

Access to Affordable and Nutritious Food: Measuring and Understanding Food Deserts and Their Consequences

Report to Congress



This report was prepared by the Economic Research Service (ERS), the Food and Nutrition Service (FNS), and the Cooperative State Research, Education, and Extension Service (CSREES) of the U.S. Department of Agriculture under the direction of Michele Ver Ploeg of ERS. Contributors include Vince Breneman, Tracey Farrigan, Karen Hamrick, David Hopkins, Phil Kaufman, Biing-Hwan Lin, Mark Nord, Travis Smith, and Ryan Williams of ERS; Kelly Kinnison, Carol Olander, and Anita Singh of FNS; Elizabeth Tuckermanty of CSREES; Rachel Krantz-Kent and Curtis Polen of the Bureau of Labor Statistics; and Howard McGowan and Stella Kim of the U.S. Census Bureau.



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June 2009

Abstract

The Food, Conservation, and Energy Act of 2008 directed the U.S. Department of Agriculture to conduct a 1-year study to assess the extent of areas with limited access to affordable and nutritious food, identify characteristics and causes of such areas, consider how limited access affects local populations, and outline recommendations to address the problem. This report presents the findings of the study, which include results from two conferences of national and international authorities on food deserts and a set of commissioned research studies done in cooperation with the National Poverty Center at the University of Michigan. It also includes reviews of existing literature, a national-level assessment of access to supermarkets and large grocery stores, analysis of the economic and public health effects of limited access, and a discussion of existing policy interventions. The study uses a variety of analytical methods and data to assess the extent of limited access to affordable and nutritious food and characteristics of areas with limited access. Overall, findings show that a small percentage of consumers are constrained in their ability to access affordable nutritious food because they live far from a supermarket or large grocery store and do not have easy access to transportation. Urban core areas with limited food access are characterized by higher levels of racial segregation and greater income inequality. In small-town and rural areas with limited food access, the lack of transportation infrastructure is the most defining characteristic. Existing data and research are insufficient to conclusively determine whether areas with limited access have *inadequate* access.

Acknowledgments

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Summary

Increases in obesity and diet-related diseases are major public health problems. These problems may be worse in some U.S. communities because access to affordable and nutritious foods is difficult. Previous studies suggest that some areas and households have easier access to fast food restaurants and convenience stores but limited access to supermarkets. Limited access to nutritious food and relatively easier access to less nutritious food may be linked to poor diets and, ultimately, to obesity and diet-related diseases. Congress, in the Food, Conservation, and Energy Act of 2008, directed the U.S. Department of Agriculture (USDA) to conduct a 1-year study to assess the extent of the problem of limited access, identify characteristics and causes, consider the effects of limited access on local populations, and outline recommendations to address the problem.

This report presents the findings of the study, which include results from two conferences of national and international authorities on food deserts and a set of commissioned research studies done in cooperation with the National Poverty Center at the University of Michigan. It also includes reviews of existing literature, a national-level assessment of access to supermarkets and large grocery stores, analysis of the economic and public health effects of limited access, and a discussion of existing policy interventions. A variety of analytical methods and data are used to assess the extent of limited access to affordable and nutritious food and characteristics of areas with limited access.

Findings

Access to a supermarket or large grocery store is a problem for a small percentage of households. Results indicate that some consumers are constrained in their ability to access affordable nutritious food because they live far from a supermarket or large grocery store and do not have easy access to transportation. Three pieces of evidence corroborate this conclusion:

- Of all households in the United States, 2.3 million, or 2.2 percent, live more than a mile from a supermarket and do not have access to a vehicle. An additional 3.4 million households, or 3.2 percent of all households, live between one-half to 1 mile and do not have access to a vehicle.
- Area-based measures of access show that 23.5 million people live in low-income areas (areas where more than 40 percent of the population has income at or below 200 percent of Federal poverty thresholds) that are more than 1 mile from a supermarket or large grocery store. However, not all of these 23.5 million people have low income. If estimates are restricted to consider only low-income people in low-income areas, then 11.5 million people, or 4.1 percent of the total U.S. population, live in low-income areas more than 1 mile from a supermarket.
- Data on time use and travel mode show that people living in low-income areas with limited access spend significantly more time (19.5 minutes) traveling to a grocery store than the national average (15 minutes). However, 93 percent of those who live in low-income areas with

limited access traveled to the grocery store in a vehicle they or another household member drove.

These distance and time-based measures are national estimates that do not consider differences between rural and urban areas in terms of distance, travel patterns, and retail market coverage.

Urban core areas with limited food access are characterized by higher levels of racial segregation and greater income inequality. In small-town and rural areas with limited food access, the lack of transportation infrastructure is the most defining characteristic.

These area- or distance-based results are in line with a nationally representative survey of U.S. households conducted in 2001. Responses to direct questions about food access show that nearly 6 percent of all U.S. households did not always have the food they wanted or needed because of access-related problems. More than half of these households also lacked enough money for food. It is unclear whether food access or income constraints were relatively greater barriers for these households.

Supermarkets and large grocery stores have lower prices than smaller stores. A key concern for people who live in areas with limited access is that they rely on small grocery or convenience stores that may not carry all the foods needed for a healthy diet and that may offer these foods and other food at higher prices. This report examines whether prices of similar foods vary across retail outlet types and whether the prices actually paid by consumers vary across income levels. These analyses use proprietary household-level data that contain information on food items purchased by approximately 40,000 demographically representative households across the United States. Results from these analyses show that when consumers shop at convenience stores, prices paid for similar goods are, on average, higher than at supermarkets.

Low-income households shop where food prices are lower, when they can. Findings also show that food purchases at convenience stores make up a small portion of total food expenditures (2 to 3 percent) for low-income consumers. Low- and middle-income households are more likely to purchase food at supercenters, where prices are lower. Administrative data on SNAP benefit redemptions from 2008 show that 86 percent of SNAP benefits were redeemed at supermarkets or large grocery stores. Research that considers the prices paid for the same food across household income levels indicates that while some of the very poorest households—those earning less than \$8,000 per year—may pay between 0.5 percent and 1.3 percent more for their groceries than households earning slightly more, households earning between \$8,000 and \$30,000 tend to pay the lowest prices for groceries, whereas higher income households pay significantly higher prices.

The study also examined food shopping behavior and the types of food purchased for SNAP participants and other low-income households. Data from the 1996/1997 NFSPS show that SNAP participants were, on average, 1.8 miles from the nearest supermarket. However, the average number of miles both SNAP participants and eligible nonparticipants traveled to the store most often used was 4.9 miles. These same data show that SNAP

participants who did not shop at supermarkets purchased less noncanned fruit, noncanned vegetables, and milk than SNAP participants who shopped frequently at a supermarket.

Easy access to all food, rather than lack of access to specific healthy foods, may be a more important factor in explaining increases in obesity. Many studies find a correlation between limited food access and lower intake of nutritious foods. Data and methods used in these studies, however, are not sufficiently robust to establish a causal link between access and nutritional outcomes. That is, other explanations cannot be eliminated as the cause of lower intake. A few studies have examined food intake before and after healthy food options become available (either within existing stores or because new stores opened). The findings are mixed—some show a small but positive increase in consumption of fruits and vegetables, while others show no effect.

The causal pathways linking limited access to nutritious food to measures of overweight like Body Mass Index (BMI) and obesity are not well understood. Several studies find that proximity of fast food restaurants and supermarkets are correlated with BMI and obesity. But increased consumption of such healthy foods as fruits and vegetables, low-fat milk, or whole grains does not necessarily lead to lower BMI. Consumers may not substitute away from less healthy foods when they increase their consumption of healthy foods. Easy access to all food, rather than lack of access to specific healthy foods, may be a more important factor in explaining increases in BMI and obesity.

Understanding the market conditions that contribute to differences in access to food is critical to the design of policy interventions that may be effective in reducing access limitations. Access to affordable and nutritious food depends on supply (availability) and consumer demand. Consumer behavior, preferences, and other factors related to the demand for some foods may account for differences in the types of foods offered across different areas. Food retailer behavior and supply-side issues such as higher costs to developing stores in underserved areas may also explain variation across areas in which foods are offered and what stores offer them. If high development costs serve as a barrier to entry for supermarkets in some areas with low access, then subsidy programs or restructured zoning policies may be effective solutions. If consumer demand factors, such as inadequate knowledge of the nutritional benefits of specific foods, contribute to differences in access by reducing demand, then a public health campaign may be a preferred strategy. Several local and State-level efforts are underway that could provide the basis for a better understanding of the types of interventions that may work best.

Food has been used as a tool for community development. Projects such as farmers' markets, community gardens, promotion of culturally specific foods for ethnic minorities and Native Americans, local food production and promotion, youth agricultural and culinary training programs, and many other types of programs have all been implemented in a variety of settings, both urban and rural. USDA's Community Food Projects Competitive Grant program has much experience in funding and nurturing such programs.

The current state of research is insufficient to conclusively determine whether some areas with limited access have inadequate access. Future research should consider improved methods to measure access levels, availability, and prices of foods faced by individuals and areas. More research is needed to understand how access, availability and price affect the shopping and consumption behaviors of consumers. Data linking information on the types of foods consumers purchase and eat with measures of consumers' levels of access and the prices they face could help explain the economic consequences of food access. Studies that use improved methods and data to determine how food access affects diet, obesity, and other health outcomes are also needed to help explain the health consequences of food access.

Methods

To conduct the analysis of the extent of food deserts, a comprehensive database was developed that identified the location of supermarkets and large grocery stores within the continental United States. Food access was estimated as the distance to the nearest supermarket or large grocery store. The analysis was refined by examining households without vehicles and specific socio-demographic subpopulations drawn from the 2000 Census. Multivariate statistical analysis was applied to identify the key determinants of areas with low access to supermarkets and large grocery stores.

Research also examined national-level data on questions of household food adequacy and access from the 2001 Current Population Survey. This information was complemented with national-level data on time spent traveling to grocery stores from the 2003-07 American Time Use Survey. To consider the economic consequences of limited access, ERS also analyzed demand for certain nutritious foods for a sample of participants in the Supplemental Nutrition Assistance Program (SNAP, formerly the Food Stamp Program), using data from the National Food Stamp Program Survey (NFSPS) of 1996/1997. Variation in prices for similar foods purchased at different store types, as indicated by hedonic models and data from the 2006 Nielsen Homescan panel, was also estimated.

ERS collaborated with other agencies and institutions to complete this study. USDA's Food and Nutrition Service (FNS) compiled information on an extensive body of work examining food access for SNAP and other low-income households. USDA's Cooperative State Research, Education, and Extension Service (CSREES) provided information on the Community Foods Projects and lessons learned in the administration of the projects.

The national-level food desert analysis was complemented by a review of existing literature and the commissioning of additional studies by experts in the field. A workshop held in October 2008 convened leading experts in the study of retail food and grocery store access, key stakeholders from community development organizations, grocery retailer organizations, other government agencies, congressional members and staff, and related public interest groups. The workshop included presentations and panel discussions of such topics as defining and describing dimensions of food deserts, implications of low access for food and nutrition assistance programs,

consequences of food deserts, and programs and policies to mitigate the adverse effects of food deserts.

USDA, in cooperation with the National Poverty Center at the University of Michigan, commissioned several studies by experts in food access to better understand concepts of low access to affordable and nutritious foods and the degree to which access varies across different types of areas. The intent of these papers was to describe characteristics of the food environment and the demographic, economic, and health conditions that typify areas with low food access and to compliment the national-level findings with more detailed and local-level information. Results from studies were presented in a conference.

USDA, in cooperation with the Institute of Medicine of the National Academies, conducted a 2-day workshop in January 2009 on the public health implications of food deserts. Workshop presentations covered methods for assessing and research findings on the impacts of food deserts on such outcomes as diet (including examination of specific foods, such as fruit and vegetable consumption and intake of high-energy, low-nutrient foods), prevalence of obesity and overweight; and diseases associated with poor diets. In addition, presentations covered promising strategies for mitigating the impacts of food deserts that have been suggested, implemented, or are in the planning stages. The workshop provided the basis for the review of the public health literature.

Introduction

Increases in rates of obesity and related chronic diseases that may be linked with poor diets, such as diabetes and heart disease, are major public health concerns. Some advocates, community leaders, and researchers are worried that these problems, and poor diets in general, may be more severe in certain poor and rural American communities because these areas have limited access to affordable and nutritious foods. A primary concern is that some poor or rural areas do not have access to supermarkets, grocery stores, or other food retailers that offer the large variety of foods needed for a healthy diet (for example, fresh fruits and vegetables, whole grains, fresh dairy and meat products). Instead, individuals in these areas may be more reliant on food retailers or fast food restaurants that only offer more limited varieties of foods. It is hypothesized that the relative lack of access to full-service grocery stores and the easier access to fast and convenience foods may be linked to poor diets and, ultimately, to obesity and other diet-related diseases.

It was this concern that led Congress, in the Food, Conservation, and Energy Act of 2008, (hereafter referred to as the 2008 Farm Bill) to direct the U.S. Department of Agriculture (USDA) to conduct a 1-year study of areas with limited access to affordable and nutritious food. The 2008 Farm Bill directed USDA to assess the extent of the problem of limited access, identify characteristics and causes of limited access and the effects limited access has on local populations, and outline recommendations for addressing the causes and effects of limited access. The USDA study was conducted by a team of researchers, policy analysts, and program leaders from USDA's Food and Nutrition Service (FNS), Cooperative State Research, Education, and Extension Service (CSREES), and the Economic Research Service (ERS), which served as the lead agency. This report provides the analysis and findings of the USDA study. A number of information-gathering and data-analysis activities were conducted as part of the study. Each of these activities and their purposes is described later in this introduction.¹

Definitions, Concepts, and Background Literature

The language in the 2008 Farm Bill defined a food desert as an "area in the United States with limited access to affordable and nutritious food, particularly such an area composed of predominantly lower income neighborhoods and communities" (Title VI, Sec. 7527). In order to consider the extent of such areas, the following questions first need to be answered:

- What is affordable food and nutritious food?
- What does it mean to have (or not have) access to such food?
- Do individuals or do areas lack access?

The concern over food deserts is that some consumers have difficulty accessing food retailers that offer affordable and nutritious food.² The ease or difficulty in getting to a food retailer depends on the location of the store in relationship to the consumer and the consumer's travel patterns, the

¹One additional activity that is not further described in this report is the Workshop on Access to Affordable and Nutritious Foods: Understanding Food Deserts held on October 9, 2008, in Washington, DC. An agenda for this workshop is included in appendix A.

²We note that this study focuses on the ease at which households and individuals can get to stores that sell the foods they want at affordable prices. We do not focus on the related concept of food security, which measures whether households or individuals have access to enough food for an active, healthy life. The concepts are clearly related, but, in general, food security measures focus less on physical access and more on whether a household can afford food. For example, some individuals or households may have low food security but may live only one block from a large supermarket, so that physical access to food is less of a problem than whether the family can afford to buy the food.

consumer's individual characteristics (e.g., income, car ownership, disability status), and neighborhood characteristics (e.g., the availability of public transportation, availability of sidewalks, and crime patterns in the area). Before considering how many people and places may be affected by limited access to affordable and nutritious food, one must first determine what is meant by “nutritious food” and “affordable,” and how access to affordable and nutritious foods can be measured.

It may be easy to identify some foods as highly *nutritious* and others as much less nutritious, but the nutrition levels of most foods fall somewhere in between. Those foods that may be easily identified as highly nutritious are available in different forms (fresh, frozen, canned, in prepared sauces or dishes). They can also be purchased at many food outlets, including those that many consider lacking in nutritious foods, such as fast food restaurants. It is likely that even the smallest food retailers stock foods that have nutritional merits; however, it is also likely that some retailers may offer very few of these options. No one food can fulfill the recommendations for a healthy diet. So measuring what “nutritious” food is and where it can be found must necessarily encompass a broad array of foods and sources of foods.

Affordability of food refers to the price of a particular food and the relative price of alternative or substitute foods. Affordability of food is also impacted by the budget constraints faced by consumers, who must consider not only the prices of different foods to meet their food needs, but also the prices of other necessities (e.g., housing, clothing, and transportation). USDA provides guidance on national standards for nutritious diets at various costs levels—the Thrifty, Low-cost, Moderate-cost and Liberal Food Plans (Carlson et al., 2007a; Carlson et al., 2007b). Within each plan is a market basket of foods in quantities that reflect current dietary recommendations, food composition data, food prices, and actual consumption patterns. According to the Low-cost Food Plan, a family of four with two adults (age 19 to 50) and two children (ages 6 to 8 and 9 to 11) could consume a nutritious diet for \$175.60 per week (USDA, 2009).

In addition to considering food prices, consumers also consider travel and time costs in deciding where to shop and what to buy. There are also monetary and time costs in preparing and serving food, as well as cleaning up. The time costs of these activities may affect consumer decisions about whether to shop for and prepare a home-cooked meal, buy products that require less preparation time, or eat a meal prepared by a restaurant.

Measuring access to affordable and nutritious food is an enormous data collection task that requires information on all the food retailers in a neighborhood or within the reach of the consumer, the types and prices of food sold in these stores, and a measure of the quality of the food. Many studies approximate the availability of these foods and a wide range of other foods by using the existence of supermarkets and grocery stores, arguing that these stores are known to carry a variety of foods and have many options for “nutritious foods,” such as fresh, frozen, and canned, and carry them at the lowest prices. But focusing only on supermarkets and larger grocery stores is likely to underestimate the availability of healthy foods since some of these foods are also available at small grocery stores, convenience stores,

pharmacies, dollar stores, farmers' markets, and restaurants. There is also some evidence of substitutability in stores—that is, areas without large chain supermarkets are often served with independent, and often smaller, grocery stores (Neckerman et al., 2009; Powell, 2009). These smaller stores may have adequate and affordable food choices, so that in ignoring them, researchers may underestimate the food that is available in those areas.

