benefits From 2009 to 2011," USDA Economic Research Service, August 2013, https://www.ers.usda.gov/publications/pub-details/?pubid=45102.

[17] Nord and Prell, *op. cit.*

[18] Nord and Prell, *op. cit.*

[19] Beatty and Tuttle, *op. cit.*

[20] Patricia Anderson and Kristin Butcher, "The Relationships Among SNAP Benefits, Grocery Spending, Diet Quality, and the Adequacy of Low-Income Families' Resources," CBPP, June 14, 2016, https://www.cbpp.org/research/food-assistance/the-relationships-among-snap-benefits-grocery-spending-diet-quality-and.

[21] See Appendix 6, "Dietary Guidelines for Americans, 2010," 7th Edition, USDA and U.S. Department of Health and Human Services, 2010, https://health.gov/sites/default/files/2020-01/DietaryGuidelines2010.pdf.

[22] Timothy Beatty, Biing-Hwan Lin, and Travis Smith, "Is Diet Quality Improving? Distributional Changes in the United States, 1989-2008," *American Journal of Agricultural Economics* 96(3):769-789, 2014, https://www.jstor.org/stable/24476527.

[23] Alisha Coleman-Jensen *et al.*, "Household Food Security in the United States in 2020," USDA, September 2021, https://www.ers.usda.gov/publications/pub-details/?pubid=102075.

[24] Anderson and Butcher, *op. cit.*

[25] James Mabli *et al.*, "Food Expenditures and Diet Quality Among Low-Income Households and Individuals," USDA Food and Nutrition Service, 2010, http://www.fns.usda.gov/sites/default/files/FoodExpendDietQuality.pdf.

[26] Christian Gregory, Michele Ver Ploeg, Margaret Andrews, and Alisha Coleman-Jensen, "Supplemental Nutrition Assistance Program (SNAP) Participation Leads to Modest Changes in Diet Quality," USDA Economic Research Service, April 2013, https://www.ers.usda.gov/webdocs/publications/45059/36939_err147.pdf?v=3518.4.

[27] Anderson and Butcher, *op. cit.*; Mabli *et al.*, *op. cit.*

[28] Irfan Ullah *et al.*, "The Systems of Consumer Demand Analysis: A Review," *Current Investigations in Agriculture and Current Research* 1(4), 2018, https://lupinepublishers.com/agriculture-journal/fulltext/the-systems-of-consumer-demand-analysis-a-review.ID.000118.php.

[29] The model can be consistent with some of the basic predictions of consumer demand theory, including that a consumer cannot spend more than what they have, and demand does not change when prices and income change by the same proportion.

[30] Arthur Lewbel and Krishna Pendakur, "Tricks with Hicks: The EASI Demand System," *American Economic Review* 99:827-63, 2009, https://www.aeaweb.org/articles?id=10.1257/aer.99.3.827.

[31] See "National Household Food Acquisition and Purchase Survey (FoodAPS): Nutrient Coding Overview," USDA Economic Research Service, 2016, https://www.ers.usda.gov/media/8737/8_foodaps-nutrient-coding-overview-puf.pdf; Yu Chen, Biing-Hwan Lin, Lisa Mancino, Michele Ver Ploeg, and Chen Zhen, "Nutritional quality of retail food

purchases is not associated with participation in the Supplemental Nutrition Assistance Program for nutrition-oriented households," *PLOS ONE* 15(12), 2020, https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0240263.

[32] Chen Zhen, Yu Chen, Biing-Hwan Lin, Shawn Karns, Lisa Mancino, and Michele Ver Ploeg, "Do Obese and Nonobese Consumers Respond Differently to Price Changes? Implications of Preference Heterogeneity for Using Food Taxes and Subsidies to Reduce Obesity," working paper, University of Georgia, 2021, https://mpra.ub.uni-muenchen.de/112697/.

[33] Canning and Stacy, *op. cit.*

[34] See Bruce Meyer, Wallace Mok, and James Sullivan, "Household Surveys in Crisis," *Journal of Economic Perspectives* 29(4): 199-226, 2015, https://www.aeaweb.org/articles?id=10.1257/jep.29.4.199.

[35] Mancino *et al., op. cit.*

[36] Simulations for households without children were also made and are available upon request.

[37] USDA, 2021, *op. cit.*

[38] By using a MPS of 0.3 for our simulations, each additional dollar of SNAP benefits frees up 70 cents of out-of-pocket food spending for purchases of FAFH and other goods and services.

[39] Mabli *et al., op. cit.*

[40] The model behind the TFP uses an adjustment factor to account for food waste (U.S. Department of Agriculture, 2021).

[41] Yang Yu and Edward Jaenicke, "Estimating Food Waste as Household Production Inefficiency," *American Journal of Agriculture Economics* 102(2): 525-547, 2020, https://onlinelibrary.wiley.com/doi/10.1002/ajae.12036.