



United States Department of Agriculture

Economic
Research
Service

Economic
Research
Report
Number 268

August 2019

USDA Special Supplemental Nutrition Program for Women, Infants, and Children (WIC): A New Look at Key Questions 10 Years After USDA Added Whole-Grain Bread to WIC Food Packages in 2009

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Recommended citation format for this publication:

Stewart, Hayden, Jeffrey Hyman, Patrick W. McLaughlin, and Diansheng Dong.
*USDA Special Supplemental Nutrition Program for Women, Infants, and Children (WIC):
A New Look at Key Questions 10 Years After USDA Added Whole-Grain Bread to WIC
Food Packages in 2009*, ERR-268, U.S. Department of Agriculture, Economic Research
Service, August 2019.

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Abstract

Given that most Americans do not consume enough whole grains to satisfy Federal dietary recommendations, in 2009, the U.S. Dept. of Agriculture (USDA) altered its Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) by adding 100-percent whole-wheat bread (and other whole-grain options like brown rice) to food packages for children and pregnant or breastfeeding women. Published research suggests that participant diet quality has likely improved, but study results are mixed. Other research has explored the availability and cost of whole-grain products in the WIC-allowed, 1-pound (16-ounce) package size at retail stores. In 2014, USDA asked the National Academies of Sciences, Engineering, and Medicine (NASEM) to convene a committee of experts to conduct an independent, comprehensive scientific review of WIC food packages and recommend cost-neutral changes in line with the nutritional status and food and nutrition needs of the WIC-eligible population. In 2017, that committee recommended a number of changes to participants' food assistance benefits. These include offering bread and other whole-grain products in more standard package sizes. Concurrent to NASEM's review of the WIC food package, the Agricultural Act of 2014 required the *Dietary Guidelines for Americans* to expand to include infants and toddlers from birth to 2 years, as well as women who are pregnant, beginning with the 2020 edition. USDA will consider changes to the WIC food packages once this work is complete. In this study, we use a combination of store- and household-level purchase data to revisit some key questions about WIC participants' whole-grain benefits. We focus on bread in a case study of the products that may be purchased with these benefits.

Keywords: WIC, food assistance, whole-grain bread, whole grains, InfoScan, FoodAPS data

Acknowledgments

The authors acknowledge retired ERS colleague Elizabeth Frazao for initiating this research. We thank peer reviewers Tatiana Andreyeva of Rudd Center for Food Policy and Obesity, of Yale University; Lorrene Ritchie, Director of the Nutrition Policy Institute, University of California; and Victor Oliveira, USDA, Economic Research Service (ERS). We also thank Kathryn Ralston, Xingyou Zhang, and John Kirilin, all of ERS, and Donna Johnson-Bailey and Melissa Abelev, both of USDA, Food and Nutrition Service. Finally, we thank Courtney Knauth for editing and Cynthia A. Ray for design and layout, both of ERS.

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What Is the Issue?

USDA's Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) provides low-income pregnant, breastfeeding, and postpartum women at nutritional risk, as well as infants and children up to age 5, with supplemental foods, along with nutrition counseling, breastfeeding promotion and support, and healthcare referrals. In 2009, USDA made comprehensive changes to the WIC food packages that largely reflect recommendations from a 2005 report of the National Academies, *WIC Food Packages: Time for a Change*. These changes included adding 1 pound of 100 percent whole-wheat bread and other whole-grain options, such as brown rice and whole-grain tortillas, to WIC food packages for pregnant and breastfeeding women and 2 pounds to the WIC food package for children 1-4 years old.

While some published research suggests that adding 100 percent whole-wheat bread and other whole-grain options to food packages has improved participant diet quality, results are varied. Other research explores the cost and availability of whole-grain products at retail food stores in the WIC-authorized 1-pound (16-ounce) package size. In 2014, USDA asked the National Academies of Sciences, Engineering, and Medicine (NASEM) to convene a committee to conduct an independent, comprehensive scientific review of WIC food packages and recommend cost-neutral changes in line with the nutritional status and food and nutrition needs of the WIC-eligible population. In 2017, the committee recommended a number of changes to participants' food assistance benefits. These include offering 16- to 24-ounce packages of 100 percent whole-wheat bread and other whole-grain options to all participants who receive this benefit, which would relax regulations that effectively require stores to stock 16-ounce packages. Concurrent to NASEM's review of the WIC food package, the Agricultural Act of 2014 required the Dietary Guidelines for Americans to expand to include infants and toddlers from birth to age 2, as well as women who are pregnant, beginning with the 2020 edition. USDA will consider changes to the WIC food packages once this work is complete.

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What Did the Study Find?

Using a combination of store- and household-level purchase data, ERS researchers looked at some key questions about WIC participants' whole-grain benefits. While WIC offers a variety of whole-grain options, whole-grain bread is used as an example of the products that may be purchased with WIC benefits.

Analysis of household-level data finds that:

- During a 1-week survey period, households with a WIC participant acquired 0.61 more ounce-equivalents of whole grains in bread (per household member over age 1) than did similar WIC-eligible households that did not participate in the program.

Analysis of sales data from a panel of retail food stores further shows that:

- Between 2009 and 2015, sales of 16-ounce packages increased from about 8 to 17 percent of all 100 percent whole-wheat bread products sold, consistent with anecdotal observations of improved product availability.
- Bread sold in 16-ounce packages appears to be less economical than bread sold in larger, more standard package sizes, including both 100 percent whole wheat and other types. For example, in 2015, a 24-ounce package of 100 percent whole-wheat bread cost \$2.85, a 20-ounce package cost \$2.60, and a 16-ounce package cost \$2.76, on average. Thus, it could be cheaper to allow WIC benefits to be redeemed for a 20-ounce loaf than a 1-pound loaf.

How Was the Study Conducted?

Store-level purchase data from Information Resources, Inc. (IRI) were used to examine the price and sales volume of 100 percent whole-wheat bread, and household-level data from the National Household Food Acquisition and Purchase Survey (FoodAPS) were used to examine the propensity of WIC households to purchase whole-grain breads. In this report, the term "100 percent whole wheat" is used when referring specifically to bread of this type, and the term "whole grain" is used elsewhere in the report. A variety of statistical techniques were used in the analysis, including summary statistics and T-tests for differences between group means. To capture the full association between WIC participation and whole-grain purchases among households, ERS would need to include separate analyses for all relevant whole-grain product types, which is beyond the scope of our study and data.

USDA Special Supplemental Nutrition Program for Women, Infants, and Children (WIC): A New Look at Key Questions 10 Years After USDA Added Whole-Grain Bread to WIC Food Packages in 2009

Introduction

USDA's Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) provides low-income, nutritionally at-risk pregnant and postpartum women, as well as infants and children up to 5 years of age, with food assistance, nutrition counseling (including breastfeeding promotion and support), and healthcare referrals (e.g., Oliveira and Frazao, 2015; USDA Food and Nutrition Service, 2019). Supplemental foods include nutrient-dense items such as infant formula and infant-fruit, vegetables, and meats; fluid milk; vitamin C-rich fruit or vegetable juice; eggs, cheese, peanut butter, dried and canned beans/peas, canned fish, whole grains, and iron-fortified cereal. USDA regulations govern which supplemental foods participants receive by establishing distinct food packages that cater to the nutritional needs of each participant type.^{1,2} Therefore, WIC provides healthy, nutrient-rich foods to its participants, including, nationwide, over a quarter of all pregnant and postpartum women, about half of all infants, and over a quarter of all children less than 5 years of age.

USDA reviews its WIC food packages every 10 years to ensure adherence to the latest dietary guidelines and to incorporate the most up-to-date nutritional science.³ Since 2005, the *Dietary Guidelines for Americans* has recommended that individuals consume at least half of their grains as whole grains.⁴ Whole grains may yield significant health benefits compared to refined grains, yet are underconsumed relative to Federal dietary recommendations by nearly all Americans.⁵ To be consistent with dietary recommendations, USDA added 1 pound of whole-grain bread to its WIC

¹WIC offers seven different packages of supplemental foods for different groups of participants, including infants less than 6 months old, infants 6 through 11 months old, children 1 through 4 years old, pregnant women, postpartum women, breastfeeding women, and participants with special dietary needs.