The limitations of considering only supermarkets and large grocery stores in measuring the availability of food are well recognized in the literature on food access. This has led to more localized studies that collect an extensive amount of data on the food environment. Some studies collect additional information about the locations of food retailers other than supermarkets, such as farmers' markets, meat markets, bakeries, or veggie carts (see, for example, Neckerman et al., 2009). Other studies actually measure a store's contents to see if "healthy foods" are sold, how much shelf space is dedicated to them, and in which forms they are sold (e.g., fresh, frozen, or canned; low-fat or regular) (see, for example, Rose et al., 2009; Sharkey and Horel, 2009). Standardized tools for conducting such studies have also been developed and tested, such as the Nutrition Environment Measures Survey (NEMS) (<http://www.sph.emory.edu/NEMS/>.) Such extensive data collections have been conducted on more localized levels, for example, in New Orleans, New York City, and six rural counties in Texas. But because these efforts require such intensive data collection and resources, they are not easily conducted on a national level.

Studies of food access have also measured the availability and prices of foods in USDA's Thrifty Food Plan (TFP) in stores as a standardized way to compare availability and affordability of foods in geographic areas (for example, Block and Kouba, 2005; Hendrickson et al., 2006; Mantovani et al., 1997; Rose et al., 2009). Such uses of the TFP provide an absolute measure of availability and price (as opposed to a relative measure) and allow aggregation across store types (Bitler and Haider, 2009).

Once the availability and price of food has been measured, studies of food access typically then measure how easy it is for consumers to access the food. The ease or difficulty of food access has been measured many ways.⁴ One common method is to measure distance from consumers' residences to the nearest food retailer that offers healthy and affordable foods (often to supermarkets or large grocery stores).⁵ Distances in sparsely populated areas are often not directly comparable to distance in densely populated areas. As a result, many studies consider access in rural areas separately from access in suburban and urban areas. "Walkable" distance measures have often been used to characterize access in urban areas. The definition of such a distance is often 1 kilometer or about a half mile (app. table B.1). Similar concepts for less densely populated suburban and rural areas have not been applied, but often a distance is designated to distinguish access limitations. For example, areas more than 10 miles from a supermarket have been called food deserts (Blanchard and Lyson, 2006; Morton and Blanchard, 2007). These designations of what may be considered an "acceptable" distance to a food source in less densely populated areas are somewhat arbitrary, especially considering that without a car, any distance of more than a mile or so could be considered unacceptably far.

⁴Appendix table B.1 summarizes the measures of access to health foods used by over 30 studies. Figure B.1 shows the locations of these studies.

⁵Distance is usually measured from the centroid of an area (e.g., ZIP Code, census tract, or block) to the nearest supermarket.

Distance is almost always measured as distance from a residential area to a store, assuming home to store travel is the way most people access supermarkets. But people do not just travel from home to store. They travel to work, school, church, and beyond and often purchase food on the way. Using an access measure that only considers distance from home is likely to underestimate the options available for food shopping.

Measures of distance to the nearest food retailer do not consider whether the consumer has other choices that can offer better products or lower prices. Thus, many studies have tried to capture the amount of choice consumers have in their measures of food access. Apparicio et al. (2007) and Sparks et al. (2009) calculate the distance to three different stores, or the distance to three different chain supermarkets to add a dimension of the level of competition in an area. Density measures that count the number of stores in a certain geographical area are also often used to describe the food environment. For example, measures such as the number of supermarkets, fast food restaurants, or convenience stores per resident within a census tract or the ratio of fast food restaurants to supermarkets per capita have been used to describe food environments within a geographic area (see, for example, Gallagher, 2007 and 2006). Density measures add richness to a measure of the food environment by looking beyond distance. Further, relatively higher densities of a store type could be a signal of the level of competition among that type of store and may signal lower prices.

A problem with both distance and density measures, however, is that they only measure “potential access,” and not “realized access.”⁶ Potential access shows where consumers could possibly shop, while realized access shows where consumers actually shop. A consumer that does not care to eat at fast food restaurants or convenience stores may have high access to these stores but may pass by them on the way to a supermarket that is farther away. And even if the concentration of convenience stores is higher in some neighborhoods, most of the food shopping could be conducted at larger supermarkets. For example, Broda et al. (forthcoming) find that compared with higher income families, low-income families spend slightly more of their food budget at convenience stores, which offer prices that are, on average, greater than those in traditional grocery stores. However, the study also found that compared with higher income families, low-income families spend a greater share of total expenditures at supercenters, where lower prices almost completely offset the higher prices at convenience stores. To further illustrate this point, data show that, on average, SNAP participants lived 1.8 miles from the nearest supermarket but traveled 4.9 miles to the foodstore they most often used (Cole, 1997). (More details on both of these findings are provided in chapter 5).

Area-based versus individual based concepts of access

Studies that use area-based measures of access, either distance or density, usually focus only on areas with high concentrations of vulnerable populations.⁷ Examining only areas in which a relatively high proportion of poor people live, for example, will miss many poor people who live in less poor areas, but who may also have limited access.⁸ Further, not everyone who lives in low-income areas is poor. There will certainly be people who live in a low-income area with limited access but who themselves have

⁶This helpful distinction is made by Sharkey and Horel, 2009.

⁷Most studies consider only areas with high concentrations of poor people. Some also consider areas with low vehicle ownership rates, high concentrations of elderly, and the availability of public transportation. See Neckerman et al., 2009, for more details.

⁸A separate concern is for those who are too poor to buy food regardless of how accessible it is. USDA's Household Food Security in the United States series reports the percent of Americans who do not have access to enough food for an active, healthy life for all household members. In 2007, 11.1 percent of households were food insecure at some time during the year and about 4.1 percent of all households had very low food security some time during the year (Nord et al., 2008).

adequate resources to travel to a supermarket regularly. Ownership of, or easy access to, a motorized vehicle may be the best marker of access regardless of whether someone lives in a poor area or not. The majority of U.S. households own cars (89.7 percent).⁹ Vehicle ownership rates among those living in rural areas (94.6 percent) are higher than among those living in urban areas (87.8 percent). Those with low incomes are less likely to own a vehicle, but time use and travel mode data reported in Chapter 2 show that most people, even low-income people, take their own vehicles or drive with someone else to do their grocery shopping.

The distinction between individual-level access and area-based access has significant implications for measuring the size of the problem of limited access—that is, the number of people with limited access. Chapter 2 illustrates this. The distinction also has implications for the design of policies that may be most cost effective in reducing the problem. For example, if those people who have low incomes and limited access are scattered throughout areas with lower concentrations of poor people, then opening up a new supermarket may be less effective than policies that make individual or group transportation to stores less expensive (for example, bus/transit subsidies, store shuttle services, or improved bus routes). However, if people with low income and low access are concentrated in certain areas, then finding a way to open a new store or improve the variety of foods carried in existing stores in that area may be more effective.

The bulk of studies of food access find relative differences across areas in access to some types of food retailers and foods.¹⁰ Researchers have documented the inequality of access to supermarkets in urban inner city areas (Donohue, 1997), while others have focused on differences in access to supermarkets in poor versus nonpoor areas (O’Conner and Abell, 1992; Cotterill and Franklin, 1995; Pike, 2000). Moore and Diez Roux (2006) investigated racial disparities in the number and variety of grocery stores in neighborhoods. Zenk et al. (2005) compared distances to the nearest supermarket among poor White and poor non-White households. Extending that approach, Gallagher (2007 and 2006) compared differences in the ratio of supermarkets to other foodstores in a neighborhood in Detroit and Chicago. More recently, Neckerman et al. (2009) examined the retail food environment in New York City. They considered the characteristics of households, such as race, income, and forms of available transportation, including vehicle ownership or access to mass transit, as factors affecting a household’s foodstore access. Findings show lower access to supermarkets and other healthy food stores for neighborhoods composed primarily of African-Americans, where populations were heavily reliant on mass transit for transportation.

While there may be relative disparities in access to specific types of food retailers, there is not general agreement on whether areas with relatively less access have *inadequate* access to food. That is—there is not a widely agreed standard above which an area has “adequate” access to affordable and nutritious food and below which, an area has “inadequate” access to food. To draw such a distinction would require more systematic consideration of what inadequate access to affordable and nutritious food means, which would require collection of very detailed data on food availability and price. That does not mean that there are not areas with inadequate access. The research

⁹See chapter 3 for details on household access to vehicles.

¹⁰Larson et al. (2009) (Not in references) reviewed 54 studies of disparities in access to healthy food.

highlighted above certainly shows some areas may have inadequate access. Rather, the point here is that the data and methods that have been used to document relative differences cannot be implemented easily on a national level to make a national-level distinction.

Absolute standards of similar concepts, such as *poverty* or *food insecurity*, have been made and are commonly used in describing conditions of the U.S. economy and the well-being of U.S. households and in making public policy. While these absolute distinctions are certainly not universally agreed upon, there is a much deeper and richer literature from which a concept like poverty can be defined and measured than there is for food deserts.

Report Outline

A variety of data and methods was used to assess the extent of limited access to affordable and nutritious food, including both individual measures of access and area-based measures of access. Responses to a national-level household survey of food adequacy and access were analyzed, as were data estimating differences among households in the time spent traveling to grocery stores and the travel mode used. To determine the extent of areas with limited access, a comprehensive database was developed to identify the location of supermarkets and large grocery stores within the continental United States. Food access was estimated as the distance to the nearest supermarket or large grocery store, which is used as a proxy for the availability of affordable and nutritious food. The analysis specifically considered distance to the nearest supermarket for low-income populations and for households without access to a vehicle. Differences in rural, urban, and areas in between were considered. These results are presented in Chapter 2. Chapter 3 uses the same data on the location of supermarkets to analyze the household and neighborhood characteristics that distinguish areas with low access from areas with better access. The novel contribution of these analyses is that they are national in scope and combine two databases on supermarket and grocery store location.

Supermarkets are not the only sources of healthy and affordable foods. Many smaller scale sources may be used by those who are underserved by supermarkets. However, a complete assessment of the food environment of every area in the United States is an enormous task that is beyond the scope of this study. Instead, USDA cooperated with the National Poverty Center (NPC) at the University of Michigan to commission six studies of the food environment at more localized levels. These studies provide more detail on the food environment in New York City; Indianapolis, Indiana; New Orleans, Louisiana; Salt Lake County, Utah; the Brazos Valley in rural Texas; and Portland, Oregon. Methods and findings from these studies, along with the national level analyses, are discussed in Chapters 2 and 3.¹¹

People who live in areas with limited access may be more prone to poor diets and have poor health outcomes, such as obesity or diabetes, because they lack access to healthy foods and may have too easy access to less healthy foods. Chapter 4 considers the extent of knowledge on the relationship between limited access and diet and health outcomes. This chapter draws heavily upon a workshop summary of the Institute of Medicine (IOM) and the National Academies. This workshop, sponsored by ERS, was

¹¹Drafts of these papers and an agenda for a conference that featured the papers are available on the NPC website: www.npc.umich.edu/news/events/food-access/index.php. Final versions of these papers and a summary of the papers will accompany the final version of this report.

conducted on January 26-27, 2009. It included sessions on measuring access; methodological challenges in assessing causal relationships between food access and diet and health outcomes; reviews of existing knowledge about the links between access and diet and health outcomes; and promising strategies for mitigating the impacts of food deserts that have been suggested, implemented, or are in the planning stages. A workshop summary will be published in June 2009.

Populations that live in areas with limited access to affordable and nutritious food may adjust their food shopping behaviors and diets based on the food environment in their area. These adjustments could be due to the lack of availability of some foods or to the relative prices of different foods offered from different food retailers. Chapter 5 considers how food access relates to food choice—that is, whether consumers in areas with limited access face higher prices for similar goods and whether they have different food purchasing behaviors. Comparisons of the prices that consumers paid for similar foods (milk, ready-to-eat cereal, and bread) purchased at different retail outlets (supermarkets and grocery stores vs. convenience stores) are made using hedonic price models. Differences in the prices offered at different retail outlets could lead consumers to adjust where they shop and what they purchase. The chapter also considers shopping behavior for populations with limited access, which can further the understanding of the adjustments that consumers make to different prices and retail availability. A summary of a body of work conducted by FNS on the shopping patterns of participants of the Supplemental Nutrition Assistance Program (SNAP—formerly called the Food Stamp Program) is provided in the chapter. ERS also analyzed how SNAP participants' expenditures on foods in several food groups (e.g., canned and noncanned fruits and vegetables) varied by self-reported measures of access to supermarkets. Spending on these food groups by people with relatively easy access to supermarkets is compared with spending by those with less access to supermarkets. Finally, findings from a study conducted by ERS and external researchers on whether poor people pay more for similar foods relative to higher income people are integrated.

Economic and market conditions may contribute to the existence of food deserts. The costs facing food retail businesses and the choices available to consumers could both account for differences among stores in where they choose to locate. Chapter 6 provides an economic framework for understanding supply and demand for food and factors that may account for difference in access to food retailers across different areas. USDA, through NPC, contracted with two economists, Marianne Bitler and Steven Haider, to provide an economic framework for understanding food access issues. The chapter draws heavily upon this paper (Bitler and Haider, 2009).

In addition to administering SNAP and other nutritional assistance programs, USDA administers programs to improve food security in low-income communities. States and localities have also implemented programs to increase access to affordable and nutritious food for underserved populations. Private retailers have responded to the needs of low-income and bargain food shoppers. Chapter 7 describes USDA's Community Foods Project Competitive Grants Program and lessons learned from this program. Chapter 8 highlights several programs that have been implemented by States and

localities, as well as describes several other policy options that may be considered to reduce the effects of limited access.

Not all of the questions about the extent, causes, and consequences of food deserts will be answered in this report. The final chapter, Chapter 9, outlines an agenda for further research on the causes and consequences of areas with limited access to affordable and nutritious food.

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The Extent of Limited Food Access in the United States

This chapter describes the extent of limitations in access to affordable and nutritious food in the United States in three separate sections. The first section provides estimates of individual measures of access, based on survey data on the number of U.S. households that indicate food access limitations. The second section uses a geographical, area-based approach to measure access to supermarkets. A national level directory of supermarkets is developed and geocoded. Distance-based measures of supermarket access are produced for the entire continental U.S. population and by selected economic and demographic characteristics of the population. Median distances to supermarkets are computed and a three-category distinction of low, medium, and high access is used to describe supermarket access for the entire U.S. and separately for low-income neighborhoods and for people outside of those areas. Information on vehicle ownership, which is an important individual-level characteristic related to the ease at which a variety of nutritious foods can be accessed, is also provided for those that live far from supermarkets. The third section of this chapter uses data from the American Time Use Survey (ATUS) to estimate the amount of time households spend traveling to the grocery store. The mode of transportation used is also considered.

Most of the previous studies on food access have focused on specific geographic areas such as cities or counties or even States. The analysis in this chapter is unique because it uses multiple methods to provide a broad overview of access to affordable and nutritious food on a national level.

Individual-Level Measures of Food Access From National Household Surveys

The vast majority of the literature on food deserts and much of the rest of this report focus on area-based measures of food access—that is, measures of access to stores or food outlets for a geographically designated area, often areas with high concentrations of low-income individuals. These measures inherently assume that everyone within a geographic area has the same level of access as everyone else in that area. But some people who live in areas with concentrated poverty may not be poor, may own their own vehicle, and may be able to access affordable and nutritious food. Other poor individuals may live outside of areas with concentrated poverty but may have limited access to food. An alternative measure of food access is the one presented in this section—access for individuals directly, regardless of where they live.

Since 1995, USDA has collected information annually on food spending, food access and adequacy, and sources of food and nutrition assistance for the U.S. population. The information is collected in an annual food security survey, conducted as a supplement to the nationally representative Current Population Survey (CPS). Data from the Food Security Supplement of the CPS (CPS-FSS) is used to provide estimates of the prevalence and severity of food insecurity in U.S. households (see, for example, Nord et al., 2008).

In addition to asking food security questions, the CPS-FSS, until 2001, asked a general question about whether the household had enough of the kinds of foods it wanted and needed. Those households who responded that they did not have enough of the kinds of foods they wanted were asked followup questions about why they did not have enough food. Respondents could answer by choosing from among several options, including options directly related to store access (see box, “CPS-FSS Questions on Food Access”). Table 2.1 provides the population weighted responses to these questions and provides a direct measure of the percent of households that do not always have enough of the foods they want because of access limitations. Eighty-one percent of households always had the kinds of foods they wanted to eat. Sixteen percent always had enough food to eat but did not always

Box CPS-FSS Questions on Food Access

- SS1 Which of these statements best describes the food eaten in your household-
 -enough of the kinds of food we want to eat, enough but not always the kinds
 of food we want to eat, sometimes not enough to eat, or often not enough to
 eat?
1. Enough of the kinds of food we want to eat (SKIP TO SX1CK)
 2. Enough but not always the kinds of food we want to eat (SKIP TO SS1B)
 3. Sometimes not enough to eat (SKIP TO SS1C)
 4. Often not enough to eat (SKIP TO SS1C)

Those who gave response #2, “enough but not always the kinds of foods we want to eat” were asked SS1B:

SS1B Here are some reasons why people don’t always have the kinds of food they want. For each one, please tell me if that is a reason why YOU don’t always have the kinds of food you want to eat.

READ LIST. MARK ALL THAT APPLY.

	YES	NO
Not enough money for food	<input type="checkbox"/>	<input type="checkbox"/>
Kinds of food we want not available	<input type="checkbox"/>	<input type="checkbox"/>
Not enough time for shopping or cooking	<input type="checkbox"/>	<input type="checkbox"/>
Too hard to get to the store	<input type="checkbox"/>	<input type="checkbox"/>
On a special diet	<input type="checkbox"/>	<input type="checkbox"/>

Those who responded to question SS1 with response #3 or #4, “sometimes” or “often not enough to eat” were asked SS1C:

SS1C Here are some reasons why people don’t always have enough to eat. For each one, please tell me if that is a reason why YOU might not always have enough to eat.

READ LIST. MARK ALL THAT APPLY.

	YES	NO
Not enough money for food	<input type="checkbox"/>	<input type="checkbox"/>
Not enough time for shopping or cooking	<input type="checkbox"/>	<input type="checkbox"/>
Too hard to get to the store	<input type="checkbox"/>	<input type="checkbox"/>
On a diet	<input type="checkbox"/>	<input type="checkbox"/>
No working stove available	<input type="checkbox"/>	<input type="checkbox"/>
Not able to cook or eat because of health problems	<input type="checkbox"/>	<input type="checkbox"/>

Notes: Question SS1 is still asked in the CPS-FSS. Up until 2001, questions SS1B and SS1C were also asked as follow up questions. For questions SS1B and SS1C, multiple responses were accepted.

Table 2.1

National estimates of the percent of households who do not have enough of the kinds of foods they want because of food access limitations

	<i>Percent of all households</i>
Households that always had the kinds of foods they wanted to eat	81.0
Households that had enough to eat but did not always have the kinds of foods they wanted to eat	16.0
Households that sometimes or often did not have enough to eat	3.1
<hr/>	
Reported reasons for not always having the kinds of foods or enough food:	
Households that always had enough to eat, but did not always have the kinds of foods they wanted to eat because it was too hard to get to the store or the kinds of foods they wanted were not available	5.1
Households that sometimes or often did not have enough to eat because it was too hard to get to the store	0.6
Total with food access limitations	5.7

Notes: Some of those who reported it was “too hard to get to the store” may be elderly or disabled. Of the 5.7 percent who reported access limitations, more than half (3.0 percent of all households) also cited that they did not have enough money for food.

Source: USDA, ERS calculations based on 2001 CPS-FSS survey data.

have the kinds of foods they wanted to eat. Another 3 percent sometimes or often did not have enough food to eat.

Respondents who reported they had enough to eat but did not always have the kinds of foods they wanted were asked why they did not have the kinds of foods they wanted. Among all households, 5.1 percent reported that they did not have the kinds of foods they wanted because it was either too hard to get to the store or the foods they wanted were not available. Respondents who reported that they sometimes or often did not have enough food to eat were also asked why. A total of 0.6 percent of all households said they did not always have enough to eat and that it was because it was too hard to get to the store. Thus, based on these questions, 5.7 percent of all households reported they did not always have the food they want or need because of access limitations.

Not all of these access limitations reflect a lack of a nearby store with adequate food. Some who report that it is too hard to get to the store may be disabled or elderly and frail. This group may very well have food access problems, but it is not necessarily because they do not have nutritious food options nearby. Further, of the 5.7 percent who cited access problems, more than half, or 3.0 percent, also cited that they did not have enough money for food. Another reason these responses may not indicate access problems related to nearby availability of food is that the condition “enough but not always the kinds of foods we want to eat” does not necessarily indicate whether the food available was nutritionally adequate or not. Despite these caveats, these estimates from the CPS-FSS could be considered an estimate of the number of households that face food access limitations.

Area-Based Measures of Access to Affordable and Nutritious Food

Individual measures of access provide one estimate of the number of people affected by limited access. The primary intent of the congressional mandate was to focus on area-based measures of access. Area-based measures are important because characteristics of the areas where people live, work, or travel may affect access to healthy and affordable food, which may affect diet and health.

This section examines the extent of areas in the U.S. that have low access to supermarkets, a reliable source of nutritious and affordable foods. A national supermarket directory is first developed and geocoded. Data on population, income, and other household characteristics from the 2000 Census are aggregated to square kilometer grids that cover the continental United States. The distances are measured from the center of these 1-kilometer grids to the nearest supermarket for the entire U.S. population, for low-income areas and higher income areas, and by characteristics of individuals or households. Access to supermarkets is described using these distance measures first for the entire U.S. population, then separately for Census Urbanized Area designations. The descriptions use simple population-weighted median distance to stores overall and across Urbanized Area and population characteristics. Each area is assigned to one of three categories of access based on whether the distance to the nearest supermarket is within a range of “walkable” distances. For rural areas, a “drivable” distance measure is considered.

Data and Methods

Definition of food retail outlets that offer affordable and nutritious food

Food is sold in a wide range of retail outlets, including traditional foodstores (e.g., supermarkets, grocery stores and convenience stores), and nontraditional retail stores that carry food products with other merchandise. Among the various forms of food retailers, supermarkets, supercenters, and warehouse club stores combined account for the largest share of food sales, 75.2 percent of the total in 2008 (Economic Research Service, 2009). These larger retail outlets typically offer all major food departments, including fresh produce, meat, poultry and seafood, as well as more economical package sizes and lower cost store brands and generic brands of packaged foods. Many studies have shown large retail outlets are more affordable relative to other retail food outlets (Andrews et al., 2001; Chung and Myers, 1999; Nayga and Weinberg, 1999; Kaufman et al., 1997).

An ERS review of studies of food prices found that supermarket prices are 10 percent lower, on average, than those of smaller foodstores, in part, due to lower per unit costs resulting in lower margins over cost of goods sold (Kaufman et al., 1997). Neckerman, et al. (2009) cite a number of audit surveys of food prices, finding that store type is highly associated with price and that supermarkets, larger chain stores, or discount stores such as supercenters, tend to offer lower prices.

Montovani et al. (1997) examined characteristics and services of a nationally representative sample of 2,400 stores authorized to receive benefits from the Supplemental Nutrition Assistance Program (SNAP). Price, quality, and variety of store foods were assessed in terms of the market basket of goods that reflect the Thrifty and Low Cost Food Plans.¹³ This analysis focused on product availability and cost in areas with different concentrations of poverty. In urban areas, market basket costs in supermarkets and large grocers were nearly equivalent across levels of poverty. Prices were less at “other” stores located in high-poverty areas versus those in lower poverty areas. Availability of market basket items did not vary by poverty level among supermarkets in urban areas. Variety did vary by poverty level for large grocers. Fresh produce and fresh seafood were less available in large grocers located in high-poverty areas. Fresh meat was more available, however, at large grocers in these locations. In rural areas, market basket costs were consistently similar in higher and lower poverty areas. With the exception of fresh seafood, a similar proportion of market basket items was available in supermarkets and large grocery stores, regardless of the area’s poverty level. Food quality was similar across different store types and poverty levels in rural areas. Results from this analysis confirm that, on average, supermarkets and large grocery stores offer lower prices and more variety than other store types. Large grocers were more similar to supermarkets than other store types, especially in rural zip codes.

The analysis uses supermarkets and large grocery stores (hereafter defined simply as “supermarkets”) as proxies for food retailers that offer a variety of nutritious, affordable retail foods. The industry-standardized definition requires that to be considered a supermarket, a retailer must have annual sales of at least \$2 million and contain all the major food departments found in a traditional supermarket, including fresh meat and poultry, produce, dairy, dry and packaged foods, and frozen foods.^{14, 15}

Two separate national-level directories of foodstores from the year 2006 were used to develop a comprehensive list of supermarkets in the U.S. The first directory is a list of authorized stores that accept SNAP benefits. More than 166,000 outlets were authorized in 2006, but only approximately 34,000 met the supermarket definition criteria. In addition to the store name and address, SNAP data include a store type classification, the most recent authorization year’s total sales and total food sales, and total SNAP redemptions. The SNAP data were augmented with additional supermarket data from Trade Dimensions TDLinx (a Nielsen company), a proprietary source of individual supermarket store listings also for the year 2006.¹⁶ This data set includes the name and address of supermarkets, the type of supermarket, annual sales volume range, and other supermarket characteristics. Details on how these data were merged and cleaned can be found in Appendix C. The combined list of supermarkets was converted into a GIS-useable format by geocoding the street addresses into store point locations. The final combined data set included locations for 40,108 supermarkets and supercenters nationwide.

By combining the two store listings and using outside sources for verification, a more comprehensive national list of supermarkets and supercenters was obtained. By comparison, a study of Salt Lake County, Utah, revealed that there can be considerable disagreement across sources of data on the presence of foodstores when conducting access studies (Fan

¹³Market basket quality was measured in terms of availability of acceptable items as guided by a USDA publication on buying quality food (1975).

¹⁴The \$2 million annual sales requirement has been used by the retail food industry since at least 1980. If adjusted for annual inflation, the equivalent in 2008 dollars is approximately \$4.5 million. By using the unadjusted annual sales, we potentially include medium-sized grocery stores in both the industry and SNAP store directories.

¹⁵Supercenters are included in our definition of supermarkets. However, warehouse club stores, also known as wholesale club stores, were not included in this study for two reasons. First, warehouse/wholesale club stores are not considered to be supermarkets by the industry, and second, few of these stores have applied to accept SNAP benefits.

¹⁶TDLinx data only include information on stores that meet the industry standard definition of a supermarket.

et al., 2009). In a study of access to foodstores in Detroit, Gallagher (2007) also describes discrepancies in supermarket classification when using SNAP-authorized store data.

Using supermarkets and supercenters may underestimate the availability of affordable and nutritious food. Smaller grocery stores, neighborhood markets, or “dollar stores,” for example, sometimes include a range of healthful, affordable foods.¹⁷ Rose et al. (2009) and Sharkey and Horel (2009) both conducted in-store audits of food availability in these store types in New Orleans and in the Brazos Valley, Texas. The problem with including these stores in the analysis is that the range of foods sold in these stores was highly varied (Franco et al., forthcoming; Neckerman et al., 2009; Rose et al. 2009; and Sharkey and Horel, 2009). It would be impossible to do a complete national level audit of the contents of these stores. Reliable data on the relative pricing of foods sold in these stores is not available either, which means it cannot be asserted with confidence that these stores are a source for a wide range of affordable and nutritious food.

Food is also sold in restaurants, fast food outlets, and related foodservice establishments. In fact, nearly half of all food spending is on food away from home (Martinez and Kaufman, 2008). In considering the effect of food access on diet and health, access to restaurants and other foodservice establishments is important because food from these sources accounts for a significant part of the total diet. However, this national-level analysis does not consider access to restaurants and other food service outlets. Compared with foodstores and other retail food outlets, the monetary costs of an equal quantity of food purchased in a restaurant are higher than the costs at supermarkets or grocery stores. The cost of food sold in restaurants represents about one-third of the price at which it is sold, so that two-thirds of the cost of restaurant food is the premium of having someone prepare and serve it to the customer. In a grocery store, the cost of food accounts for about three-fourths of the retail price, on average. Thus, while eating at a restaurant may diminish the time costs of buying and preparing food for a consumer, those costs are eventually paid for by the consumer. For these reasons, food eaten at restaurants is less affordable due to its higher per unit cost relative to foodstores and other retail food outlets.

Defining and measuring the geographical unit of interest

This study uses the Socioeconomic Data and Applications Center (SEDAC) grids data, which is based on information from the 2000 Census of Population (SEDAC, 2006). These population data (including some socioeconomic and demographic data), which are released at the block group level, are first allocated to blocks and then allocated aurally down to roughly 1-square-kilometer grids across the continental United States. These data provide two important benefits for the analysis. First, they give better estimates of where people and households are located than data on larger geographic areas, such as census tracts. Second, the process of allocating census data to 1-square-kilometer grid cells transforms the irregular shapes and sizes of census geographies into regularized grid cells, providing for faster spatial computation needed for national-level analysis.

¹⁷Specialized foodstores, such as produce markets, meat and seafood markets, and retail bakeries, can serve as a source for affordable and nutritious food; however, they typically do not provide the full range of foods that supermarkets and supercenters do.

Measuring access from the geographical unit to the foodstore

This study uses distance to the nearest supermarket as a measure of access.¹⁸ For each grid cell, the distance is calculated from its geographic center to the nearest supermarket. Median distances to the nearest supermarket are calculated for the Nation as a whole and across different subpopulations. Based on the grid measure of distance to the nearest supermarket, three categories of access (high, medium, and low) are created for two types of access—walking access and driving access. Walking access measures a range of distances for which it is feasible to walk to a supermarket, while drivable access measures a range of distances for which it is feasible to drive to a supermarket. A time-based distance measure equivalent for both walking and driving is developed. The walkability range is categorized as either 1) high, if a supermarket is within a half mile; 2) medium, if a supermarket is between ½ and 1 mile; and 3) low, if the nearest supermarket is more than a mile away. For rural areas, a drivability range is also measured. Drivability is categorized as either 1) high, if a supermarket is within 10 miles; 2) medium, if a supermarket is between 10 and 20 miles; and 3) low, if a supermarket is greater than 20 miles away.

Defining vulnerable subpopulations of interest

This national-level assessment of access to affordable and nutritious food first characterizes access for the entire U.S. population. But the interest here is in subpopulations that may be particularly vulnerable to access barriers. The study considers supermarket access across the following four subpopulations:

- Low-income individuals, where anyone living in a household with income less than or equal to 200 percent of the Federal poverty thresholds for family size is considered low-income.¹⁹
- Household vehicle access, where households that do not have access to an automobile, van, or truck of 1-ton-load capacity or less are considered separately from those households who do have access.
- Race and ethnicity, where non-Whites include those individuals who identified their race as something other than “White” or their ethnicity as Hispanic (regardless of race).
- Elderly or nonelderly status, where individuals over age 65 are considered elderly.

Specifying areas with high concentrations of low-income people

This study is interested not only in vulnerable individuals and households but also in vulnerable areas—neighborhoods that are highly deprived and for which, food access could be limited. Areas (the 1-kilometer-square grids) are identified as low-income areas if more than 40 percent of the people in the grid had income at or below 200 percent of the Federal poverty thresholds using kernel-density smoothing. Comparisons of distances to supermarkets across these low-income and higher income areas are made.

¹⁸Chapter 4 also uses a variety measure of distance, which is the distance to three different supermarkets.

¹⁹In 2008, the poverty threshold for a family of two adults and two children was \$21,835, so 200 percent of this threshold would double the threshold to \$43,670.

Finally, because it is difficult to use the same measures to characterize access in densely populated urban areas compared with less populated suburban and rural areas, a separate analysis is conducted using Census Urbanized Area definitions. The three definitions are as follows: Urban Areas, densely settled that contain 50,000 or more people, such as a core city and surrounding suburbs; Urban Clusters, densely settled local areas that have at least 2,500 people but fewer than 50,000 people, such as smaller cities and towns; and Rural Areas, low-density areas with populations of less than 2,500, including all areas not classified as either Urban Areas or Urban Clusters.

Results and Findings

This section presents a national overview of access to supermarkets. Separate analyses of access are also conducted for each of three Census-designated urbanicity types. Measures of access are presented for the overall population and then by each of the four vulnerable subpopulations. Differences in supermarket access are compared between low-income and higher income areas within each urbanicity type.

National access overview

Table 2.2 shows supermarket access for selected individual characteristics of vulnerable populations. Median distance to the nearest supermarket is given.²⁰ The number and percentage of individuals or households that have high, medium, and low access are also presented. The data in this table are for the Nation as a whole, not separately by areas or by urbanicity.

Overall, median distance to the nearest supermarket is 0.85 miles. Median distance for low-income individuals is about 0.1 of a mile less than for those with higher income, and a greater share of low-income individuals (61.8 percent) have high or medium access to supermarkets than those with higher income (56.1 percent).

Overall, ethnic and racial minorities have better access to supermarkets than Whites. Median distance to the nearest supermarket for non-White individuals is 0.63 miles, compared with 0.96 miles on average for Whites. Similarly, a smaller percentage of non-Whites (26.6 percent) have low access to supermarkets than do Whites (48.2 percent). These differences do not consider income, only race/ethnicity.

There are not great differences in access to supermarkets by elderly status. In terms of distance to the supermarket, the elderly compare very much with the nonelderly, overall. Despite their similar distances to supermarkets, the elderly could face additional barriers to access due to disability or inability to drive to the supermarket.

Vehicle access is perhaps the most important determinant of whether or not a family can access affordable and nutritious food. Table 2.3 focuses specifically on vehicle ownership for the entire Nation. It shows the total number of households in the U.S., the number without access to a vehicle and their distance to the nearest supermarket. The table reports these statistics for all households in the U.S. and for all households in low-income areas and then separately by the three urbanicity categories. The study focuses only on

²⁰The median distance is the point at which over the range of distances, half of the population is closer to that point, while half is farther away.