²Regulations are published by the Federal Register in the Code of Federal Regulations, 7 CFR 246.10. WIC, for example, emphasizes low-fat (1-percent) and fat-free milk. Similarly, it allows only breakfast cereals high in iron and low in sugar.

³The U.S. Congress has mandated that an evaluation of WIC Food Packages occur every 10 years (Public Law No: 101-147).

⁴The U.S. Congress has mandated that WIC provide food and services in alignment with the *Dietary Guidelines for Americans* (Public Law No: 101-445). Every 5 years, the Department of Health and Human Services and USDA publish a new edition of these guidelines. The latest edition reflects the current body of nutrition science, helps health professionals and policymakers guide Americans to make healthy food and beverage choices, and serves as the science-based foundation for vital nutrition policies and programs across the Nation.

⁵A balanced diet rich in whole grains may help individuals to maintain a healthy weight and lower their risks of developing type 2 diabetes and cardiovascular disease (e.g., Ye et al., 2012; Jonnalagadda et al., 2010). In one study, Lin and Yen (2007) find that 93 percent of Americans do not satisfy Federal dietary recommendations for whole grains. Children, in particular, prefer refined grains, and the presence of children in a home even reduces whole-grain consumption among adults (Lin and Yen, 2007).

food packages for pregnant and breastfeeding women and 2 pounds of whole-grain bread to the food packages for children 1 through 4 years old in 2009, after a review of its WIC food packages by the Institute of Medicine (IOM).⁶ Bread (of any kind) was not previously among the supplemental foods provided to WIC participants. WIC State agencies were also given an array of other whole-grain food options to offer participants in their jurisdictions—such as brown rice, soft corn, or whole wheat tortillas—as alternatives to bread in order to accommodate different food cultures.⁷

WIC participants have been generally satisfied with the whole-grain bread and other whole-grain options added to their food packages since 2009 (e.g., Gleason and Pooler, 2011; Phillips et al., 2014; Ritchie et al., 2014). Published research suggests that they may even be purchasing and consuming more whole grains, although study results are mixed. While some researchers find a positive association between WIC and whole grains (e.g., Stewart et al., 2019; Oh et al., 2016; Ishdorj and Capps, 2013; Andreyeva and Luedicke, 2013; Chiasson et al., 2013; Whaley et al., 2012), others find little or no significant association (e.g., Tester et al., 2016; Kong et al., 2014; Odoms-Young et al., 2014). In one study, Kong et al. collected 24-hour dietary recalls from WIC-participating, mother-child dyads in Chicago in 2009 before the revision of WIC food packages and again 18 months afterward. All study participants were African American or Hispanic, including 209 mothers and 164 children. Eighteen months after the WIC food package changes went into effect, increases in dietary fiber intake were observed among Hispanic children. No significant changes were observed among other groups (i.e., Hispanic mothers, African American mothers, and African American children).

When USDA announced its intention in the mid-2000s to add bread and other whole-grain products in 1-pound (16-ounce) packages to some WIC food packages, researchers and other interested parties questioned the availability and cost of such products at retail stores (e.g., Gleason et al., 2011; Gleason and Pooler, 2011; USDA Food and Nutrition Service, 2007).⁸ WIC participants typically receive monthly paper vouchers or electronic benefits that they can exchange for their specified WIC food packages at retail food stores at no personal cost. However, bread was (and still is) commonly sold in 20-ounce and 24-ounce packages. Manufacturers seeking to produce WIC-eligible products had to adjust their production processes in order to supply whole-grain bread in 16-ounce packages. Retailers likewise needed to create shelf space for a package of bread that was at the time not readily available on the wholesale market and not widely purchased by non-WIC participants. Concerns arose about the potential for limited availability and inflated prices.

In 2014, given the need for another decennial review of its WIC food packages, USDA asked the National Academies of Sciences, Engineering, and Medicine (NASEM) to convene a committee to conduct an independent, comprehensive scientific review of WIC food packages and recommend cost-neutral changes in line with the nutritional status and food and nutrition needs of the WIC-eligible population. The committee was asked to provide USDA with specific, scientifically

⁶In 2003, USDA asked the IOM, currently called the National Academy of Medicine and an affiliate of the National Academies of Sciences, Engineering, and Medicine (NASEM), to conduct a review of its WIC food packages. The IOM accepted and released its recommendations in a 2005 report, *WIC Food Packages: Time for a Change* (Committee to Review the WIC Food Packages and Food and Nutrition Board, 2005). In 2007, based on many of the IOM's recommendations, USDA issued an interim rule detailing its revised WIC food packages (USDA Food and Nutrition Service, 2007), which allowed USDA to continue obtaining feedback on the new food packages while also moving forward with implementation. All WIC State agencies were initially required to implement all changes by August 5, 2009. In a separate rule, USDA later extended the deadline to October 1, 2009. The comment period on the interim rule ended February 1, 2010. The final rule was published on March 4, 2014 (USDA, Food and Nutrition Service, 2014).

⁷See 7 CFR 246.10 (Table 4).

⁸USDA received comments from the public on its proposed and interim rules (e.g., USDA Food and Nutrition Service, 2007).

based recommendations. It ultimately released three reports. The third report, *Review of WIC Food Packages: Improving Balance and Choice: Final Report*, recommends providing children 1 through 4 years old, pregnant women, and breastfeeding women with 16 to 24 ounces of 100 percent whole-wheat bread and other whole-grain options (Committee to Review WIC Food Packages, 2017). If adopted by USDA, this would relax current regulations, which effectively require stores to stock these products in 16-ounce packages. NASEM also recommends limiting the types of bread allowable on a WIC State Agency's list of approved food products to only 100 percent whole-wheat. The 2017 recommendations are based in part on food consumption surveys showing that WIC participants continue to underconsume whole grains, a review of the above-cited research on the association between WIC participation and whole grains, and concerns about the cost and availability of whole-grain products in the WIC-allowed package size at retail stores.

Concurrent to NASEM's review of the WIC food package, the Agricultural Act of 2014 required the *Dietary Guidelines for Americans* to expand to include infants and toddlers from birth to age 2, as well as women who are pregnant, beginning with the 2020 edition. USDA will consider changes to the WIC food packages once this work is complete.

Given this background, in this study we take a new look at some key questions about WIC participants' whole-grain benefits, with a focus on bread as a case study of the products that may be bought with these benefits. Specifically, using a combination of store- and household-level data not previously used for this purpose, we ask:

- Do WIC households acquire more whole grains in bread than households that are eligible for WIC but do not participate in the program?
- What do recent data on consumer purchases indicate about the availability of 100 percent whole-wheat bread in general and the availability of specific package sizes? How does this availability compare to that of 2009?
- What is the price of 100 percent whole-wheat bread in various package sizes?

Whole-Grain Options Added to WIC Food Packages

Participants in USDA's WIC program include low-income women who are pregnant and postpartum as well as infants and children up to age 5. Eligible individuals must have one or more medically based or dietary conditions. Examples of a qualifying medical condition include anemia (low blood levels of iron), underweight, or history of a poor pregnancy outcome. A qualifying dietary condition includes, for example, poor diet quality, which may be assessed by a 24-hour dietary recall, dietary history, or food-frequency checklist. By offering a package of supplemental foods, WIC provides nutrient-dense foods to individuals for whom food prices may have previously been a barrier to consumption. However, WIC does more than simply provide foods. It couples food assistance with nutrition education in order to "help participants incorporate WIC supplemental foods into their overall diets and make healthy choices in all the foods they consume" (USDA, Food and Nutrition Service, 2018, p. 11). Research confirms that WIC nutrition education has a positive, reinforcing impact on participants (Au et al., 2016 and 2017; Bensley et al., 2011; Ritchie et al., 2010). In Ritchie et al.'s study of over 3,000 WIC participants, women and caregivers reported that their families were consuming more fruits, vegetables, and whole grains after receiving nutrition education, separate from the effects of other WIC services.

WIC is administered at the Federal level by USDA's Food and Nutrition Service (FNS) and at the local level by WIC State agencies. While USDA establishes what types of foods may be provided through its WIC program, WIC State agencies create their own lists of approved food products based on those guidelines. Regarding bread, USDA has authorized 100 percent whole-wheat and other whole-grain options. For 100 percent whole-wheat bread, USDA stipulates that whole-wheat flour must be the only flour used in making the dough.⁹ For all other whole-grain breads, USDA stipulates that whole grains must be the primary ingredient by weight.¹⁰ Notably, many bread products with front-of-the-package claims—such as "multi-grain," "ancient grains," "a source of whole grains" or "made with whole grains"—do not qualify.