Table 2.2

Supermarket access by household income, race/ethnicity, age, and vehicle access (walking distance)

	Number (millions)	Percent	Median ¹ (miles)	Distance to nearest supermarket miles					
				High access (0.5 miles or less)		Medium access (Between 0.5-1 mile)		Low access (More than 1 mile)	
				Number (millions)	Percent	Number (millions)	Percent	Number (millions)	Percent
Income: ²									
Low-income	79.3	28.8	0.76	22.6	28.5	26.4	33.3	30.2	38.1
Higher-income	196.1	71.2	0.87	43.8	22.3	66.3	33.8	86.1	43.9
All income levels	275.5	100.0	0.84	66.5	24.1	92.7	33.7	116.3	42.2
Race/ethnicity:									
Non-White	85.7	30.7	0.63	31.4	36.6	31.5	36.8	22.8	26.6
White	193.9	69.3	0.96	39.1	20.2	61.3	31.6	93.4	48.2
All races/ethnicities	279.6	100.0	0.86	70.5	25.2	92.8	33.2	116.3	41.6
Age:									
Age 65 or more	34.8	12.4	0.81	8.9	25.7	11.8	33.9	14.1	40.4
Less than age 65	244.8	87.6	0.82	61.6	25.2	81.0	33.1	102.2	41.8
All ages	279.6	100.0	0.82	70.6	25.2	92.7	33.2	116.3	41.6
Vehicle access:									
Households without vehicle	10.8	10.3	0.55	5.0	46.2	3.4	31.7	2.4	22.1
Households with vehicle	94.1	89.7	0.84	22.2	23.6	31.7	33.7	40.2	42.7
All households	104.9	100.0	0.81	27.2	25.9	35.1	33.5	42.5	40.6

¹Medians are weighted by population of each square kilometer grid area.

²Low-income households are those with income less than or equal to 200 percent of the Federal poverty threshold for family size.

Sources: USDA, ERS analysis based on data from Census of Population, 2000 and the ERS-compiled supermarket directory for the contiguous U.S. in 2006.

Table 2-3

Household vehicle access and supermarket access

Geographic area	Total households ¹	Households without access to a vehicle			
		Between 1/2 to 1 mile from a supermarket		More than 1 mile from a supermarket	
		Number	Percent	Number	Percent
	<i>Millions</i>	<i>Millions</i>		<i>Millions</i>	
Total U.S.	104.9	3.4	3.2	2.4	2.3
Low-income areas	25.1	1.6	6.4	0.9	3.8
Urban areas	69.9	2.9	4.1	1.1	1.5
Low-income areas	15.6	1.3	8.3	0.4	2.5
Urban clusters	9.7	0.4	4.1	0.2	2.5
Low-income areas	3.6	0.2	5.6	0.1	3.3
Rural areas	25.3	0.2	0.8	1.1	4.4
Low-income areas	5.9	0.1	1.7	0.4	7.4

¹ This column shows the total number of households regardless of vehicle access.

Source: USDA, ERS analysis based on data from Census of Population, 2000 and the ERS-compiled supermarket directory for the contiguous U.S. in 2006.

households with medium or low access (those more than one-half mile from a supermarket) since those who have high access can walk to a supermarket that, at most, is one-half mile away.

Only 2.4 million households, or 2.3 percent of all 104.9 million households in the U.S., live more than a mile from a supermarket and do not have access to a vehicle. An additional 3.4 million households, or 3.2 percent of all households, do not have access to a vehicle and are between one-half to 1 mile from a supermarket. Thus, for the total U.S. population, between 2.3 and 5.5 percent of all households may be outside of a walking distance to a supermarket and lack access to a vehicle.

Not surprisingly, the percentage of households without access to vehicles is higher in low-income areas. Overall, 0.9 million households do not have access to a vehicle and live in low-income areas more than a mile from a supermarket. This represents 3.6 percent of all households in low-income areas. A much greater percentage of households without vehicles in low-income areas is between one-half to 1 mile from the nearest supermarket—1.6 million households, or 6.4 percent of all low-income households.

Table 2.3 also presents the number of households without access to vehicles and distance to supermarkets by urbanicity. These estimates show that 1.1 million households, or 4.3 percent of all rural households, lacks access to a vehicle and lives more than 1 mile from a supermarket. It is not surprising that people in rural areas live farther from the nearest supermarkets. But it is perhaps unexpected that a greater percentage lack access to a vehicle. Urban areas have the smallest percentages of households without access to a vehicle that are more than a mile from a supermarket. For urban areas, 4.1 percent of households are between one-half to 1 mile from the nearest supermarket and do not have access to a vehicle.

The analysis now turns specifically to supermarket access for areas with high concentrations of low-income people. Map 2.1 shows low-income areas in the U.S., which are 1-kilometer grid cells where more than 40 percent of the total population has income less than or equal to 200 percent of the Federal poverty level. The map shows the dispersion of low-income areas across the country, but the map also shows greater concentration of low-income areas in the South, Southwest, and Upper Plains States. Rural low-income areas are better reflected on the map than urban low-income areas, which are difficult to see on the national level view the map provides.

Table 2.4 focuses on these low-income areas. The right half of the table shows the number (and percent) of people in low-income areas by access level. It also shows the percent of the total U.S. population represented in these low-income areas. The left half of the table focuses only on those people with incomes below 200 percent of Federal poverty guidelines. It is worth noting here, and will be supported later in the chapter, that low-income people who live outside of low-income areas are, in general, farther from supermarkets than low-income people who live in low-income areas.

Table 2-4

Supermarket access for people in low-income and higher-income areas (walking distances)

Access level ² (walking)	Low-income areas ¹					
	All people in low-income areas			All low-income people in low-income areas		
	Total number (millions)	Percent of people in low-income areas	Percent of total U.S. population (millions)	Total number	Percent of low- income people	Percent of total U.S. population
High	22.9	32.1	8.2	12.1	33.5	4.3
Medium	24.9	34.9	8.9	12.5	34.7	4.5
Low	23.5	33.0	8.4	11.5	31.8	4.1
Subtotal in low- income areas	71.3	100.0	25.5	36.0	100.0	12.9
Total U.S. population	279.6			79.3		

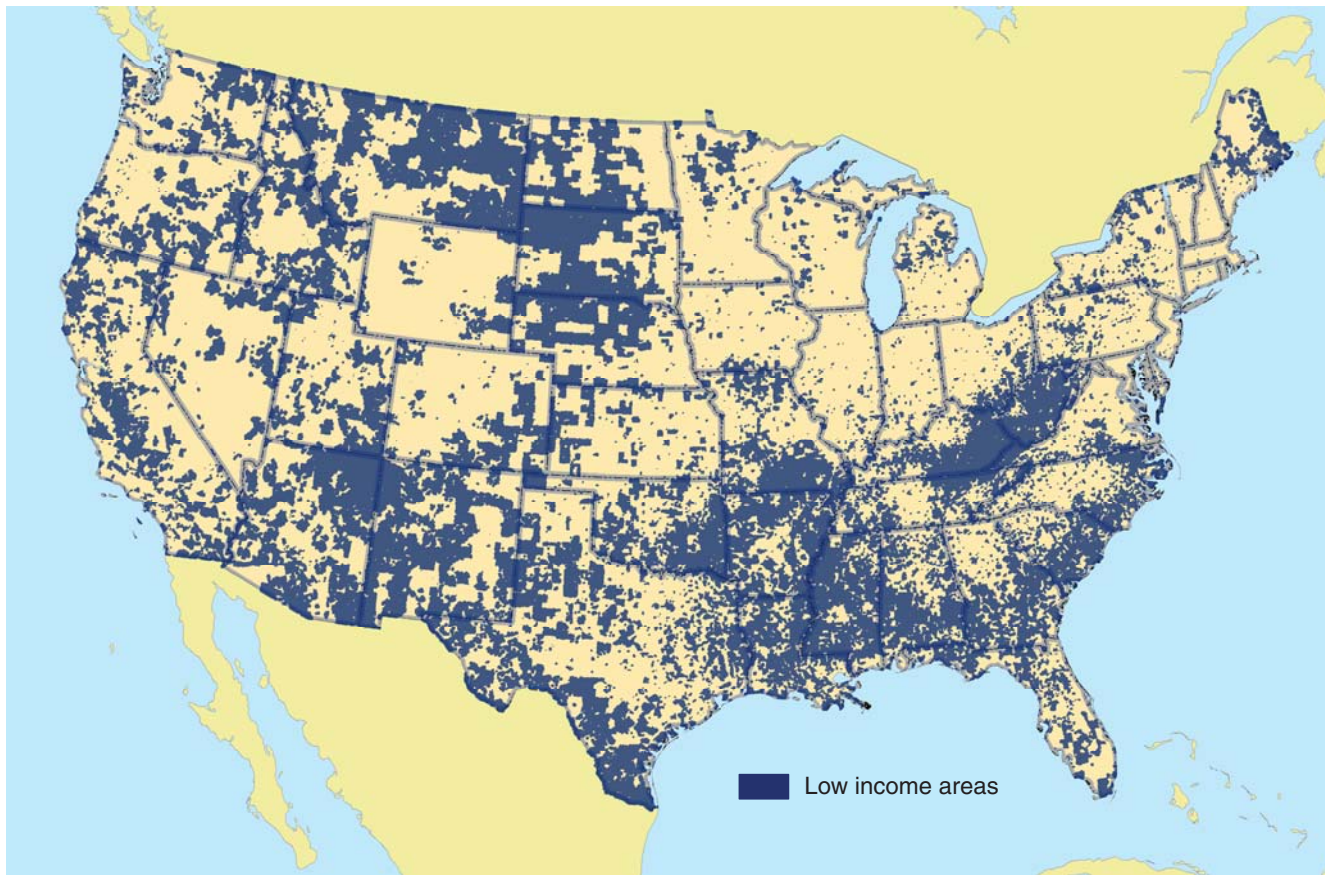
¹Low-income and non-low-income areas defined according to ERS criteria. See text for details.

²High access defined as less than or equal to 1/2 mile of a supermarket. Medium access defined as more than 1/2 mile but less than or equal to one mile from a supermarket. Low access defined as more than one mile from a supermarket.

Source: USDA, ERS analysis based on data from Census of Population, 2000 and the ERS-compiled supermarket directory for the contiguous U.S. in 2006.

Map 2.1

Low income areas of the contiguous 48 United States (1 km grids in which 40 percent of population have incomes below 200 percent of the Federal poverty level)



The first point to note in table 2.4 is that only 33 percent of people in low-income areas live in areas with low access. In contrast, 32 percent of people in low-income areas live in high-access areas and 35 percent live in medium-access areas. Thus, one estimate of the number of people who live in low-income areas with low access to supermarkets is 23.5 million, which is 8.4 percent of the total U.S. population (out of a total of 279.6 million people in 2000). If those with medium-access levels who live in low-income areas are included, then 48.4 million, or 17 percent of the total U.S. population, is more than half a mile from a supermarket.

Not all people in low-income areas, however, have low income. In fact, only about half have income less than 200 percent of the Federal poverty thresholds (36 million out of a total of 71 million). It is likely that those who are not low income but live in low-income areas have adequate resources to access supermarkets even if they are more than a mile away. If the analysis excludes those who live in low-income areas, but who are not themselves, low income, then only 11.5 million, or 4.1 percent of the total U.S. population, has low access to supermarkets. Including those low-income people in low-income areas with medium access yields a total of 24 million people, or 8.6 percent of the total population.

Supermarket access in urban areas

Thus far, the study has considered urban, rural, and all areas in between similarly. But distance does not mean the same thing in rural areas as in urban areas. The focus next turns to analysis of access by urbanicity. Each grid area is assigned to one of three Census Urbanized Areas: Urban Areas, Urban Clusters, and Rural Areas. Together, these three urban types characterize the range of urbanicity found in the U.S. population. A separate analysis of access is conducted for each urban type at the national level. Populations within an urban type are assumed to have similar levels of density, measured as population per unit of area, such as per square mile or square kilometer. Areas having similar population densities are more likely to have similar levels of the built environment—the infrastructure (e.g., networks of roads, transportation services, utilities, communication networks, and government services) and businesses, manufacturing plants, and retail stores. Analysis by urban type results in measurement of access within similar built environments, resulting in greater comparability across similar populations regardless of location.

Table 2.5 shows measures of access to supermarkets in urban areas only. Median distances to supermarkets are calculated for each of the four vulnerable populations as are the percentage of the populations with high, medium and low access to supermarkets. To better understand how access to supermarkets differs for vulnerable and disadvantaged groups, the study compares access measures by each of the four economic and demographic characteristics: income, race/ethnicity, vehicle access, and elderly status. For each of the vulnerable populations, access for those who live in areas with high concentrations of low-income individuals is compared with that of those who live outside of areas with high concentrations of low-income individuals.

Table 2.5

Urban area access to supermarkets--overall and for income and demographic subpopulations (walking distance)

Population	Income level of area	Number (millions)	Total percent	Sub-population percent	Median (miles)	Distance to nearest supermarket					
						High access (0.5 miles or less)		Medium access (Between 0.5-1 mile)		Low access (More than 1 mile)	
						Number (millions)	Percent	Number (millions)	Percent	Number (millions)	Percent
Total population of urban areas	Low income	45.3	100.0	24.4	0.57	19.2	42.5	19.0	42.1	7.0	15.4
	Higher income	140.6	100.0	75.6	0.71	42.1	30.0	57.9	41.2	40.6	28.9
	Total	185.9	100.0	100.0		61.4	33.0	76.9	41.4	47.6	25.6
Subpopulations											
Population with low income	Low income	23.5	51.9	46.4	0.56	10.2	43.3	9.8	41.5	3.6	15.1
	Higher income	27.1	19.3	53.6	0.65	9.0	33.1	11.5	42.3	6.7	24.6
	Total	50.6	27.2	100.0		19.1	37.8	21.2	41.9	10.2	20.2
Households without access to a vehicle	Low income	3.4	22.0	40.5	0.50	1.7	50.2	1.3	38.4	0.4	11.3
	Higher income	5.1	9.3	59.5	0.42	2.8	56.1	1.6	30.8	0.7	13.1
	Total	8.5	12.2	100.0		4.6	53.7	2.9	33.9	1.1	12.4
Non-White population	Low income	30.8	68.1	44.2	0.55	13.7	44.5	12.6	41.0	4.5	14.5
	Higher income	38.9	27.7	55.8	0.60	15.3	39.4	15.6	40.1	8.0	20.5
	Total	69.8	37.5	100.0		29.1	41.6	28.2	40.5	12.5	17.9
Elderly population	Low income	4.5	10.0	20.3	0.58	1.8	40.8	2.0	43.7	0.7	15.6
	Higher income	17.7	12.6	79.7	0.69	5.4	30.5	7.5	42.5	4.8	27.0
	Total	22.2	11.9	100.0		7.2	32.6	9.5	42.7	5.5	24.6

Source: Source: USDA, ERS analysis based on data from Census of Population, 2000 and the ERS-compiled supermarket directory for the contiguous U.S. in 2006.

Table 2.5 first presents data on supermarket access for urban areas. A greater share of low-income individuals lives outside of low-income areas (53.6 percent) than in low-income areas (46.4 percent). Further, low-income individuals who live in higher income areas live farther from supermarkets than those who live in low-income urban areas. About 15 percent of those in low-income urban areas are more than a mile from a supermarket, compared with 29 percent for those in higher income areas. Median distances to supermarkets reflect this as well.

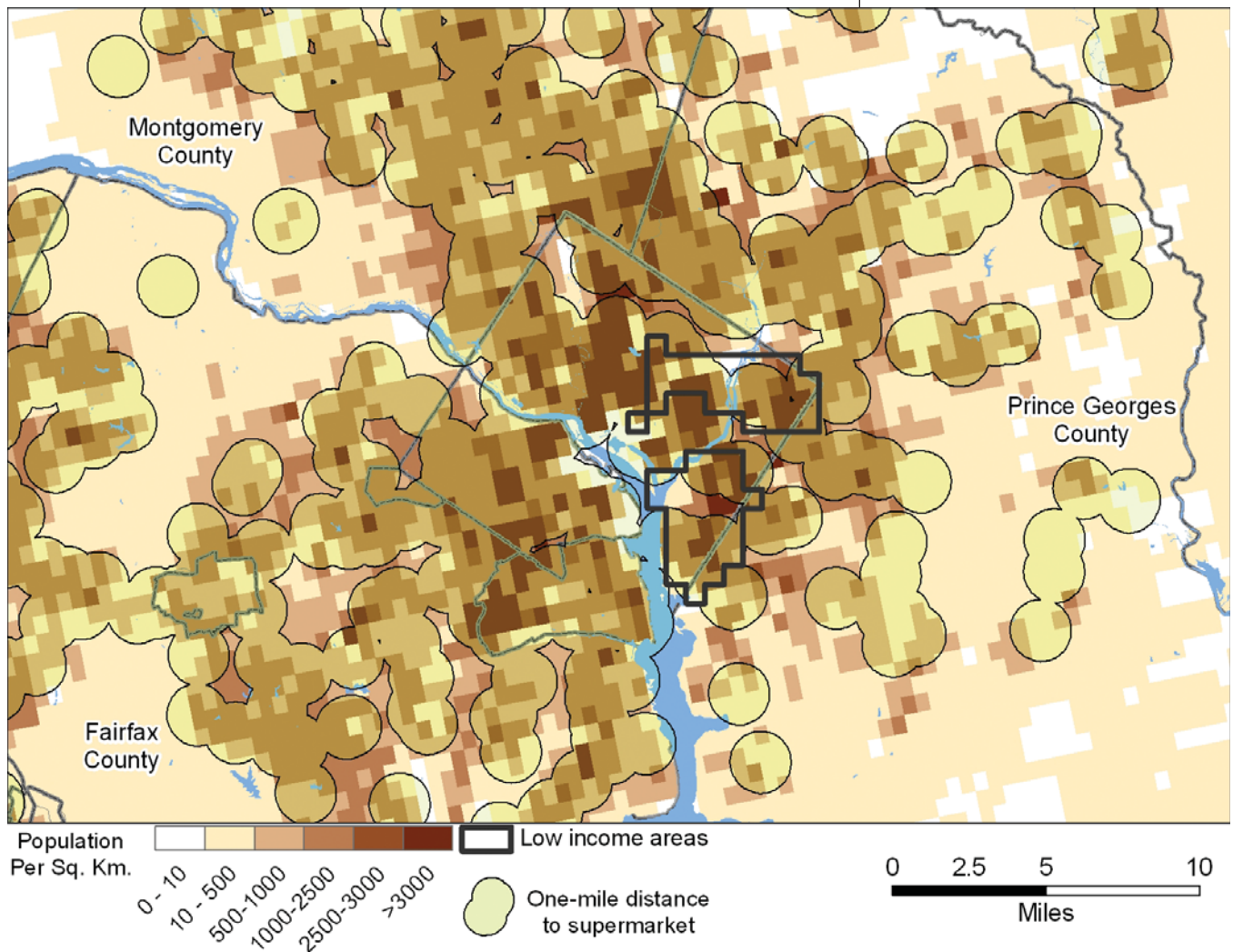
The next rows focus specifically on access for low-income individuals, which make up 27.2 percent of all urban dwellers. Results show that 43.3 percent of low-income individuals who live in low-income areas are within one-half mile of a supermarket and another 41.5 percent of are between half a mile to one mile from the nearest supermarket. The remaining 15.1 percent of the

low-income individuals who live in low-income areas resided more than a mile from the nearest supermarket.

Similar statistics were calculated for low-income urban individuals who live outside of low-income areas. Applying the access categories, 33.1 percent had high levels of access, 42.3 percent had medium access, and 24.6 percent had low access. This is greater than the 15.1 percent of low-income individuals living in low-income areas that had low access.

Maps 2.2 and 2.3 illustrate these measures of access for two urban areas, the Washington, DC, and St. Louis, Missouri, metro areas. For Washington, DC, there were two low-income areas, outlined in black, that are largely contained within the city's boundaries. The St. Louis area has a large low-income area that spans a good portion of the City of St. Louis in Missouri and across the Mississippi River into Illinois. In both maps, circles shaded light green indicate areas that are within a 1-mile radius of a supermarket. The color shadings of the areas indicate population density where the darker shading indicates grids with more people and the lighter shading indicates grids with fewer people. This study focuses particular attention on areas that are

Map 2.2
Washington, DC Urban Area

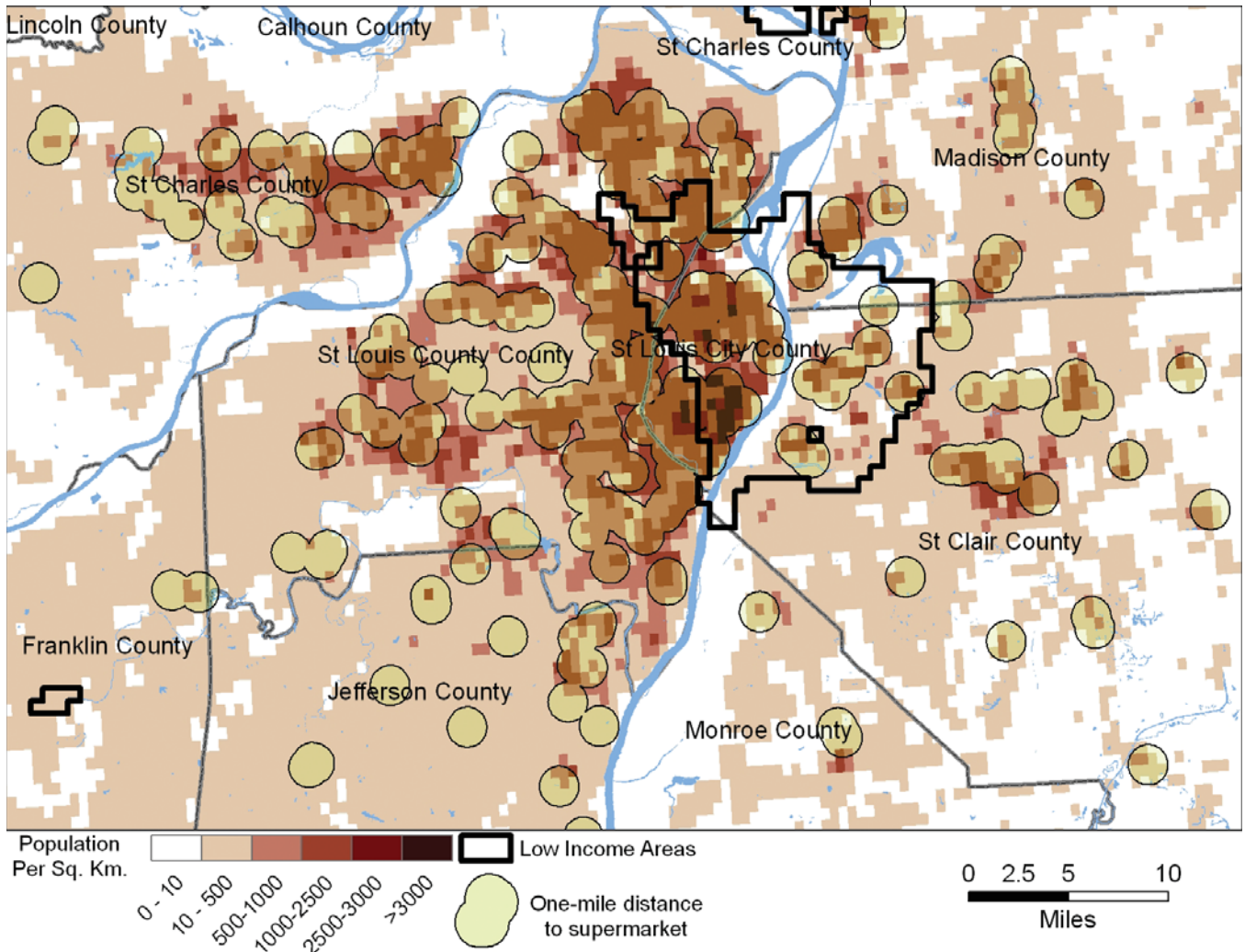


outside of the one-mile radius of a supermarket and in the neighborhoods with low income.

Map 2.2 shows that there are some low-income areas within DC and on the border with Prince Georges County, Maryland, which are outside of 1 mile from a supermarket. But for most of these areas, the population density is low to moderate. The situation looks more severe in the St. Louis area. While the most densely populated grids are within one mile of a supermarket, there are several low-income grids with moderate to high densities that are more than a mile from a supermarket, especially in the central and northern part of St. Louis, Missouri. The low-income area just east of the Mississippi River in Illinois has few supermarkets, but there are few grids outside of one mile that have moderate to high population densities. The Illinois side of the river has many grids with low population densities that are more than a mile from a supermarket.

Table 2.5 also shows supermarket access for households without access to vehicles, overall, and then separately by whether or not the households live in low-income or higher income areas. About 12.2 percent of urban households

Map 2.3
St. Louis, Missouri Urban Area



do not have access to a vehicle; however, this number is almost twice as large—22 percent—for households in low-income areas. Those who live in higher income areas are much more likely to have access to a vehicle—only 9.3 percent do not have access to a vehicle. Just over 50 percent of low-income-area households without access to a vehicle had a high level of access. Another 38.4 percent of this population had medium access. The remaining 11.3 percent of households living in low-income areas without access to vehicles were more than 1 mile from the nearest supermarket and had low access to supermarkets. Among households that lived outside of low-income areas and did not have access to a vehicle, a greater percentage had high access than similar households that lived in low-income areas, but fewer had medium access and more had low access.

About 15 percent of non-White individuals living in low-income areas have low access to supermarkets. An additional 41 percent have medium access. This compares with 21 percent of non-White individuals living outside of low-income areas with low access and 40 percent with medium access.

A greater share of the elderly population in low-income areas had high access (40.8 percent) than those living outside low-income areas (30.5 percent). While both groups have about the same percentage of the population of elderly with medium access, the greatest difference occurred among the low-access group. Almost 16 percent of the elderly who lived in low-income areas were outside of 1 mile from the nearest supermarket, but 27 percent of those living outside low-income areas were more than a mile from a supermarket.

Supermarket access in urban clusters

The population in urban clusters (areas with at least 2,500 people but fewer than 50,000 people) makes up 9.1 percent of the total U.S. population. Table 2.6 presents accessibility measures for vulnerable populations in low-income and higher income areas within urban clusters.

Individuals with income below 200 percent of Federal poverty thresholds represent 34.6 percent of the total urban cluster population. Of these individuals, 54.4 percent lived in low-income areas while 45.6 percent lived outside of low-income areas. Almost 29 percent of low-income individuals who live in low-income areas are within half a mile of a supermarket. Another 42.0 percent were between half a mile and 1 mile. The remaining 29.3 percent of low-income individuals in low-income areas were outside of a mile from the nearest supermarket. Thus, about 30 percent of low-income individuals in low-income urban clusters have low access to supermarkets.

The percentage of low-income individuals with low access to supermarkets is greater for those who live outside of low-income areas within urban clusters. Thirty-five percent lived more than a mile from a supermarket and an additional 39.5 percent were between a half mile and a mile. Only 26 percent were within a half mile of a supermarket.

Less than 10 percent of households in urban clusters lacked access to a vehicle. Among households without access to vehicles, those who lived in

Table 2.6

Urban cluster access to supermarkets--overall and for income and demographic subpopulations (walking distance)

Population	Income level of area	Number (millions)	Total percent	Sub-population percent	Median (miles)	Distance to nearest supermarket					
						High access (0.5 miles or less)		Medium access (Between 0.5-1 mile)		Low access (More than 1 mile)	
						Number (millions)	Percent	Number (millions)	Percent	Number (millions)	Percent
Total population of urban clusters	Low income	9.9	100.0	38.8	0.72	2.8	28.7	4.1	41.8	2.9	29.6
	Higher income	15.6	100.0	61.2	0.82	3.6	23.4	5.9	38.0	6.0	38.6
	Total	25.5	100.0	100.0		6.5	25.4	10.1	39.5	8.9	35.1
Subpopulations											
Population with low income	Low income	4.8	48.6	54.4	0.71	1.4	28.7	2.0	42.0	1.4	29.3
	Higher income	4.0	25.8	45.6	0.77	1.0	25.5	1.6	39.5	1.4	35.0
	Total	8.8	34.6	100.0		2.4	27.3	3.6	40.9	2.8	31.9
Households without access to a vehicle	Low income	0.5	13.5	52.3	0.66	0.2	32.4	0.2	43.1	0.1	24.5
	Higher income	0.4	7.3	47.6	0.69	0.1	30.5	0.2	41.5	0.1	28.0
	Total	0.9	9.6	99.9		0.3	31.5	0.4	42.3	0.2	26.1
Non-White population	Low income	4.0	40.8	66.7	0.75	1.1	26.4	1.7	41.5	1.3	32.1
	Higher income	2.0	12.9	33.3	0.85	0.4	22.3	0.7	36.3	0.8	41.5
	Total	6.0	23.7	100.0		1.5	25.0	2.4	39.7	2.1	35.3
Elderly population	Low income	1.4	13.8	35.2	0.68	1.5	30.7	0.6	42.9	0.4	26.4
	Higher income	2.5	16.1	64.8	0.78	1.5	25.0	1.0	39.5	0.9	35.6
	Total	3.9	15.2	100.0		3.0	27.0	1.6	40.7	1.3	32.3

Source: USDA, ERS analysis based on data from Census of Population, 2000 and the ERS-compiled supermarket directory for the contiguous U.S. in 2006.

low-income areas had slightly better access to supermarkets than those who lived outside of low-income areas, but the distributions are very similar.

Supermarket access in rural areas

Because the population in rural areas is dispersed, this analysis measures access to the nearest supermarket according to driving distances. Rural areas represent 36.9 percent of the total land area of the U.S., but only 24.4 percent of the U.S. population. Just over 29 percent of the rural population is low-income, which is lower than the percent in urban clusters but greater than the percent in urban areas (table 2.7).

Almost 39 percent of low-income individuals in rural areas lived in low-income areas, while the remaining 61 percent lived in higher income rural areas. Among low-income individuals, those living in higher income

Table 2.7

Rural areas access to supermarkets--overall and for income and demographic subpopulations (driving distance)

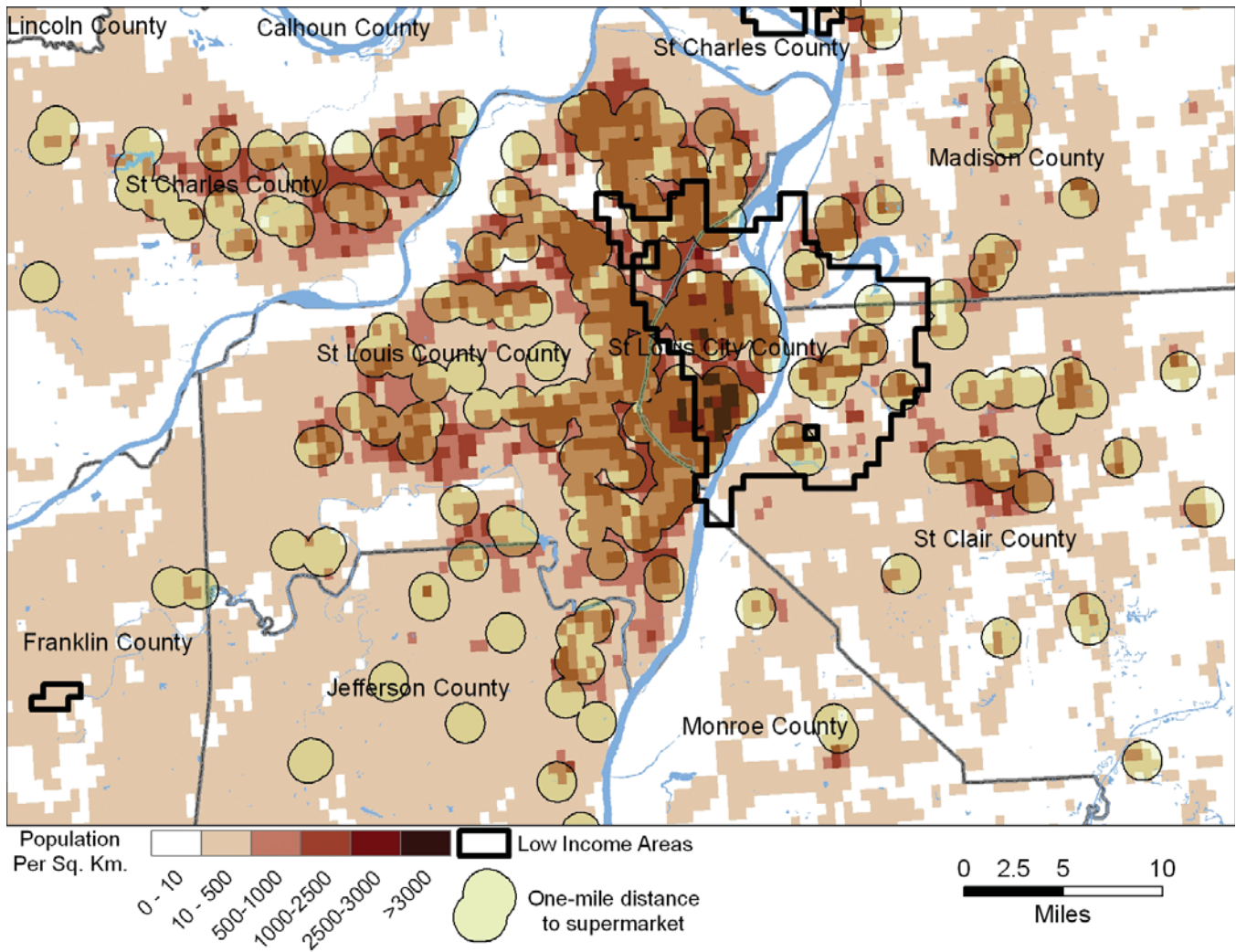
Population	Income level of area	Number (millions)	Total percent	Sub-population percent	Distance to nearest supermarket						
					Median (miles)	High access (10 miles or less)		Medium access (Between 10-20 miles)		Low access (More than 20 miles)	
						Number (millions)	Percent	Number (millions)	Percent	Number (millions)	Percent
Total population of rural areas	Low income	16.1	100.0	23.6	4.11	13.8	85.7	1.9	11.7	0.4	2.6
	Higher income	52.1	100.0	76.4	3.42	49.1	94.1	2.8	5.3	0.3	0.6
	Total	68.2	100.0	100.0		62.8	92.1	4.6	6.8	0.7	1.0
Subpopulations											
Population with low income	Low income	7.7	48.1	38.9	4.21	6.6	85.0	0.9	12.0	0.2	3.0
	Higher income	12.2	23.3	61.1	3.70	11.3	92.6	0.8	6.6	0.1	0.8
	Total	19.9	29.2	100.0		17.8	89.7	1.7	8.7	0.3	1.6
Households without access to a vehicle	Low income	0.6	9.4	40.2	3.37	0.5	87.3	0.1	10.4	0.0	2.3
	Higher income	0.8	4.2	59.8	3.08	0.8	93.7	0.0	5.7	0.0	0.7
	Total	1.4	5.4	100.0		1.2	91.1	0.1	7.6	0.0	1.3
Non-White population	Low income	4.8	29.9	48.4	3.65	4.1	84.5	0.6	12.0	0.2	3.5
	Higher income	5.1	9.8	51.6	2.98	4.8	94.6	0.2	4.8	0.0	0.6
	Total	9.9	14.6	100.0		8.9	89.8	0.8	8.3	0.2	2.0
Elderly population	Low income	2.1	13.3	24.4	4.04	1.8	84.4	0.3	12.7	0.1	2.9
	Higher income	6.6	12.7	75.6	3.32	6.1	92.6	0.4	6.6	0.1	0.8
	Total	8.7	12.8	100.0		7.9	90.6	0.7	8.1	0.1	1.3

Source: USDA, ERS analysis based on data from Census of Population, 2000 and the ERS-compiled supermarket directory for the contiguous U.S. in 2006.

areas (93 percent) had better access than those who lived in low-income areas (85 percent). This is in contrast to low-income populations in urban areas and urban clusters where low-income individuals who lived in low-income areas were closer to supermarkets than low-income individuals who lived in higher income areas. For rural populations, supermarket access typically involves driving to an urban area or urban cluster, where higher population densities are more likely to contain larger stores. Map 2.4 shows supermarket access of South Dakota, a largely rural state. This map uses light blue shading to indicate the location of low-income areas. Circles with the 10 and 20 mile radii around a supermarket indicate which areas are within each of these distances of a supermarket. Finally, the brown shading scheme (white to dark brown) indicates population density (low to high).