Although USDA has authorized additional whole-grain options, 100 percent whole-wheat bread appears to account for the bulk of bread redemptions. According to NASEM's Committee to Review WIC Food Packages, "Currently, very few states offer a whole-grain bread option, possibly as a result of the expansive selection of bread products in the marketplace that include the words *whole grain* but that contain various proportions of whole grain and refined grain" (Committee to Review WIC Food Packages, 2017, pp. 6-38). California WIC, for example, allows 1-pound packages of bread with the words "100 percent Whole Wheat" written on the front label, including loaves, buns, and rolls. Even store bakery bread is allowed, if labeled appropriately. California WIC does not allow participants to purchase any other types of bread, including other whole-grain breads, with their benefits.

For the sake of variety and to accommodate different food cultures, WIC regulations allow State agencies to offer participants 1 or 2 pounds of other whole-grain options. California WIC, for example, allows tortillas, brown rice, oatmeal or oats, whole grain barley, and bulgur. According to

⁹Specifically, these products must conform to the Food and Drug Administration (FDA) standard of identity as defined by 21 CFR 136.180, per which whole-wheat flour must be the only flour used in making the dough.

¹⁰These products must conform to the FDA standard of identity defined by 21 CFR 136.110. Additionally, they must satisfy the FDA's requirements for labeling products a "whole grain food with moderate fat content," and whole grains must be the primary ingredient by weight.

NASEM, 97 percent of State agencies allow brown rice and 90 percent allow tortillas as alternatives to bread (Committee to Review WIC Food Packages, 2017).

Limited product availability and high prices were a concern in 2009 shortly after USDA added 100 percent whole-wheat bread and other whole-grain options to some WIC food packages (e.g., Gleason et al., 2011; Gleason and Pooler, 2011; USDA Food and Nutrition Service, 2007). These newly added WIC foods were not widely available in the specified 1-pound (16-ounce) package size. Bread, for one, is commonly sold in 20-ounce and 24-ounce loaves. In a study of small, WIC-authorized stores, Gleason et al. found that some retailers struggled to source 1-pound packages of whole-grain bread shortly after the launch of the new WIC food packages. Small, single-register stores were least likely to stock this item. Store managers also reported that WIC-authorized breads were often more expensive than other breads. In a separate study, when Gleason and Pooler (2011) organized focus groups of WIC participants in Wisconsin 6 months post-implementation, many participants complained that their store did not carry WIC-allowed breads or that these breads were often out of stock. Eighteen months post-implementation, when Gleason and Pooler conducted followup sessions with the same focus group participants, such complaints were less common, which suggests supply-related problems had improved.

While there is some evidence that WIC-allowed, whole-grain options have become more widely available since 2009, NASEM's Committee to Review WIC Food Packages expressed concern about product availability and high prices. In 2015, when members of the committee conducted shopping trips, they reported that "... commercially packaged WIC bread is smaller than all other bread and is often difficult to locate in the store" (Committee to Review WIC Food Packages, 2015, pp. 2-16). However, this conclusion is based on a small number of committee-member observations. Committee members also noted that, "Even though a 1-pound loaf provides fewer servings than the more common 24-ounce loaf of bread, it is usually sold at the same or a higher price" (Committee to Review WIC Food Packages, 2015, pp. 2-22). We are unaware of a larger body of peer-reviewed research that examines WIC participants' perceptions.

WIC participants generally convey that they are satisfied with their whole-grain benefits, and a majority redeem them (e.g., Gleason and Pooler, 2011; Phillips et al., 2014; Ritchie et al., 2014). For example, 84.4 percent of participants in Gleason and Pooler's Wisconsin focus group study fully redeemed their whole-grain benefits at 18 months post-implementation, indicating a high level of satisfaction with the addition of this new food. In a 2010 telephone survey of 2,996 California WIC participants, Ritchie et al. (2014) similarly found that 89.5 percent of respondents were satisfied with their whole-grain benefits. In a study of WIC participants in Kentucky, Michigan, and Nevada, Phillips et al. (2014) found that only 51.3 percent of WIC families fully redeemed their whole-grain benefit, and more than one-third did not use it at all, making the whole-grain benefit the second-least-used among all foods for women and children, with rates of nonredemption that were surpassed only by beans and peanut butter. Still, a majority of participants in this study at least partially redeemed the benefit.¹¹

Evidence indicates that WIC participants bought and consumed more whole grains after USDA revised its WIC food packages in 2009. Notably, buying and consumption measures are not equal since some purchased food may be wasted. Despite the differences in measures, many studies find

¹¹Phillips et al.'s (2014) estimated redemption rate of 51.3 percent appears to be consistent with redemption data provided by USDA's Food and Nutrition Service from five unidentified States for fiscal year 2013-14 and analyzed by NASEM (see Committee to Review WIC Food Packages, 2017, pp. 2-38, Table 2-15).

that WIC is positively associated with purchasing and/or consuming whole grains (e.g., Stewart et al., 2019; Oh et al., 2016; Ishdorj and Capps, 2013; Andreyeva and Luedicke, 2013; Chiasson et al., 2013; Whaley et al., 2012). However, research findings are mixed. Some studies find no significant change or find that any significant changes are limited to only a subset of WIC participants (e.g., Tester et al., 2016; Kong et al., 2014; Odoms-Young et al., 2014).^{12,13}

To better understand WIC households' food-purchase decisions, Stewart et al. (2019) examined the bread purchases of non-WIC and WIC households during weeks when they use and do not use benefits. The researchers identified an overall positive association between WIC and households' purchases of whole grains in bread. They also found that WIC households are less likely than other households to choose a whole-grain product when paying "out of pocket" (defined to include using any payment method besides WIC benefits, such as cash or Supplemental Nutrition Assistance Program (SNAP) benefits). It is possible that, because of either food prices or tastes and preferences, WIC-provided, supplemental foods provide nearly all of the whole grains some households desire.

¹²No correlation appears to exist between a study's reported findings and how researchers measure food demand (i.e., consumption versus purchases). Among the cited studies, Oh et al. (2016) and Andreyeva and Luedicke (2013) investigate purchases. The other six cited studies all examine food consumption, including three that find a positive association between WIC and whole grains as well as three that find no such association or find that any significant associations are limited to only a subset of WIC participants.

¹³NASEM's Committee to Review WIC Food Packages (2017) reviewed these same studies. Interested readers may consult the committee's report for additional details.

National Household Food Acquisition and Purchase Survey

In order to better understand the food shopping behavior of U.S. households, ERS has invested in household-level data. USDA's National Household Food Acquisition and Purchase Survey (FoodAPS) is among these efforts. A total of 4,826 households that are economically and demographically representative of the contiguous United States participated for 1 week each between April 2012 and January 2013. While participating in the survey, each of these 4,826 households was asked to report all food items purchased (even food products acquired for free), where they bought those items, and how they paid (see box: "Household Survey Provides Unique Insights on Americans' Food Shopping Behavior").

FoodAPS has been widely used to study WIC households' shopping behavior. NASEM, for one, used these data to compare the food expenditure patterns of three distinct household groups: (1) WIC households, (2) WIC-eligible, nonparticipating households, and (3) income-ineligible households with a pregnant woman or children less than 5 years of age (Committee to Review WIC Food Packages, 2017). ERS researchers have also used FoodAPS to study WIC households' bread and cereal purchases (Stewart et al., 2019), as well as the cost of cold cereals purchased by WIC households when they use benefits (Dong et al., 2016).

WIC-Participating Households in FoodAPS

Among all 4,826 households that participated in the survey, FoodAPS includes 471 households that either self-identified as receiving WIC benefits or reported using WIC benefits during the survey period. Given the detailed demographic information available about these households, we can compare the WIC participants in them with all U.S. WIC participants. We can also check what percentage of the 471 WIC households in our sample were eligible to receive bread while participating in the survey. Since 1988, USDA has produced biennial reports on the characteristics of the WIC population (e.g., Thorn et al., 2015). Overall, based on these USDA administrative data, all U.S. WIC participants and the individuals in our sample of WIC households look similar with respect to participant type, race and ethnicity, and household size (table 1). Among all 471 WIC households, we also estimate that 417 (89 percent) were eligible to receive bread through WIC because they included at least one child under 5 years old, a pregnant woman, and/or a breastfeeding woman.