The map shows that there are several small towns in low-income portions of the State that are outside of a driving range from a supermarket (more

Map 2.4
Supermarket access in South Dakota



than 20 miles). Individuals in these areas, and in the surrounding sparsely populated areas, are likely to have considerable time and out-of-pocket costs to accessing food sources.

There are also several Indian reservations in South Dakota, as well as in other rural areas, primarily in the Midwest and West. These areas may be served by the Food Distribution Program on Indian Reservations (FDPIR), a commodity food assistance program for eligible Native Americans offered as an alternative to the SNAP.²¹ The locations of these distribution centers are not yet incorporated in the analysis but will be in the future.

Obviously, those outside of walking distance to a store who do not have a vehicle in rural areas will face much higher transportation costs, both in terms of hiring transportation (taxi, shuttle, or public transportation if they exist at all) and in time costs in walking to the store or waiting for a friend or family member to take them to a store. These households make up only a small share (5.4 percent) of the rural population in total and 9.4 percent of low-income people, yet most of them live between 1 mile and 10 miles from a supermarket. Although this is a small portion of the overall population, the

²¹The FDPIR operates in 23 States and served 90,100 persons in FY2008, primarily individuals living on or near Indian reservations

population certainly has very limited access to supermarkets based on driving distances.

The non-White population represents 14.6 percent of the total rural population, or 9.9 million persons. Of the non-White population, 51.6 percent live in low-income areas. Almost 90 percent of the non-White population lives within 10 miles of a supermarket. Non-White individuals that live in low-income areas are more likely to reside more than 20 miles from a supermarket than non-White individuals who did not live in low-income areas (3.5 percent, compared with less than 1 percent).

Over 84 percent of elderly individuals in low-income rural areas were within 10 miles of a supermarket, while another 12.7 percent were between 10 and 20 miles. Only 2.9 percent were more than 20 miles from the nearest supermarket.

Time Costs of Access to Food

In addition to the effects of price, income, and the availability of different foods, consumers' food shopping and consumption behavior may also be affected by the time costs of food shopping and food preparation. Higher time costs of travel to grocery stores are likely associated with lower demand for those stores or for some foods. Likewise, greater time costs of preparing some foods may be associated with lower demand for those foods. ERS analysis of time diary data from the ATUS provides information about variations in time costs across areas with different levels of access to supermarkets and across different population groups.

The ATUS collects information on how Americans spend their time. Sponsored by the Bureau of Labor Statistics (BLS, <http://stats.bls.gov/tus/home.htm>) and conducted by the U.S. Census Bureau, the ATUS is a continuous, monthly survey that started in January 2003. The ATUS sample is nationally representative of civilian Americans age 15 and older, and the data include about 13,000 completed interviews annually. Estimates from the survey show the range of detailed activities performed daily, how much time is spent in each activity as well as where and with whom, and how time is allocated by demographic group, labor force status, and weekdays versus weekends.

Table 2.8 shows the average time spent in travel to grocery shopping on an average day by level of access to the nearest supermarket (as defined above). The table shows the average minutes spent traveling to grocery stores for shoppers who live in low-income areas with low, medium, and high access to supermarkets.²² These averages are compared with the national average. Overall, the national average time spent traveling, one-way, to the grocery store was almost 15 minutes, and about 14 percent of the population traveled to the grocery store on an average day.

Time spent traveling to the grocery store was greater in low-income areas with low-access. The average time spent traveling to the grocery store for those who lived in these areas, 19.5 minutes, was significantly greater than the average time spent traveling to the grocery store for those in low-income areas with high access (15.5 minutes) and for those in low-income areas

²²Survey respondents did not report which type of "grocery" store they visited, only that they reported the activity of grocery shopping.

Table 2.8

Average time spent in travel to grocery shopping on an average day by access to grocery stores

Average time is one-way, not total travel time (based on the shortest one-way time). Pooled 2003-2007 American Time Use Survey data

	Average minutes per day of travel related to grocery shopping, for those who grocery shopped	Average % engaged in travel related to grocery shopping (on an average day)	Average minutes, 90% CI min	Average minutes, 90% CI max	Average percent, 90 CI min	Average percent, 90% CI max
	<i>Minutes</i>	<i>Percent</i>				
Total population, age 15+, 2003-07	15.0	14.0	14.7	15.3	13.7	14.3
Low-income areas						
Low access	19.5	12.1	18.1	20.9	11.1	13.1
Medium access	14.1	13.5	13.0	15.1	12.5	14.5
High access	15.5	12.3	14.3	16.7	11.3	13.4
Not-low-income areas						
Low access	15.9	14.4	15.2	16.5	13.7	15.1
Medium access	12.5	14.7	12.1	12.9	14.1	15.3
High access	13.3	16.3	12.6	14.1	15.4	17.3
<i>Metropolitan areas, 2005-07</i>	14.2	13.9	13.8	14.6	13.4	14.3
Low-income areas						
Low access	20.4	12.9	17.5	23.3	10.7	15.0
Medium access	14.4	11.7	13.1	15.6	10.2	13.1
High access	15.5	11.5	13.7	17.3	10.0	13.1
Not-low-income areas						
Low access	15.5	14.3	14.8	16.3	13.4	15.2
Medium access	12.1	14.0	11.5	12.6	13.2	14.7
High access	12.9	15.9	11.9	13.7	14.6	17.2
<i>Nonmetropolitan areas, 2005-07</i>	16.9	12.2	15.8	18.0	11.5	13.0
Low-income areas						
Low access	18.8	11.0	16.9	20.6	9.6	12.4
Medium access	11.2	13.6	8.4	14.0	10.7	16.6
High access	--	11.8	--	--	6.3	17.4
Not-low-income areas						
Low access	--	16.0	--	--	8.3	23.6
Medium access	--	--	--	--	--	--
High access	--	--	--	--	--	--
<i>Note: 2003 Met/nonmet classification used for 2005-07 data.</i>						
Income, 2003-07						
Household Income <= 200% poverty threshold	15.8	13.6	15.3	16.4	13.0	14.2
Low-income areas						
Low access	19.3	13.7	17.3	21.3	12.2	15.1
Medium access	14.2	13.4	13.1	15.3	12.0	14.7
High access	16.4	12.5	14.5	18.2	11.0	14.0
Not-low-income areas						
Low access	16.3	14.7	15.0	17.6	13.2	16.3
Medium access	13.6	13.3	12.6	14.7	12.0	14.6
High access	2.3	16.7	11.1	13.6	14.6	18.8
Household Income > 200% poverty threshold	14.2	14.2	13.9	14.6	13.8	14.7
Low-income areas						
Low access	20.5	11.3	18.3	22.6	9.8	12.8
Medium access	12.1	14.1	10.9	13.4	12.3	15.8
High access	13.5	12.6	11.9	15.2	10.9	14.4
Not-low-income areas						
Low access	15.6	14.3	14.8	16.4	13.4	15.2
Medium access	11.8	15.0	11.4	12.3	14.2	15.9
High access	13.4	16.3	12.3	14.4	15.1	17.6

Table 2.8

Average time spent in travel to grocery shopping on an average day by access to grocery stores (continued)

Average time is one-way, not total travel time (based on the shortest one-way time). Pooled 2003-2007 American Time Use Survey data

	Average minutes per day of travel related to grocery shopping, for those who grocery shopped	Average % engaged in travel related to grocery shopping (on an average day)	Average minutes, 90% CI min	Average minutes, 90% CI max	Average percent, 90 CI min	Average percent, 90% CI max
	Minutes	Percent				
Household Income missing	16.3	13.9	15.4	17.2	13.1	14.7
Low-income areas						
Low access	17.7	9.7	14.4	21.1	7.5	12.0
Medium access	19.4	12.3	14.5	24.5	9.6	14.9
High access	17.0	11.2	12.8	21.1	8.8	13.5
Not-low-income areas						
Low access	16.5	14.4	14.9	18.0	12.5	16.3
Medium access	14.4	15.0	12.9	15.8	13.1	16.9
High access	14.4	15.9	12.4	16.4	13.5	18.3

-- indicates that estimate is suppressed due to small cell size.

Source: 2003-2007 American Time Use Survey data, Current Population Survey sampling frame from Census Bureau.

Store access levels are tract-level classifications based on categories of access used in Chapter 2.

Data with missing tract-level classification were included in Total population, age 15+ estimates.

with medium access (14.1 minutes). These differences are large and statistically significant. In addition, those in low-access areas shopped less frequently—on average once every 8 days versus a national average of once every 7 days.

The difference in average time spent traveling to the grocery store by access level may not be surprising given that this study's definition of access is based on distance, and that, all else equal, it is expected that those who live more than 1 mile from a supermarket would spend more time traveling to the grocery store than those who live less than half a mile or less than a mile from the supermarket. To put these averages into context, table 2.8 also reports average time spent traveling to grocery stores by households in higher income areas separately by their access levels. As expected, those with low access spend the most time traveling to the grocery store (15.8 minutes) compared with those who are closer. But the average of those in higher income areas that are more than a mile from a store is still almost 4 minutes shorter than the 19.5 minute average of those in low-income areas who are more than a mile from a grocery store.

Table 2.8 also considers average time spent traveling to get groceries for sample members living in metropolitan (metro) areas compared with those living in nonmetropolitan (nonmetro) areas.²³ Not surprisingly, those who live in nonmetro areas spent more time, on average (16.9 minutes), traveling to the grocery store than those living in metro areas (14.2 minutes), and a smaller percent of nonmetro residents shopped on an average day than metro residents. Surprisingly, those in nonmetro areas with low access spend about the same amount of time traveling to supermarkets as those in metro areas with low access.

The final set of averages shown in table 2.8 compares average time spent traveling to grocery stores for those with household income below 200 percent of Federal poverty guidelines and for those with income above 200 percent of poverty. Also included are national estimates for the 13 percent of the sample with missing income information. Those with low income who

²³There are not enough households in urban clusters or rural areas in the sample to examine average minutes spent traveling to supermarkets across the same urbanicity categories used above, so here we focus on metro and nonmetro statistical areas.

live in low-income areas with low access spend about the same amount of time traveling to grocery stores (19.3 minutes) as those who do not have low income but who live in low-income areas with low access to grocery stores (20.5 minutes). In contrast, those with low income who live in low-income areas with medium or high access take more time to get to the grocery store (14.2 minutes and 16.4 minutes, respectively) than those who do not have low income but who live in low-income areas with medium (12.1 minutes) or high access (13.5 minutes). It is possible that these higher income individuals in low-income areas have access to their own vehicles for grocery shopping and choose to shop outside their neighborhoods.

These data show some expected patterns, but it is difficult to interpret without further information. For example, it is not known whether shoppers in the time use sample go to the nearest grocery store to do their shopping or if they are selectively shopping further from their neighborhood because of price or availability factors. If the latter is true, these time use estimates do not reflect true differences in access, just differences in choice. Of course, it is not clear whether these differences in choices are correlated with the area-level measures of access or not—for example, if those in low-access areas pass several stores that may not have the foods they want to get to stores with better selection or price.

Table 2.9 shows the mode of transportation used in getting to grocery stores.²⁴ These results show that the majority of people who shopped for groceries drove to the store as either the driver of a vehicle or as a passenger with another household member. Those with the lowest levels of access were the most likely to drive to the grocery store (93.3 percent, compared with 87.1 percent for medium-access shoppers and 65.3 percent for high-access shoppers). Those who lived closest to grocery stores were more likely to walk or bicycle to the store than those in low or medium access areas (23.1 percent, compared with 2.3 and 5.4 percent for those with low and medium access). Very few shoppers used public transportation to get to a grocery store. Only 4 percent of shoppers in low-access areas got rides to the grocery store with nonhousehold members or in taxis, while 10 percent of shoppers in high-access areas got rides to grocery stores with nonhousehold members or in taxis.

Grocery shoppers from low-access areas were more likely to have been accompanied by children on their trips to the grocery store than others—29.1 percent versus a national average of 22.8 percent. Having children along on the trip is likely to make the trip more cumbersome, making travel and grocery shopping more difficult for these low-access shoppers.

The last rows in table 2.9 show whether grocery shoppers shop from home or from work, or their trip chaining patterns.²⁵ For the majority of shoppers, the time distance from the grocery store to home is shorter than the time distance from the grocery store to work (about 92 percent). But for about 8 percent, the time distance from work to the grocery store was shorter than the time distance from home to the grocery store (5.9 percent directly from work to the grocery store and 2.1 percent clustered with other stops from work to the grocery store). Interestingly, those in low-income areas with low access were the most likely to access grocery stores directly, bunched with other activities, or from work (7.7 percent directly from work and 3.6 percent

²⁴Mode of transportation estimates are for all grocery shoppers, not just low-income grocery shoppers.

²⁵Appendix C contains information on how trip chaining was classified.

Table 2.9

Characteristics of grocery shopping by level of access to supermarkets

Characteristics are of one-way shortest travel time to grocery store.
Pooled 2003-2007 American Time Use Survey data

	Total	Low-income areas			Not-low-income areas		
		Low access	Medium access	High access	Low access	Medium access	High access
<i>Percent</i>							
Mode of transportation							
1. Car, truck, motorcycle (driver or passenger w/hh member)	90.2	93.3	87.1	65.3	96.7	92.3	83.9
2. Walking or bicycle	4.8	2.3	5.4	23.1	0.3	3.1	10.0
3. Public transportation (bus, subway/train)	0.3	0.1	0.9	1.9	0.0	0.3	0.3
4. Other (passenger w/nonhh member, boat/ferry, taxi/limo, unspecified)	4.8	4.3	6.6	9.7	2.9	4.4	5.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
With whom							
Alone	48.8	40.0	39.0	40.8	49.9	52.7	53.6
With household members	42.1	49.3	49.9	46.1	41.1	39.5	37.9
With others, not household members	9.1	10.8	11.1	13.1	9.1	7.8	8.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
With children (persons under 18 years old)	22.8	29.1	28.2	32.8	20.3	22.6	19.4
<i>Note that "with whom" is for travel to grocery store, and not grocery shopping. The person or persons with the respondent may only be present for part of the travel.</i>							
Trip chaining							
Home to store, direct / Store to home direct	63.6	54.8	64.1	61.0	64.5	68.4	66.6
Home to store, clustered activities/ Store to home, clustered activities	28.4	33.9	31.1	34.9	26.5	25.8	26.3
Work to store, direct / Store to work direct	5.9	7.7	3.5	3.3	6.6	3.9	5.9
Work to store, clustered activities/ Store to work, clustered activities	2.1	3.6	1.4	0.8	2.5	1.9	1.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: 2003-2007 American Time Use Survey data, Current Population Survey sampling frame from Census Bureau. Store access levels are tract-level classifications based on categories of access used in Chapter 2. Data with missing tract-level classification were included in Total population estimates.

bunched with other activities from work). Those from low-income areas that had medium or high levels of access were less likely to access grocery stores from work. These data indicate that some of those who live in low income areas with low access choose grocery stores closer to work than to home.

Data presented here are for the entire U.S. population. One study specifically focused on a sample of low-income people. The National Food Stamp Program Survey of 1996/1997 (NFSPS) surveyed a sample of participants of the SNAP and eligible nonparticipants. Sample members were asked about the modes of transportation and out-of-pocket costs used to travel to stores where they shopped for food and about how much time it took to travel to foodstores (Ohls et al., 1999). Close to 76 percent of participants and 85 percent of eligible nonparticipants reported use of a car to shop. Food stamp participants either drove (45 percent) or got a ride with family or friends (31 percent). Among the 22 percent of participants who reported some transportation expenses, the average cost per shopping trip was \$6.54. Average round trip travel time to the most frequently used store was 23-24 minutes for participants and eligible nonparticipants. The survey compared these patterns across participants who lived in urban, mixed, and rural areas.

Average distance, time, and out-of-pocket cost to the most often used store were greater for those living in rural settings. Rural participants were less likely than their urban area counterparts to report out-of-pocket expenses associated with food shopping—perhaps because 94 percent either drove or got a ride with others.

Time costs to travel to grocery stores are only part of the time costs involved in healthy eating—preparing nutritious food can be more costly in terms of time than prepared meals or restaurant meals. Previous ERS research examined time spent in food preparation for women across income levels and family composition. This study found that being a mother who worked full-time or a single mother were more important in explaining differences in time spent in food preparation than were either earnings or income (Mancino and Newman, 2007). Specifically, food preparation time falls as mothers spend more time working outside the home. Single women with children spend less time preparing food than married women.

Summary

The number of people who have low access to healthy food depends upon which measure is used. Direct questions from a nationally representative sample of U.S. households in 2001 show that up to 5.7 percent of all U.S. households did not always have the food they wanted or needed because of access-related problems. Households that live far from a supermarket and that do not have vehicles likely have limited access to nutritious food. Of all households in the U.S., 2.3 million, or 2.2 percent, live more than a mile from a supermarket and do not have access to a vehicle. An additional 3.4 million households, or 3.2 percent of all households, live between one-half to 1 mile and do not have access to a vehicle.

Area-based measures of access show that 23.5 million people live in low-income areas that are more than 1 mile from a supermarket, which represents 8.4 percent of the total U.S. population. However, not all of these 23.5 million are themselves, low income. If only the low-income people in low-income areas are considered, then 11.5 million, or 4.1 percent of the total U.S. population, lives in low-income areas more than 1 mile from a supermarket. Both of these estimates are national totals that do not consider differences in distance, travel modes and travel patterns, and retail markets for urban versus rural areas.

Within urban areas, 10.1 million low-income individuals (20.2 percent) were more than 1 mile from the nearest supermarket. Of the total, 3.6 million lived in low-income areas. Within urban clusters, 1.4 million persons, or 29.3 percent of the low-income population, were more than 1 mile from the nearest supermarket. Of the 16.1 million persons living in rural low-income areas, 85.7 percent (13.7 million persons) were within 10 miles of a supermarket. Another 11.7 percent (1.9 million persons) were between 10 and 20 miles distant, and only 2.6 percent were more than 20 miles from a supermarket. These differences underscore the importance of owning a vehicle or having access to affordable transportation in rural areas.

Data on time use and travel mode show that those who live in low-income areas that are more than a mile from a supermarket spend more time (19.5

minutes) traveling to grocery stores than the national average (15 minutes). However, 93 percent of those who live in low-income areas more than a mile from a supermarket traveled to the grocery store in a vehicle they or another household member drove.

While considerable efforts were made to develop these data, measures, and methods, different assumptions and measures are likely to produce differing outcomes and conclusions when applied to the same data. More detailed information which is not currently available would likely result in more precise findings. It is hoped that the methods and findings in this chapter will stimulate new research to provide additional insights about the nature and extent of low-income populations faced with low access to sources of nutritious and affordable foods.

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The Interaction of Neighborhood and Household Characteristics in Explaining Areas With Limited Access

The food deserts literature suggests that those who have better access to supermarkets tend to have healthier diets and lower levels of obesity and related diseases (Laraia et al., 2007; Larson et al., 2009). However, the extent to which limited access to supermarkets and other differential aspects of the food environment contribute to known economic and racial health disparities remains unclear. That lack of clarity stems in part from conflicting findings with regard to access to supermarkets for low-income, minority, and racially mixed neighborhoods. Some researchers have found economically disadvantaged populations and neighborhoods with high concentrations of racial minorities to have better access than their counterparts (e.g., Moore and Diez Roux, 2006), while others have found the reverse (e.g., Burns and Inglis, 2007). There is substantial literature showing that low-income and minority populations are disproportionately at risk when it comes to major public health concerns (e.g., Diez Roux et al., 2001; Odoms-Young et al., 2009). But critical gaps remain in the understanding of the associations between the neighborhood food environment and indicators of health. Investigators have made considerable gains in the development of approaches to better characterize neighborhood food environments and thus identify the mechanisms that underlie those associations between the food environment and poor health outcomes (e.g., Moore et al., 2008; Sharkey, 2009), but doing so continues to be a major challenge.

This chapter uses physical distance to the nearest supermarket as a measure of access, but also extends the analysis to include distance to the third nearest supermarket, which serves as a proxy for variety (Apparicio et al., 2007). Access in relation to the neighborhood and household socioeconomic environment is also explicitly examined. Examining areas of low-access to food from a socioeconomic perspective as such is both theoretically and empirically important. In theory, those with the lowest incomes, living in the most disadvantaged places, will have limited provisional access in general, whether in reference to food, health care, transportation, or other services and resources. Further, households that lack access to a vehicle (particularly in rural areas) or have very few financial resources may have difficulty purchasing affordable and nutritious food, which in turn may translate into poor health (Bostock, 2001). Lack of access to food and poor health could be amplified if the same households live in a disadvantaged neighborhood, such as one where public transportation options are nonexistent and food retail choices are limited (Ford and Dzewaltowski, 2008).

There are a number of phrases used in the health inequalities literature to capture the relationship between household and neighborhood risk factors (e.g., pathways of disadvantage). The one utilized in this study is “deprivation amplification” (Macintyre et al., 2008). Deprivation amplification is best explained as a process that could impact an individual’s health whereby, for example, risk factors for obesity, such as low-income, combined with limited knowledge about nutrition are intensified by exposure

to a food retail environment that offers too few choices for nutritious food and/or too many options for less nutritious alternatives. Thus, the food environments of low-income populations require special consideration due to the vulnerability of the individuals as well as that of the unique social and physical setting in which they live (Gittelsohn and Sharma, 2009).

Empirical evidence suggests that deprivation amplification may be more of a problem in the United States than in the United Kingdom and elsewhere where food desert research has been conducted. That is, while research on food deserts in the United States is in its infancy, research completed to date shows that in comparison to other country studies (e.g., Pearce et al., 2009) complex social and physical contexts are greater determinants of health outcomes for the low-income population of the United States than for the European counterparts. Cummins and Macintyre (2006) suggest that one explanation for this uniquely U.S. “contextual effect” may be that “residential segregation along socioeconomic and racial lines may be more pronounced in the USA and planning regulations less focused on compensating for such segregation than in the UK, continental Europe, or Australia.” A number of studies lend support to this notion (e.g., Franco et al., 2008; Galvez et al., 2008; Morland et al., 2002). Thus, while the main objective of this analysis is to determine the characteristics that best differentiate groups with dissimilar levels of supermarket access (i.e., low, medium, or high), the secondary objective is to examine segregation based on race and income inequality as a determinant of low supermarket access in comparison to other neighborhood and household contextual risk factors.

Research Method and Indicators

The research method applied to this study is referred to as multiple discriminant analysis, or MDA. This approach is useful to understand the differences between groups, to identify which variables best capture those differences, to describe the dimensionality of groups, or to test theories or taxonomies (Huberty and Lowman, 1997).²⁶ In health geography and inequality research it is often used to discover the variables that contribute to group separation and to describe grouping variable effects. For example, Hemphill et al. (2008) used discriminant analysis to explore the relationship between the placement of fast food outlets and neighborhood-level socioeconomic variables, where neighborhoods were classified as high-, medium-, or low-access based on the number of fast food opportunities available to them. The study found significant differences between the three levels of fast food accessibility across the socioeconomic variables, with successively greater percentages of unemployment, low-income, and renters in neighborhoods with increasingly greater access to fast food restaurants. Several of these variables were also found to be predictive of greater access to fast food restaurants.

Similarly, discriminant analysis is used here to capture the characteristics that best differentiate urban and rural neighborhoods grouped into low-, medium-, and high-access categories given distance to first and third nearest supermarkets (i.e., supermarket proximity and variety). Those relative accessibility measures were determined based on the criterion given in the previous chapter (i.e., with low-access defined by a distance greater than 1 mile for walking and 20 miles for driving, medium-access defined by a

²⁶Discriminant analysis is conceptually and mathematically analogous to multiple regression analysis. Both techniques involve calculating from a set of continuous predictor variables to a criterion. The primary difference is that the dependent variables in discriminant analysis are linearly combined mathematically to maximally discriminate between the groups, thereby emphasizing group differences and deemphasizing group similarities. In other words, multiple discriminant analysis calculates a linear equation using standardized discriminant function coefficients, which are analogous to beta weights in regression. As such, similar to regression, these coefficients identify the relative importance of each continuous variable in predicting the criterion. However, unlike regression analysis, the dependent variables are linearly combined to create a synthetic or composite dependent variable that separates or maximally differentiates the groups.

distance between one-half and 1 mile for walking and between 10 and 20 miles for driving, and high-access defined by a distance less than one-half mile for walking and 10 miles for driving). However, for this analysis, the geographic area of interest is neighborhoods, for which Census tracts are commonly used proxies. As such, the grid-defined distance measures used in Chapter 2 were aggregated to the Census tract for this study.²⁷

As with the area-based analysis in Chapter 2, little variation was found among subpopulations with respect to distance measures and access levels. For example, based on distance alone, the low-income population was found to be no worse off than female-headed households with children, or the African-American population, the severely poor (50 percent of the poverty income threshold), or any other vulnerable population. Likewise, non-White and low-income populations were found to have better access than their counterparts, and lack of access to a vehicle within the household did not emerge as a defining characteristic of low access. With respect to the latter, walking distance to a variety of supermarkets proved to be the greatest access barrier for low-income households with or without a vehicle, in either urban or rural neighborhoods. Yet, the same was determined for all neighborhoods regardless of whether they were low-income or not, leading us to conclude that low access in general is not specifically a low-income area phenomenon.

For this reason, this study does not limit the discriminant analysis to low-income areas; it includes all neighborhoods in the analytical models. In keeping with the geography applied to the area-based analysis, the study categorizes those neighborhoods as being located in metro core, micropolitan or small town core, and rural tracts, which are census tract-level equivalents of urbanized areas, urban clusters, and rural areas, respectively.²⁸ Using that geography in association with the access groups (a dependent variable), 12 independent discriminant analyses are conducted—one for each of the three geographic groups given walking and driving distances to first and third nearest supermarkets (see table 3.1 for group frequencies).

A number of factors were included in each analysis in addition to a select set of socio-economic indicators believed to be potential predictors of group membership given existing literature on vulnerable people and places.²⁹ The factors consisted of indicators of neighborhood and household composition that have previously been associated with deprivation, such as householder age and race/ethnicity, income and education levels, household structure, area population density, and degree of rurality. The predictor variables consisted of indicators of neighborhood context that are hypothesized to be associated with deprivation amplification, such as depth and persistence of poverty, housing values and vacancy rates, area unemployment and labor force participation rates, low-income concentration, and segregation based on race and income. Most of these variables are straightforward and require little explanation, but there are a few exceptions for which additional details are provided below. Summary statistics for each are given in table 3.2.

- *Dissimilarity index of segregation*: This variable captures dissimilarity by race or the evenness with which one racial population group is located (or segregated) within an area with respect to another racial group. The dissimilarity statistic is interpreted as the proportion of one racial group that would need to relocate to another neighborhood (census tract) in

²⁷Specifically, tract-level distance measures were calculated by first assigning grids to 2000 Census defined tracts. Then median distances for all grids within a tract were computed, including total tract population and population-specific distances to the nearest and third closest supermarket based on income, age, race/ethnicity, and various household characteristics (e.g., households without a vehicle and female-headed households with children).

²⁸These tract-level geographic designations are based on ERS 2000 Rural-Urban Commuting Area (RUCA) Codes, which were developed using the same theoretical concepts used by the Office of Management and Budget to define county-level metropolitan and micropolitan areas. Metropolitan cores (code 1) are defined as census tract equivalents of urbanized areas. Micropolitan and small town cores (codes 4 and 7) are tract equivalents of urban clusters. And, rural tract (code 10) designation is defined by a primary commuting flow that is local or to another rural tract.

²⁹All factor and predictor variable data stem from RAND's Center for Population Health and Health Disparities Data Core (<http://www.rand.org/health/centers/pophealth/data.html>). The RAND data include a range of census-based variables tabulated to capture various characteristics known to be correlated with health disparities, such as standard measures of socioeconomic disadvantage (e.g., unemployment, poverty, and education), disability by type and population, cost of living, segregation, unevenness, and inequality by race and/or income, alternative measures of environmental pollution by level and type, and various forms of physical access based on extent of roadway connectivity and complexity. The full range of potential factor and predictor variables from the RAND data were initially considered for analysis and selection of variables was based on a standard variable reduction process (e.g., univariate analysis to determine significance and elimination of redundant or overlapping variables).

Table 3.1

Access Category Variables and Corresponding Percent Frequency: Metro Core, Micropolitan / Small Town Core, and Rural Tracts

Access category variables	Percent of metro core tracts	Percent of micropolitan or small-town core tracts	Percent of rural tracts
	<i>Percent</i>		
Walking--1 store (proximity)			
High access	31.5	12.4	1.3
Medium access	42.6	46.9	8.6
Low access	25.9	40.7	90.1
Driving--1 store (proximity)			
High access	100.0	99.8	75.8
Medium access	0.0	0.1	17.8
Low access	0.0	0.1	6.4
Walking--3 stores (variety)			
High access	0.0	0.0	0.0
Medium access	12.8	3.3	0.3
Low access	87.2	96.7	99.7
Driving--3 stores (variety)			
High access	100.0	84.5	32.5
Medium access	0.0	11.0	45.5
Low access	0.0	4.5	22.0

Source: USDA, ERS estimations based on 2006 ERS-compiled directory of supermarkets and RAND's Center for Population Health and Health Disparities Data Care.

order to be evenly distributed across the county (or metro area) with respect to other racial groups. A dissimilarity statistic value of 0 reflects absolute integration while a value of 1 reflects absolute segregation.

- *Gini index of segregation*: This variable represents income inequality by race. The Gini statistic is understood much like the dissimilarity statistic. It ranges in value from 0 to 1 with 0 indicating complete equality and 1 indicating complete inequality. In other words, higher values indicate that the study area is more unequal in terms of how income is distributed among racial groups while lower values mean that income is more equally distributed.
- *Roadway connectivity (alpha)*: This measure is used to examine connectivity with respect to the availability of alternative travel routes within a tract. The alpha value represents the ratio of the actual number of complete loops to the maximum number of possible loops given the number of tract intersections. A higher alpha value indicates a greater degree of roadway complexity and connectivity, and thereby serves as an indicator of access to supermarkets given the extent of the area's physical transportation infrastructure.
- *Index of disadvantage*: This is a normalized socioeconomic status measure for all census tracts developed from six measures understood to represent disadvantage: percent of adults older than age 25 with less than a high school education; percent male unemployment; percent of households with income below the poverty line; percent of households

Table 3.2

Summary Descriptives; Factor and Predictor Variables: Metro Core, Micropolitan / Small Town Core, and Rural Tracts

Variable	Rural core		Micro/Small-town core		Metro core	
	Mean	Std. deviation	Mean	Std. deviation	Mean	Std. deviation
Region (NE, MW, S, W)	2.59	0.91	2.6314	0.91390	2.5416	1.09064
Segregation by Race (dissimilarity)	0.24	0.15	0.29	0.12	0.44	0.14
Segregation by income (Gini)	0.29	0.17	0.37	0.15	0.57	0.16
Land area of tract in miles	452	2146	50	238	4	22
Roadway connectivity (alpha)	0.11	0.06	0.17	0.07	0.17	0.08
Median value of owner-occupied housing	\$72,056	\$53,004	\$85,896	\$50,248	\$153,295	\$123,395
Percent rural population	95.6%	18.2%	18.3%	20.5%	3.3%	10.8%
Percent Black or African-American population	5.5%	13.8%	10.4%	18.5%	15.6%	25.3%
Percent Hispanic population	4.8%	11.4%	8.6%	16.2%	13.5%	20.1%
Percent linguistically isolated households	5.8%	10.5%	5.7%	7.3%	11.2%	10.4%
Percent of tract poverty population who are 65+ years old	14.2%	8.4%	12.7%	8.1%	11.8%	12.2%
Percent of tract poverty population who are children	31.4%	10.3%	32.2%	10.5%	29.7%	14.6%
Percent vacant housing units	20.2%	15.3%	10.5%	8.4%	6.6%	6.6%
SES index of disadvantage	74.94	13.14	75.7635	6.24350	78.0322	9.80811
Percent persistent poverty county	14.8%	35.5%	9.9%	29.9%	1.7%	13.0%
Valid N (listwise)	N = 4141		N = 6392		N = 40436	

Source: USDA, ERS estimates based on 2006 ERS-compiled directory of supermarkets and RAND's Center for Population Health and Health Disparities Data Care.

receiving public assistance; percent of female-headed households with children; and median household income. The index is scaled such that the values fall between 0 and 100, with the lower number indicating a greater degree of tract disadvantage than a tract with a higher number.

- *Linguistically isolated households*: A linguistically isolated household is defined as one in which no member age 14 or older speaks only English or speaks a non-English language while also being able to speak English well. In other words, for a household to be declared linguistically isolated then at least one member age 14 or older must have some difficulty with the English language.
- *Persistent poverty counties*: This designation is based on the ERS 2004 County Typology, which classifies all U.S. counties according to six non-overlapping categories of economic dependence and seven overlapping categories of policy-relevant themes. Persistent poverty counties belong to the latter group and are defined as such if 20 percent or more of their populations were living in poverty over the last 30 years (measured by 1970, 1980, 1990, and 2000 decennial censuses).