In addition to the 471 WIC households that participated in FoodAPS, the data include another 266 households that did not participate in the program but were income-eligible (income < 185 percent of poverty thresholds) and contained at least 1 categorically eligible member (women who are pregnant, breastfeeding, or postpartum and/or children under the age of 5 years).¹⁴ These households are notably similar to our 471 WIC households in many key ways (table 2). Households in both groups were larger and less likely to have a White, non-Hispanic meal planner as compared with all 4,826 FoodAPS households. The meal planner in both types of households was also less apt to have completed college and less likely to use the Nutrition Facts Panel—which lists the number of servings in a package and calories per serving, among other nutrition information—on most packaged food products. Much research shows that level of education, use of food labels, and nutrition knowledge are the key determinants of whole-grain consumption (e.g., Hiza et al., 2013; Lin and Yen, 2007).

¹⁴This may not include all eligible, nonparticipating households. It does not include, for example, households that are eligible based on participation in the Temporary Assistance for Needy Families program, SNAP, or Medicaid.

Household Survey Provides Unique Insights on Americans' Food Shopping Behavior

To study the food shopping behavior of U.S. households, ERS has invested in household-level data. USDA's National Household Food Acquisition and Purchase Survey (FoodAPS) is among these data sources. Mathematica Policy Research (Mathematica) designed and fielded the survey, and Westat independently assessed the quality and accuracy of the data, both under contract with USDA. A total of 4,826 households participated for 1 week each between April 2012 and January 2013. In each household, the main meal planner (primary respondent) reported the household's income, whether the household received food assistance benefits, and the identity of any individuals receiving WIC benefits, if applicable. The primary respondent also reported demographic information for each person living in the household, including gender, age, education level, race, and ethnicity.

Key to FoodAPS was a food acquisition diary. Households reported all foods acquired by all members over a 7-day period. Mathematica and USDA then matched each acquired food to the most recently available National Nutrient Database for Standard Reference (SR-26), Food and Nutrient Database for Dietary Studies (FNDDS 2011-2012), and Food Patterns Equivalents Database (FPED 2011-2012). These datasets report each food's nutritional attributes, including micronutrient, macronutrient, and caloric content as well as Food Pattern Equivalent (FPE) values such as ounces of whole grains per 100 grams of bread or breakfast cereal.

FoodAPS was designed to be economically and demographically representative of all households living in the contiguous United States and of four specific population subgroups. The entire U.S. population was first divided into four nonoverlapping subgroups or strata, including one strata comprised of SNAP participants. Households within each of the four strata were then independently sampled. The final dataset was created by stacking data for the four population subgroups.

Food assistance households that participated in FoodAPS, including both WIC and SNAP households, report higher-than-expected levels of income. WIC households reported an average income-to-poverty ratio of 1.69 (i.e., 69 percent above the poverty threshold), whereas FNS data show that about two-thirds of all WIC participants live in a household at or below the Federal poverty guideline (Thorn et al., 2015). SNAP households participating in FoodAPS similarly reported an average income-to-poverty ratio of 1.28 (i.e., 28 percent above the poverty threshold), whereas the U.S. Census Bureau's Survey of Income and Program Participation (SIPP) shows SNAP participants have an average income-to-poverty ratio of only 1.04. Clay et al. (2016) argue that these differences can be partially explained by the definitions of a "household" and "income" used in FoodAPS as compared with SIPP.

FoodAPS data have been previously used by ERS researchers to study WIC households' bread and cereal purchases (Stewart et al., 2019), to compare the cost of cold cereals purchased by WIC households when they are using benefits versus other payment methods (Dong et al., 2016), and to describe the shopping behavior of SNAP and U.S. households in general (e.g., Todd and Scharadin, 2016; Ver Ploeg et al., 2015). A thorough overview of FoodAPS, including research findings and insights on Americans' diet quality and food assistance programs in general, is available in Page et al. (2019).

Table 1

Characteristics of WIC participants in the National Household Food Acquisition and Purchase Survey (FoodAPS) versus all U.S. WIC participants (administrative data)

	WIC administrative data	FoodAPS data
Participant type		
Women (mothers)	23.6%	28.8%
Infants (age < 1 year)	23.0%	16.8%
Children	53.3%	54.4%
Participant race and ethnicity		
Hispanic	41.6%	39.3%
Black	20.3%	18.3%
White	58.7%	63.0%
Other household characteristics		
Household size	4.1 people	4.4 people

WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.

Source: USDA, Economic Research Service comparison of administrative data on the characteristics of all WIC participants versus the characteristics of 471 WIC households that completed FoodAPS. These 471 WIC households included 669 WIC participants since some households had more than 1 WIC beneficiary (e.g., both mother and child received benefits). WIC administrative data are taken from Thorn et al. (2015).

Table 2

Characteristics of National Household Food Acquisition and Purchase Survey (FoodAPS) participants, 2012-13

	WIC households ¹ (n=471)		Eligible, non-WIC households ² (n=266)		Other households (n=4,089)	
Income relative to poverty threshold	169.3 ^a	(8.304)	108.2 ^b	(5.885)	397.9 ^c	(17.202)
WIC household (0/1)	1.0 ^a	(0.0)	0.0 ^b	(0.0)	0.0 ^b	(0.0)
Used WIC benefits during survey week (0/1)	0.352 ^a	(0.034)	0.0 ^b	(0.0)	0.0 ^b	(0.0)
SNAP household (0/1)	0.516 ^a	(0.034)	0.521 ^a	(0.046)	0.11 ^b	(0.007)
Used SNAP benefits during survey week (0/1)	0.317 ^a	(0.029)	0.349 ^a	(0.04)	0.066 ^b	(0.005)
Meal planner finished college (0/1)	0.066 ^a	(0.012)	0.089 ^a	(0.024)	0.34 ^b	(0.021)
Meal planner uses nutrition facts panel at least sometimes (0/1)	0.543 ^a	(0.033)	0.499 ^a	(0.05)	0.724 ^b	(0.012)
Meal planner aware of MyPlate (0/1)	0.297 ^a	(0.03)	0.216 ^a	(0.053)	0.255 ^a	(0.01)
Meal planner is White, non-Hispanic (0/1)	0.392 ^a	(0.05)	0.441 ^a	(0.046)	0.702 ^b	(0.025)
Total number of people in the household	4.609 ^a	(0.122)	4.522 ^a	(0.151)	2.297 ^b	(0.041)

WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.

¹FoodAPS includes 471 households who either self-identified as receiving WIC benefits or reported using WIC benefits during the survey period.

²FoodAPS includes 266 non-WIC households that are income eligible (income < 185 percent of poverty thresholds) and categorically eligible (include a pregnant or postpartum female and/or children under 5 years old).

Source: USDA, Economic Research Service analysis of FoodAPS. Means and standard errors were calculated in Stata 14 using the "svyset" command and "over" option to account for survey design. Standard errors are in parentheses. T-tests were conducted to evaluate the statistical significance of differences between two groups. Means that have different superscript letters (a,b,c) are significantly different at the 5-percent level.

Food assistance households that participated in FoodAPS, including both WIC and SNAP households, report higher-than-expected levels of income (see box, “Household Survey Provides Unique Insights on Americans’ Food Shopping Behavior”). WIC households reported an average income-to-poverty ratio of 1.69 (i.e., 69 percent above the poverty threshold) (table 2), which is greater than FNS administrative data suggest.¹⁵ The definitions of “household” and “income” used in FoodAPS may be partially responsible for the discrepancy (Clay et al., 2016). However, even if food assistance households that participated in FoodAPS reported more income than all U.S. food assistance households, on average, it would not likely be enough to affect their whole-grain purchases. Much research shows that differences in income, especially at the lower end of the income distribution, are rarely associated with large differences in diet quality. Hiza et al. (2013), for example, find no significant differences in whole-grain consumption relative to Federal dietary recommendations for individuals in families with an income below 130 percent of poverty thresholds versus individuals in families with an income between 130 and 299 percent of poverty thresholds. In another study, Lin and Yen (2007) find that household income does not affect whole grain consumption after accounting for education, use of nutrition labels, and nutrition knowledge.

Data on FoodAPS household demographic characteristics can be paired with detailed information on their food purchases. In our ensuing analysis, we focus on FoodAPS households’ bread purchases.¹⁶ Focusing on bread as a case study allows us to investigate the shopping behavior of WIC households with respect to a key WIC-provided food.¹⁷ Moreover, we chose to define “bread” broadly to include loaves, buns, and rolls, as well as bagels, breads made with fruit, and some other products not provided through the WIC program. Since participation in WIC may affect a household’s propensity to choose whole grains, even when it pays out of pocket and it is not restricted to choosing WIC-allowed foods, we adopt this broader definition to best measure the association between WIC and a participating household’s overall whole- versus refined-grain bread purchases.¹⁸ Among all 471 WIC households, 273 (58 percent) bought bread during the week-long survey. These 273 households reported obtaining 600 bread items during 67 transactions financed with WIC benefits and 533 financed with cash or SNAP benefits (table 3).¹⁹ During the survey period, supplemental foods provided through the WIC program account for roughly 11 percent of all bread purchases by participating households, on average.

¹⁵In 2014, 67.4 percent of all WIC participants reported incomes at or below the Federal poverty guideline (Thorn et al., 2015).

¹⁶Our analysis largely follows Stewart et al.’s (2019) approach. However, unlike that study, we do not consider cereal; rather, we focus exclusively on households’ bread purchases and combine our analysis of FoodAPS data with an analysis of IRI InfoScan data to examine a broader range of questions, including questions related to the availability and cost of 100 percent whole-wheat bread in 1-pound packages.

¹⁷Choosing bread for our case study in lieu of another whole-grain option seems reasonable for several reasons. First, all WIC State agencies offer a bread product. Second, 100 percent whole-wheat bread appears to be the most commonly redeemed product within the benefit category. When analyzing the effects of its newly proposed recommendations on program costs and participants’ nutrient intakes, NASEM’s Committee to Review WIC Food Packages (2017) assumes that 100 percent whole-wheat bread accounts for the bulk of whole-grain redemptions (76 percent), followed by corn tortillas (19 percent) and instant oatmeal (6 percent). These assumptions are based on 2015 average redemption rates from the Chickasaw Nation, Texas, and Wyoming.

¹⁸As discussed in Stewart et al. (2019), for example, some WIC households might develop a preference for whole grains after learning about their nutritional importance and trying them through the program. If so, these households may choose whole grains with an increased propensity even when paying by other means. Alternatively, because of either food prices or tastes and preferences, WIC-provided foods might provide nearly all of the whole grains other WIC households desire. These households may choose refined grains with an increased propensity when using financial resources other than WIC benefits to buy foods.

¹⁹FoodAPS reports all payment methods used on a shopping trip. However, if multiple payment methods are reported, it is not clear which payment methods financed which foods. Following Dong et al. (2016), we assume that WIC benefits financed all WIC-allowed foods if WIC benefits were among the reported payment methods.

Table 3

Participants in the National Household Food Acquisition and Purchase Survey (FoodAPS), 2012-13, and their bread purchases

Total number of households who participated in FoodAPS	4,826
- Number who purchased bread	2,718
- Bread transactions financed with WIC benefits ¹	67
- Bread transactions financed out of pocket	5,653
Number of WIC households who participated in FoodAPS ²	471
- Number who purchased bread	273
- Purchases of bread financed with WIC benefits ¹	67
- Purchases of bread financed out of pocket	533
Number of eligible, non-WIC households who participated in FoodAPS ³	266
- Number who purchased bread	151
- Purchases of bread financed with WIC benefits ¹	0
- Purchases of bread financed out of pocket	376

WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.

¹FoodAPS reports all payments methods used on a shopping trip. Following Dong et al. (2016), if WIC benefits were among the reported payment methods, we assume that those benefits covered all WIC-allowed foods.

²FoodAPS includes 471 households who either self-identified as receiving WIC benefits or reported using WIC benefits during the survey period.

³FoodAPS includes 266 non-WIC households who are income eligible (income < 185 percent of poverty thresholds) and categorically eligible (include a pregnant or postpartum female and/or children under 5 years old).

Source: USDA, Economic Research Service analysis of FoodAPS. Simple count of FoodAPS households and their purchases of bread. Sample weights not used.

WIC Participation Positively Associated With Acquiring Whole Grains in Bread

Do WIC households acquire more whole grains in bread than households that are eligible for WIC but do not participate in the program? To answer this question, we compare the amounts of whole and refined grains acquired in bread by the 471 WIC and 266 eligible, non-WIC households that participated in FoodAPS.²⁰ Comparing purchases between these two groups who are similar in key respects aside from their participation in WIC allows us to control for other factors that affect a household's demand for whole grains, such as level of education, knowledge of nutrition, and use of food labels (e.g., Hiza et al., 2013; Lin and Yen, 2007).²¹ T-tests are used to evaluate the statistical significance of any differences. Notably, because our sample of 471 WIC households includes 417 households that were eligible for whole-grain benefits as well as 54 households that were not eligible for that particular benefit at the time of the survey, our test measures an average association between whole grains and program participation, capturing both the effect of the whole-grain benefit at the time of purchase and the effect of previous experience with the benefit and WIC nutrition

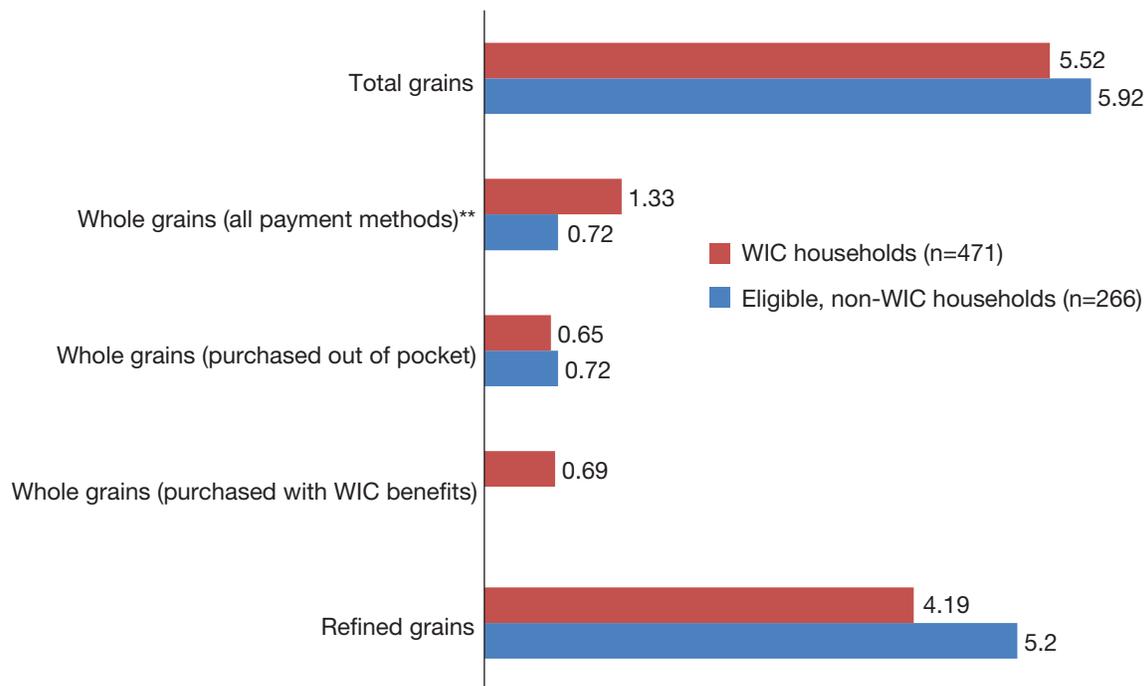
²⁰Mathematica Policy Research (Mathematica) and USDA matched each acquired food to USDA datasets, including the Food and Nutrient Database for Dietary Studies (FNDDS) and the Food Patterns Equivalents Database (FPED). These datasets, in turn, report the amount of whole and refined grains in the acquired breads, given their "as purchased" weight.

²¹We do not seek to compare our 471 WIC households to all eligible, non-WIC households that participated in FoodAPS as discussed in footnote 14; rather we compare them with a group of 266 such households who are also demographically alike and responded similarly to questions that measure dietary knowledge and health awareness. As shown in table 2, our WIC and eligible, non-WIC households are similar on these characteristics. Statistical tests revealed few differences in variable means between the two groups.

education.²² Note that to capture the full association between WIC participation and households' purchases of whole grains, we would need to conduct separate analyses for each of these relevant product categories and sum over them, which is beyond the scope of our study and data.²³ A summary of our results is shown in figure 1. The complete set of results is available in Appendix 1.

Figure 1

Amount of refined and whole grains acquired in bread by WIC and eligible, non-WIC households during 1 week, ounce-equivalents per household member over 1 year old



WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.

**= Statistically significant at the 5-percent level. Bread is defined broadly to include products not available through WIC, like bagels and breads made with fruit. Whole grains calculated include those in 100 percent whole-wheat bread, other types of whole-grain bread, and other breads that contain a mix of both refined grains and some whole grains. The complete set of results is available in Appendix 1.

Source: USDA, Economic Research Service analysis of National Household Food Acquisition and Purchase Survey (FoodAPS). Means and standard errors were calculated in Stata 14 using the “svyset” command and “over” option to account for survey design.

²²As discussed above, among all 471 WIC households, we estimate that 417 (89 percent) were eligible to receive bread through WIC because they include at least 1 child under 5 years old, a pregnant woman, and/or a breastfeeding woman. Although the other 54 (11 percent) WIC households were not eligible to receive bread during the survey period, we continue to include them in our analysis for 2 reasons. First, they may have previously been eligible to receive whole-grain bread through WIC while the mother was still pregnant, which could have a lasting effect on their behavior, given evidence of the impact of WIC nutrition education on participants’ food choices (e.g., Ritchie et al., 2010). Second, while the characteristics of all WIC participants in the FoodAPS sample closely match administrative data, it is not possible to examine such a comparison for the subsample of participants eligible to receive whole-grain benefits. Administrative data on the characteristics of WIC participants focus on the individual. These data do not include sufficient information about participants’ households to determine whether any household member is currently eligible for whole-grain benefits.

²³For example, while participating in FoodAPS, 118 WIC households bought tortillas, including 62 who bought whole-wheat and/or soft-corn tortillas. However, we cannot determine whether those soft-corn tortillas were whole grain, that is, made with whole-grain corn flour. Soft-corn tortillas made from germ-removed (degermed) corn would not be considered whole grain.

During their week of involvement in FoodAPS, the 471 WIC households in our data acquired 1.33 ounce-equivalents of whole grains in bread per member over 1 year old, on average, versus 0.72 ounce-equivalents for the 266 eligible, non-WIC households (fig. 1). This difference is statistically significant and can be attributed to purchases of bread through the WIC program, which must be whole-grain products.

However, much like other American households, WIC and WIC-eligible households still acquire substantially more refined than whole grains overall as a result of their out-of-pocket purchases. WIC households acquired 4.19 ounce-equivalents of refined grains in bread per member over 1 year old, on average, versus 1.33 ounce-equivalents of whole grains, as discussed above. An even larger disparity is observed among non-WIC households. This group of households acquired 5.20 ounce-equivalents of refined grains in bread per member over 1 year old, on average, versus 0.72 ounce-equivalents of whole grains.

Finally, we note that WIC households did not acquire more total grains than did non-WIC households. Both groups acquired slightly less than 6 ounce-equivalents of total grains per member over 1 year old, on average. WIC households acquired more whole grains because of their purchases through the program. They bought slightly less whole and refined grains when using another means to pay for bread, although neither difference is statistically significant.

Overall, our FoodAPS data show that, despite inconsistencies in the literature (e.g., Tester et al., 2016; Kong et al., 2014; Odoms-Young et al., 2014), WIC participation is positively associated with acquiring whole grains in bread. Moreover, the differences we identify in figure 1 capture only a portion of the overall association between WIC and whole grains, since our study focuses exclusively on bread. Some households may redeem their whole-grain benefits for tortillas, brown rice, or another whole-grain product besides bread.

Store-Level Purchase Data Provide Insights on the U.S. Food Marketing System

In addition to household-level data, ERS has also purchased store-level data from Information Resources, Inc. (IRI) to better understand the U.S. food marketing system. A panel of retail stores across the Nation provides IRI with a record of their weekly food purchase transactions. This panel includes supercenters, club warehouses, grocery stores, convenience stores, and drugstores, among others, many of which are large-volume, WIC-authorized retailers. For its retail scanner data product (named InfoScan), IRI combines transaction data with detailed information about each product sold by a participating store. It is therefore possible to examine trends in the availability and cost of very specific types of bread (such as 100 percent whole-wheat bread versus other bread types) in distinct package sizes (such as 24-ounce, 20-ounce, and 16-ounce packages). (See box: “Retail Scanner Data Enhance Ability To Study Food Prices and Food Product Availability.”)

Below, we use InfoScan to investigate trends in the availability and cost of 1-pound (16-ounce) packages of 100 percent whole-wheat bread at retail food stores. Focusing on this particular product seems reasonable for several reasons. First, a review of approved food lists posted on the websites of WIC State agencies suggested that 100 percent whole-wheat bread is universally offered. Secondly, 100 percent whole-wheat bread appears to be the most commonly redeemed product within the benefit category.²⁴ Finally, manufacturers and retailers have faced similar challenges supplying 1- or 2-pound packages of bread and other whole-grain products, including tortillas (Committee to Review WIC Food Packages, 2015; Gleason and Pooler, 2011).

One caveat applies to our analysis of IRI InfoScan data. Unlike our analysis of FoodAPS data, in which we were interested in the association between WIC participation and acquiring whole grains in bread, including products acquired through the program and those purchased with other means, we now define “bread” more narrowly to include only loaves, buns, and rolls. We exclude bagels, muffins, bread sticks, pastries, croissants, bread crumbs, breads made with fruit, and other product types not provided through the WIC program. Each loaf, bun, and roll product sold by a member of IRI’s retail panel was classified as 100 percent whole-wheat or “other” bread.

Finally, we focus our analysis on the years 2009 through 2015. Although WIC State agencies revised their food packages at different times throughout 2009, we treat 2009 as a quasi-baseline measure, mostly reflecting market conditions around the time of implementation, with differences from 2009 reflecting improvements in product availability since that time.

²⁴As noted above in footnote 17, when analyzing the effects of its newly proposed recommendations, NASEM’s Committee to Review WIC Food Packages (2017) assumes that 100 percent whole-wheat bread accounts for the bulk of redemptions (76 percent), followed by corn tortillas (19 percent) and instant oatmeal (6 percent).

Retail Scanner Data Enhance Ability To Study Food Prices and Food Product Availability

A panel of retail stores across the United States provides Information Resources, Inc. (IRI) with a record of their weekly food purchase transactions. IRI's retail panel is comprised of nearly 60,000 stores, including supercenters, club warehouses, grocery stores, supermarkets, convenience stores, and drugstores, among others (Muth et al., 2016). Many of the Nation's largest food retailers are among its participants. Some report sales for individual retail outlets. Others provide data by retail market area (RMA), such as total sales by all stores in the Southeast or Northeast. Total sales by all panel members can be estimated by combining data from retailers who provide data in either of the two ways.

For each item sold by a participating store, InfoScan reports both the quantity purchased and the retailer's revenue in dollars. Detailed information is also collected and reported on the various characteristics of each item sold by a participating store, such as the form, the package size, and a number of relevant health characteristics. Variables identify, for example, whether breads are 100 percent whole-wheat, contain other amounts or types of whole grains, or are made with purely refined grains.

The comprehensive nature of InfoScan data enhances the ability of ERS researchers to examine the availability and cost of very specific types of bread (such as 100 percent whole-wheat versus other bread types) in distinct package sizes (such as 24-ounce loaves, 20-ounce loaves, and 16-ounce loaves). This large panel of stores reporting sales information for all products sold further ensures a large enough sample size to estimate average retail prices, even for food products that households purchase less frequently.

ERS economists have previously used InfoScan data to describe product entry and exit in each of 17 food and beverage categories over the period 2008-12, comparing the nutritional quality of products entering the market, products exiting the market, and "established" products (i.e., neither entered nor exited) (Martinez and Levin, 2017). In the yogurt category, for example, it was found that new, entering products had 47 percent more fiber per serving on average than exiting products, which can be attributed to the growing popularity of probiotic yogurt and the addition of yogurt toppings.

In another study, ERS economists used InfoScan data to estimate a consumer's costs for satisfying Federal dietary guidelines for fruits and vegetables (Stewart et al., 2016). They found that, in 2013, it was possible for an individual to satisfy fruit and vegetable recommendations, based on a 2,000-calorie diet, for about \$2.10 to \$2.60 per day.

Further details on the methodology, characteristics, and statistical properties of IRI InfoScan data, including the number of stores in the retail panel by store type, are available in a report produced by RTI International under contract with ERS (Muth et al., 2016).

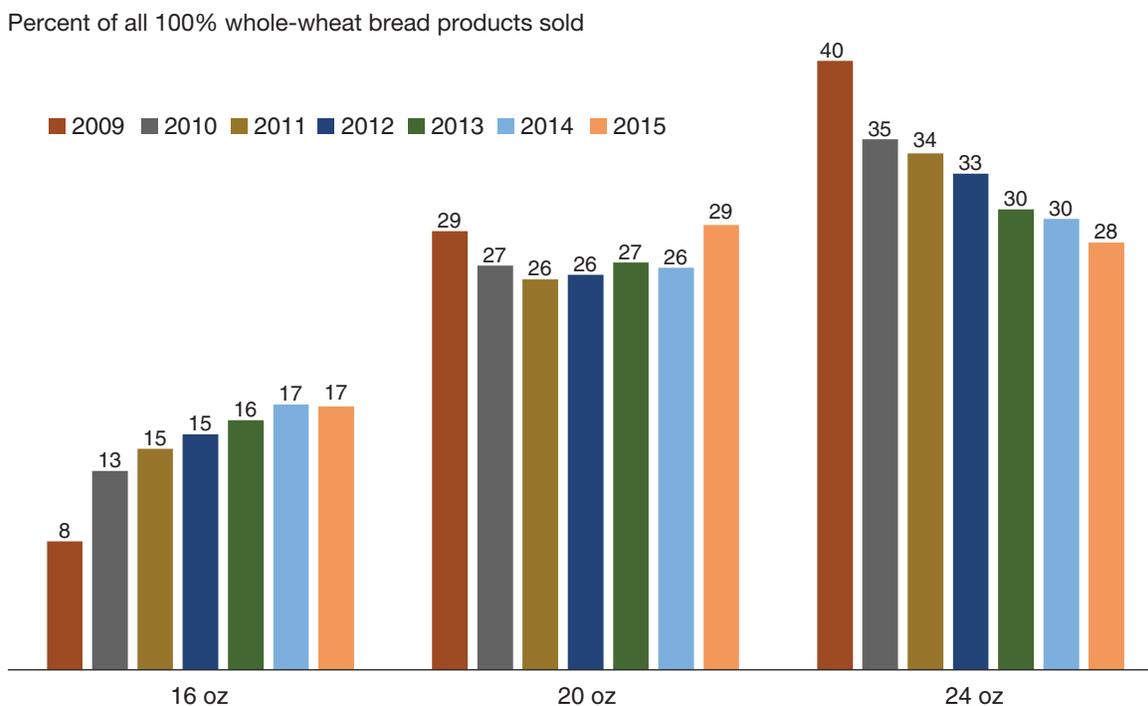
Product Availability Has Increased

As discussed, when USDA implemented its new WIC food packages in 2009, some retailers initially struggled to source products in the WIC-allowed, 16-ounce package size, although product availability improved after an adjustment period (e.g., Gleason and Pooler, 2011). Analysis of InfoScan data confirms that manufacturers and retailers responded to USDA's revision of WIC food packages by supplying more 100 percent whole-wheat bread in the authorized package size (fig. 2). In 2015, 1-pound packages represented 17 percent of all 100 percent whole-wheat bread products sold, more than double the product's 2009 share of 8 percent.

The most common package sizes for 100 percent whole-wheat bread continue to be 20 and 24 ounces. InfoScan data show that, during the each of the 7 years under study, 20-ounce packages consistently accounted for between 26 and 29 percent of all 100 percent whole-wheat bread products sold. By contrast, there was a notable decrease in the relative popularity of 24-ounce packages, with sales accounting for 28 percent in 2015 compared with 40 percent in 2009. Altogether, 16-ounce, 20-ounce, and 24-ounce packages have consistently accounted for about three-quarters of the overall market for 100 percent whole-wheat bread.²⁵

Figure 2

In 2015, 1-pound (16-oz.) packages represented 17 percent of all 100 percent whole-wheat bread products sold compared with 8 percent in 2009



Bread is defined to include bread, buns, and rolls. Excludes other products like biscuits, muffins, croissants, and bagels. All products are 100 percent whole-wheat.

Source: USDA, Economic Research Service analysis of IRI InfoScan data. Data are from stores that participate in IRI's retail panel, which may not be representative of all stores nationwide.

²⁵No other package size appears to account for a large share of the overall market for 100 percent whole-wheat bread; rather, there exists a wide range of package sizes. Aside from 16-, 20-, and 24-oz. packages, few products may be available within each existing size.

Despite growth in the availability of 16-ounce packages as a share of all 100 percent whole-wheat bread products sold, NASEM researchers noted that WIC-allowed breads remain difficult to locate on store shelves (Committee to Review WIC Food Packages, 2015). One reason may be that 100 percent whole-wheat bread occupies a small share of the overall bread aisle. According to IRI data, in 2015, for example, 100 percent whole-wheat products accounted for about 11 percent of all bread products sold in all package sizes, which implies that specifically 1-pound loaves of 100 percent whole-wheat represented only 2 percent (i.e., 17 percent of 11 percent). However, this does not suggest WIC participants are unable to fully redeem their whole-grain benefits if they choose to do so. According to USDA administrative data, WIC participants represent less than 3 percent of the U.S. population,²⁶ and not all WIC participants make the decision to redeem their benefits for bread.²⁷

Bread in 16-ounce Packages Less Economical

When USDA implemented its new WIC food packages in 2009, along with concern over the availability of whole-grain bread in the WIC-allowed package size, questions also arose about the cost of such products. As discussed above, in Gleason et al.'s (2011) study of retailers, store managers reported that 16-ounce packages were often more expensive than other bread products in more common, larger package sizes. Moreover, according to NASEM researchers, WIC-authorized bread products may still sell for a premium (Committee to Review WIC Food Packages, 2015). Below, we use IRI InfoScan data to compare the cost of bread in distinct package sizes between 2009 and 2015. However, it should be noted that prices estimated using the data may not be equal to the amount it would cost USDA to serve WIC participants. IRI's retail store panel includes both stores that accept WIC benefits and stores that do not accept them. Prices calculated with the data instead represent a very broad estimate of national average prices across a wide range of store types, across different regions of the country, and across all seasons of the year.

An analysis of InfoScan data confirms that bread is generally less expensive when purchased in a larger, economy-sized package (fig. 3). In 2015, for example, a 24-ounce package of 100 percent whole-wheat bread cost \$2.85, a 20-ounce package cost \$2.60, and a 16-ounce package cost \$2.76, on average. While it is not uncommon for food products to cost less on a dollars-per pound basis in larger package sizes, it is perhaps somewhat surprising that a 1-pound loaf can cost more than a 20-ounce loaf. In other words, it could be cheaper to buy 20 ounces and consume the extra 4 ounces than to just buy 1 pound.

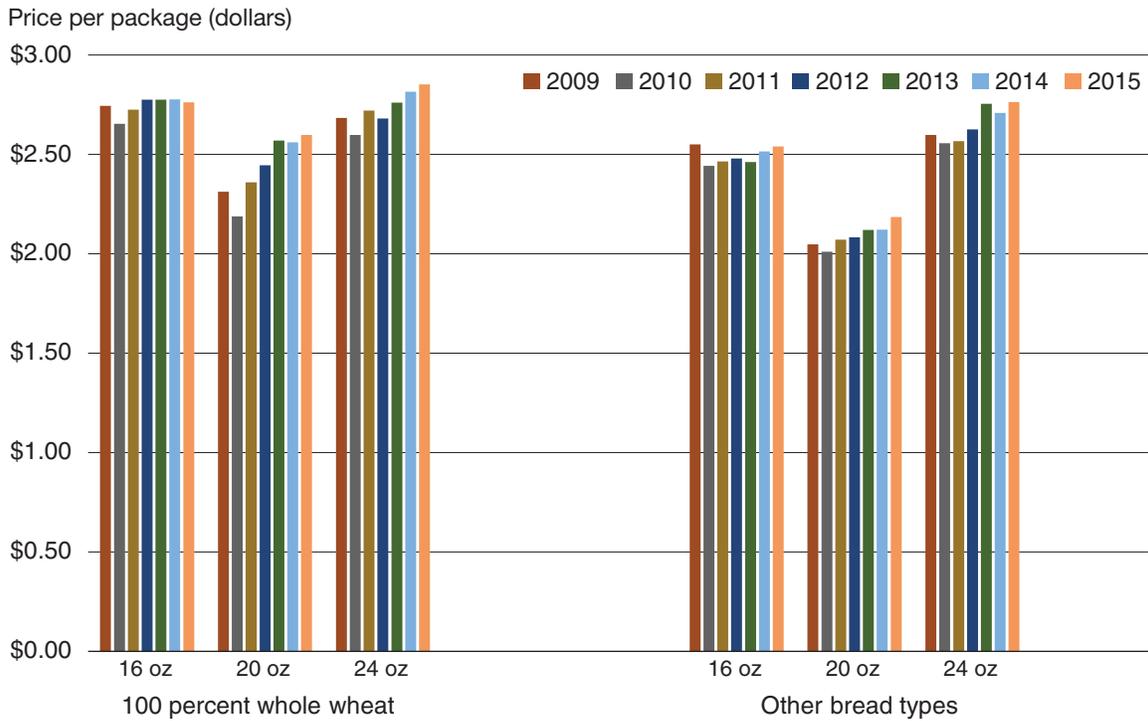
Interestingly, the above described phenomenon is not unique to 100 percent whole wheat (fig.3). In 2015, a 24-ounce package of non-100 percent whole-wheat bread cost \$2.76, a 20-ounce package cost \$2.18, and a 16-ounce package cost \$2.54, on average. Thus, a similar price-to-package size relationship exists among both 100 percent whole-wheat and other types of bread.

²⁶In fiscal 2017, WIC participation averaged 7.3 million people per month, or approximately 2-3 percent of all 330 million Americans alive at the time (USDA Food and Nutrition Service, 2019).

²⁷WIC food packages for infants and postpartum women do not include whole-grain bread. These two groups together represented about 30 percent of the WIC population in 2012 and 2014 (Thorn et al., 2015). Moreover, among participants who receive whole-grain bread, researchers have estimated the redemption rate for this benefit category at between 51.3 percent and 89.5 percent (Phillips et al., 2014; Ritchie et al., 2014; Gleason and Pooler, 2011). Finally, NASEM's Committee to Review WIC Food Packages estimates that other whole-grain options, such as whole-grain tortillas, account for about 24 percent of redemptions within the benefit category, as discussed in footnotes 17 and 24.

Figure 3

Bread in a 1-pound (16-oz.) package can cost more than same type of bread in a 20-oz. package



Bread is defined to include bread, buns, and rolls. Excludes other products like biscuits, muffins, croissants, and bagels. Source: USDA, Economic Research Service analysis of IRI InfoScan data. Data are from stores that participate in IRI's retail panel, which may not be representative of all stores nationwide.

Finally, we note that the premium charged by retailers for 100 percent whole-wheat bread in the smaller, WIC-authorized, 16-ounce package size has decreased over the years as supply-side issues associated with the rollout of USDA's new WIC food packages were likely resolved (fig. 3). However, it is also notable the average cost of the WIC-authorized product has not decreased; rather, the WIC-authorized product's average retail price has remained fairly steady, while 100 percent whole-wheat bread in other package sizes has become more expensive over the years.

Conclusions

About a decade has passed since USDA last revised its WIC food packages. In 2014, given the need for another decennial review, USDA asked NASEM to convene a committee to conduct an independent, comprehensive scientific review of WIC food packages and recommend cost-neutral changes in line with the nutritional status and food and nutrition needs of the WIC-eligible population. In 2017, that committee released its final report with a number of recommendations to revise participants' food assistance benefits. These include offering 16- to 24-ounce packages of 100 percent whole-wheat bread and other whole-grain options to all participants who receive this benefit, relaxing regulations that effectively require stores to stock 16-ounce packages. The committee also recommends removing all types of whole-grain bread other than 100 percent whole-wheat from WIC State agencies' lists of approved food products. These suggestions are based in part on an analysis of food consumption surveys and a review of existing research on WIC participants' food-purchase and food-consumption behavior, as well as concern over the cost and availability of whole-grain products in the WIC-allowed package size at retail stores. In this study, we use a combination of store- and household-level data not previously used for this purpose to take a new look at some key questions and conclude that:

- WIC households acquire more whole grains in bread than similar households that are eligible for—but do not participate in—the program.
- 1-pound packages have become more widely available since 2009 and now represent about 17 percent of all sales of 100 percent whole-wheat bread, compared with 8 percent in 2009.
- 100 percent whole-wheat bread in 1-pound packages remains expensive compared with the same type of bread in other sizes, and these price gaps have not entirely abated, even as the WIC-allowed product became more widely available.

Altogether, these findings address some longstanding concerns expressed by researchers and others about WIC participants' whole-grain benefits. The Agricultural Act of 2014 required the *Dietary Guidelines for Americans* to expand to include infants and toddlers from birth to age 2 years, as well as women who are pregnant, beginning with the 2020 edition. USDA will consider changes to the WIC food packages once this work is complete.

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Appendix 1. The Amount of Grains Acquired in Bread by WIC and Non-WIC Households

In this study, we compared the amounts of whole and refined grains acquired in bread products by WIC and eligible, non-WIC households. Product weights for all purchased breads were converted into ounce-equivalents of whole and refined grains using the FNDDS and FPED datasets. To control for differences in household sizes, we further divided each household's grain acquisitions by the number of household members over 1 year old. Finally, we calculated average values over our 471 WIC households and our 266 eligible, non-WIC households, using the software package Stata 14 with the "svyset" command and "over" option to incorporate sample weights that account for survey design. T-tests were conducted to evaluate the statistical significance of any differences between the two groups. The results are shown in Table A.1.

Table A.1

Grain ounce-equivalents acquired in bread per household member over 1 year old, FoodAPS 2012-13

	WIC households ¹ (n=471)		Eligible, non-WIC households ² (n=266)		Difference ³	
Oz.-equivalents bought out-of-pocket						
(i) Refined grains	4.19	(0.47)	5.20	(0.53)		
(ii) Whole grains	0.65	(0.15)	0.72	(0.17)		
Oz.-equivalents bought with benefits ⁴						
(i) Refined grains	0	0				
(ii) Whole grains	0.69	(0.17)				
Oz.-equivalents acquired by all payment methods						
(i) Refined grains	4.19	(0.47)	5.20	(0.53)	-1.01	(0.71)
(ii) Whole grains	1.33	(0.22)	0.72	(0.17)	0.61**	(0.28)
(ii) Total grains	5.52	(0.53)	5.92	(0.56)	-0.4	(0.77)

Notes: Means and standard errors were calculated in Stata 14 using the "svyset" command and "over" option to account for survey design. Standard errors are in parentheses.

¹FoodAPS includes 471 households who either self-identified as receiving WIC benefits or reported using WIC benefits during the survey period.

²FoodAPS includes 266 non-WIC households who are income-eligible (income < 185 percent of poverty thresholds) and categorically eligible (include a pregnant or postpartum female and/or children under 5 years old).

³Statistical significance based on T-tests. ** = Statistically significant at the 5-percent level. Samples are assumed to be independent. The standard error reported in parentheses was calculated as the square root of the sum of the two sample variances.

⁴FoodAPS reports all payment methods used on a shopping trip. Following Dong et al. (2016), if WIC benefits were among the reported payment methods, we assume that those benefits covered all WIC-allowed foods (i.e., whole-grain bread).

Source: USDA, Economic Research Service analysis of National Household Food Acquisition and Purchase Survey (FoodAPS).