Discussion of Results

MDA yields two types of output that are particularly useful for this investigation. The first is the structure coefficients, which are useful for determining the characteristics that contribute the most to group separation (i.e., low-, medium-, and high-access groups). The second is the set of standardized discriminant coefficients (similar to beta coefficients in regression analysis), which are useful for identifying the characteristics that best predict group membership and can thereby be thought of as indicators of associated risk. That output for all 12 discriminant analyses, and, therefore, the three geographies (metro core, micropolitan/small-town core, and rural core), are summarized in two typology tables.

Table 3.3 provides information on the characteristics of supermarket accessibility walking proximity and variety, while table 3.4 provides similar information for driving proximity and variety. Both tables give corresponding structure coefficients (access group separation) and standardized discriminant coefficients (access group predictors) with the top three most influential (on the basis of absolute value) highlighted. Those values can be interpreted following an example for rural core neighborhoods from table 3.3.

Considering walking proximity, roadway connectivity has the strongest correlation with the grouping variable (.797), followed by percent of vacant housing units (-.356) and percent rural population (-.289). This means that the extent and complexity of the road system contributes most to groupings of low-, medium-, and high-access. Its relative contribution can be understood by taking the square of the coefficient (.635), which indicates that 63.5 percent of the variance in the composite grouping variable is explained by the roadway connectivity variable. In other words, roadway connectivity is the characteristic that best discriminates among groups of neighborhoods categorized as having low-, medium-, or high-access to the nearest supermarket given walking distance. It also happens to be the strongest predictor of group membership (.913).

The second and third most powerful predictors for rural core neighborhoods were found to be the index of disadvantage (-.311) and the percent of the tract poverty population who are 65 years of age or older (.252). This finding implies, for example, that limited access is associated with a combination of indicators of socioeconomic disadvantage. This reinforces the need to give greater consideration to the notion of deprivation amplification in access and related health inequalities research. Further, the relevance of the elderly poverty population highlights that some people may face multiple barriers to access. Thus, continued efforts to improve measurement and advance multivariate techniques are needed.

The discriminant analysis results presented in tables 3.3 and 3.4 offer evidence in support of the hypothesis that segregation by race and income are associated with limited access. Segregation by race and income inequality are the dominant predictors among all neighborhood and household context variables that predict low-, medium-, and high-access levels. This was particularly true for access based on driving distances in rural core and micro/small-town core neighborhoods. However, some variability in

Table 3.3

**Group Separation and Predictor Variables for Low-, Medium-, and High-Access to Supermarkets:
Walking Proximity and Variety for Metro Core, Micropolitan / Small Town Core, and Rural Neighborhoods**

Access group separation	Walking proximity			Walking variety		
	Rural core	Micro/Small-town core	Metro core	Rural core	Micro/Small-town core	Metro core
Region (NE, MW, S, W)	-0.125	0.114	0.115	0.218	0.062	-0.035
Segregation by race (dissimilarity)	0.072	-0.002	0.232	-0.296	-0.110	0.294
Segregation by income (Gini)	0.061	0.006	0.245	-0.323	-0.137	0.303
Land area of tract in miles	-0.181	0.208	-0.266	0.091	0.207	-0.126
Roadway connectivity (alpha)	0.797	-0.740	0.582	0.019	-0.717	0.465
Median value of owner-occupied housing	-0.227	0.189	0.035	0.204	-0.024	0.204
Percent rural population	-0.289	0.901	-0.677	0.878	0.833	-0.253
Percent Black or African-American population	-0.065	0.046	0.130	0.066	0.045	0.108
Percent Hispanic population	0.093	-0.079	0.379	0.068	-0.155	0.506
Percent linguistically isolated households	-0.118	-0.020	0.489	0.089	-0.188	0.778
Percent of tract poverty population who are 65+ years old	0.201	-0.027	-0.062	0.258	0.091	-0.091
Percent of tract poverty population who are children	-0.129	0.039	-0.038	0.456	0.188	-0.026
Percent vacant housing units	-0.356	0.184	-0.027	0.207	0.135	-0.046
SES index of disadvantage	-0.234	0.159	-0.304	0.834	0.318	-0.327
Persistent poverty county	-0.120	0.047	-0.070	0.071	0.022	-0.055

Access group predication	Walking proximity			Walking variety		
	Rural core	Micro/Small-town core	Metro core	Rural core	Micro/Small-town core	Metro core
Region (NE, MW, S, W)	-0.026	0.046	0.211	0.340	0.030	-0.050
Segregation by race (dissimilarity)	0.197	-0.604	0.322	0.167	0.532	0.554
Segregation by income (Gini)	-0.168	0.696	-0.228	-0.291	-0.600	-0.463
Land area of tract in miles	-0.251	0.046	-0.070	-0.112	0.002	-0.024
Roadway connectivity (alpha)	0.913	-0.387	0.478	-0.098	-0.512	0.388
Median value of owner-occupied housing	0.105	-0.046	0.096	-0.104	-0.382	0.353
Percent rural population	-0.061	0.728	-0.501	0.387	0.479	0.014
Percent Black or African-American population	-0.075	0.088	0.067	0.080	0.171	0.175
Percent Hispanic population	0.050	0.051	0.117	0.025	0.120	0.258
Percent linguistically isolated households	-0.190	-0.004	0.390	0.139	-0.102	0.605
Percent of tract poverty population who are 65+ years old	0.252	-0.097	-0.031	0.044	0.022	-0.089
Percent of tract poverty population who are children	0.014	-0.013	-0.172	0.069	0.155	-0.173
Percent vacant housing units	-0.054	0.121	-0.113	0.117	0.127	-0.108
SES index of disadvantage	-0.511	0.153	-0.171	0.582	0.451	-0.241
Persistent poverty county	-0.052	-0.045	-0.150	0.044	-0.071	-0.141

Source: ERS estimates based on 2006 ERS-compiled directory of supermarkets and RAND's Center for Population Health and Health Disparities Data Care.

Table 3.4

**Group Separation and Predictor Variables for Low-, Medium-, and High-Access to Supermarkets:
Driving Proximity and Variety for Metro Core, Micropolitan / Small Town Core, and Rural Neighborhoods**

Access group separation	Driving proximity			Driving variety		
	Rural core	Micro/Small-town core	Metro core	Rural core	Micro/Small-town core	Metro core
Region (NE, MW, S, W)	0.263	0.130	n/a	0.256	0.255	0.075
Segregation by race (dissimilarity)	-0.027	0.026	n/a	-0.125	-0.271	-0.013
Segregation by income (Gini)	-0.085	0.033	n/a	-0.190	-0.358	-0.008
Land area of tract in miles	0.725	0.900	n/a	0.640	0.584	0.693
Roadway connectivity (alpha)	0.334	-0.063	n/a	0.374	0.202	-0.154
Median value of owner-occupied housing	-0.313	-0.033	n/a	-0.266	-0.211	0.113
Percent rural population	-0.005	0.105	n/a	0.099	0.071	0.483
Percent Black or African-American population	-0.173	-0.041	n/a	-0.178	-0.134	-0.060
Percent Hispanic population	0.191	0.055	n/a	0.147	0.307	-0.086
Percent linguistically isolated households	0.323	0.265	n/a	0.194	0.178	0.182
Percent of tract poverty population who are 65+ years old	-0.056	-0.025	n/a	0.035	0.081	0.122
Percent of tract poverty population who are children	0.003	0.073	n/a	0.069	0.137	-0.080
Percent vacant housing units	0.182	0.133	n/a	0.179	0.257	0.413
SES index of disadvantage	-0.077	-0.187	n/a	0.036	-0.092	0.040
Persistent poverty county	0.072	0.052	n/a	0.018	0.106	0.350

Access group prediction	Driving proximity			Driving variety		
	Rural core	Micro/Small-town core	Metro core	Rural core	Micro/Small-town core	Metro core
Region (NE, MW, S, W)	0.222	0.045	n/a	0.351	0.198	0.208
Segregation by race (dissimilarity)	1.251	-0.870	n/a	1.742	2.558	-0.362
Segregation by income (Gini)	-1.316	0.958	n/a	-1.921	-2.893	0.462
land area of tract in miles	0.591	0.953	n/a	0.514	0.529	0.575
Roadway connectivity (alpha)	0.356	-0.007	n/a	0.479	0.242	-0.048
Median value of owner-occupied housing	-0.373	0.045	n/a	-0.374	-0.258	0.050
Percent rural population	-0.032	-0.088	n/a	0.095	0.017	0.309
Percent Black or African-American population	-0.158	-0.271	n/a	-0.232	-0.107	-0.114
Percent Hispanic population	-0.035	-0.340	n/a	-0.075	0.166	-0.393
Percent linguistically isolated households	0.350	0.237	n/a	0.243	0.156	0.455
Percent of tract poverty population who are 65+ years old	-0.052	0.111	n/a	0.058	0.187	0.088
Percent of tract poverty population who are children	-0.169	0.101	n/a	-0.037	0.071	0.020
Percent vacant housing units	0.302	0.032	n/a	0.401	0.283	0.429
SES index of disadvantage	-0.016	-0.385	n/a	-0.145	0.017	-0.034
Persistent poverty county	0.104	0.016	n/a	0.046	0.043	0.327

Source: ERS estimates based on 2006 ERS-compiled directory of supermarkets and RAND's Center for Population Health and Health Disparities Data Care.

predictors was found; for example, in rural core areas segregation was not among the top predictors of walking accessibility. This finding lends some support to the need for situation-specific research and policy.

Summary

The findings of this study indicate that low-access to supermarkets is most heavily influenced by characteristics of neighborhood and household socioeconomic environments, such as the extent of income inequality, racial segregation, transportation infrastructure, housing vacancies, household deprivation, and rurality. This lends support to the notion that there is indeed a socioeconomic “contextual effect” that should be considered when designing food access policy. In that vein, there is growing evidence that documents the success of non-health interventions that have had a positive impact on health (e.g., improvements to road networks and investments in public transportation options), particularly for those living in deprived areas (e.g., Cassidy and Mohan, 2004; Wrigley et al., 2003).

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Food Access and Its Relationship to Diet and Health Outcomes

Many factors contribute to an individual's overall diet, body weight, and the risk of developing diet-related diseases, such as diabetes or cardiovascular disease. Individual factors can explain some but not all of the differences in the rates in which different population groups experience these problems. Focus on food access has increased as researchers try to better understand the factors besides individual behaviors that may lead to differences in diet and health outcomes (Diez-Roux, 2009). Interest in the relationship of food access to diet and health is also rooted in a substantial body of literature that shows disparities in many health outcomes across race, ethnicity, and socioeconomic status (Institute of Medicine, 2003; National Research Council, 2004). It is hypothesized that differences in food access across race, ethnicity, and socioeconomic status may contribute to or reinforce these health disparities (Diez-Roux, 2009).

This chapter first considers different conceptual and methodological approaches to understanding how food access can affect diet and diet-related outcomes. It then briefly reviews what is known about the relationship between food access and diet, obesity, and diet-related problems. Evidence regarding what is known about effects of diet on health outcomes like obesity, diabetes, and other diet-related diseases is also considered. The chapter concludes with a discussion of research and data needs to advance knowledge of the effects of food access on diet and health.

Conceptual Framework

In a simple conceptual model, it is hypothesized that individual (and family) characteristics as well as characteristics of the physical environment impact dietary decisions. Individual characteristics include demographics (age, sex, race/ethnicity), socioeconomic status (income, education, and employment), family characteristics (family size and composition, presence of children), and preferences for food and other goods. The physical environment includes the food environment (accessibility to stores and restaurants) along with characteristics of the built environment, such as parks, sidewalks, availability of public transportation, air pollution, and noise. It is also likely that the social environment faced by individuals and families (e.g., cultural and social norms, social support, and safety and violence) affects diet. Diet is a major determinant of BMI and obesity status, and it is also a factor in risks of such diseases as diabetes and cardiovascular disease. Some of the same individual factors and physical and social environments affect BMI and diet-related diseases as well.

The conceptualized model is an effective starting point, but it is oversimplified. Individuals are certainly impacted by their larger physical and social environments, but physical and social environments are also impacted by individuals. Individuals have some choice over which physical and social environments with which to interact. Diet-related outcomes and health conditions are affected by other factors besides diet, including genetic

makeup, exercise habits, and working conditions. The directions of these relationships are not necessarily one-way. Obese individuals may have difficulty exercising or engaging in an active lifestyle. Obesity has also been tied to lower wages among women, which could affect their family's economic situation (Averett and Korenman, 1996; Cawley, 2004). And health conditions themselves can impact diet; for example, those with high blood pressure or diabetes may need to adopt special diets.

These complicated relationships highlight the limitations of the cross-sectional studies that have dominated the research in this area. Such studies are important because they illuminate how food access and the larger environment potentially impact diet and diet-related problems. But the results can not be interpreted causally.

Literature Review

In reviewing the literature on food access and diet and health outcomes, one must first distinguish between studies that attempt to examine causal links between food access and health outcomes and those that only consider cross-sectional correlations. Also, most of the studies examine the effects of food access on proximal outcomes, such as food shopping behavior and food consumption, often focusing on particular foods such as fruits and vegetables, whole grains, or low-fat milk. Other studies, however, focus on outcomes such as high BMI, obesity, and heart disease, which are not as proximate outcomes. The causes of these more distant outcomes are much broader than just food access, and, thus, other factors besides lack of access to some foods may help account for the rate of incidence of these health outcomes. To get a sense of this, the analysis includes a review of literature on the degree to which specific foods that may be lacking in some neighborhoods (such as fresh fruits and vegetables, low fat milk, and whole grains) are related to such health outcomes as obesity, diabetes, cardiovascular disease, and cancer.

Food access and dietary intake

The majority of studies that have examined the relationship between store access and dietary intake find that better access to a supermarket or large grocery store is associated with healthier food intakes (Larson et al., 2009). The relationship between the availability of restaurants (both fast food and full-service) and dietary intake has also been studied. In general, these studies have found that greater availability of fast food restaurants and lower prices of fast food restaurant items are related to poorer diet. Access to full-service restaurants shows either no relationship or a positive relationship with healthy dietary intake.

Only a few studies have used longitudinal data to measure how changes in access affect changes in diet. The few that exist focus on changes in shopping behavior and changes in dietary intake, not more distant outcomes such as obesity or other diet-related diseases. Two studies have examined the impact of the opening of a large supermarket in underserved areas in Leeds and Glasgow, UK (Wrigley et al., 2003; Cummins et al., 2005). The Leeds study used a pre-post intervention design, with survey interviews of participants about their shopping and food intake 5 months before and

7 months after a Tesco supermarket opened in the area. The Glasgow study used a pre-post study design to assess change in shopping and food intake behaviors surrounding a new store opening, but it also considered a comparison area that had similar neighborhood characteristics but did not have a new store open in the area. The comparison area was added to determine if any changes in shopping or diet could be due to secular changes in diet that were not due to a new store opening. Results of both studies showed that shopping behavior was affected by the openings of new stores—that is, a significant number of sampled individuals from the neighborhood switched their shopping to the new store. Both studies also show that average fruit and vegetable intake increased among surveyed individuals, but that the average increase was small (just over one-third of a serving). The average increase in fruit and vegetable intake among those who switched their main food shopping to the new store was larger, but still under one-half of a full serving size. The increase in fruit and vegetable intake in Leeds was statistically significant, but the increase in Glasgow was not. The Glasgow study, which used a control comparison area, shows that some of the increase in fruit and vegetable intake among sampled individuals could be due to overall increased consumption of these foods in both the control and study area—not due to the better accessibility to the store in the study area. Also noteworthy is that in both studies, respondents who switched to the new store reported better self-reported psychological health.

In contrast to opening new supermarkets, some areas have implemented programs to improve what is offered in small corner or convenience stores in underserved areas. Rather than build a whole new store, the idea is to work within the existing infrastructure to offer more healthy options and fewer less healthy options. Some of these interventions have measured the impact on shopping, sales, and food intake. Overall, results from these studies show that stocking and promoting healthier food items increases sales of the items. Some studies have also shown increases in healthy food consumption (Ayala et al., 2009; Gittelsohn, 2009). One intervention stocked prepared packs of fruits and vegetables (washed, cut, and bagged) at two tiendas (small stores) that served primarily Latino customers in North Carolina. Fruit and vegetable intake for customers at these two tiendas was compared with the fruit and vegetable intake of customers at two control group tiendas that did not offer the fruit and vegetable packs (Ayala et al., 2009). The study found that customers who shopped at stores where the packs were sold increased fruit and vegetable intake by one full serving. Customers who shopped in the two control tiendas exhibited no change in consumption.

These small store interventions show some promise, however, much of the research on the effectiveness of these interventions is formative. The studies are usually on very small and localized samples and often have very short followup periods from which changes can be observed. Further, there has also been little evaluative research to determine the cost effectiveness and sustainability of the changes in the stores and in consumers' diets.

Food access and obesity

Many studies have examined the link between store and restaurant access and BMI and obesity (see Larson et al., 2009, for a recent summary). In general, these studies find that better access to a supermarket is associated with

reduced risk of obesity and better access to convenience stores is associated with increased risk of obesity. Results with respect to restaurants are mixed. Some show that fast food availability is associated with increased risk of obesity for adults and children, but others find no association (Larson et al., 2009).

Currie et al. (2009) examine how school-level obesity rates among ninth graders in California are related to the distance between the school and fast food and full-service restaurants. The study also examines weight gain during pregnancy for women in Michigan, New Jersey, and Texas using Vital Statistics data and measuring distance from each woman's home to fast food and full-service restaurants. Results vary across the two samples. They find very localized effects in the sample of ninth graders in schools—the rate of obesity in the school increases 5.2 percent for schools located within 0.10 of a mile of a fast food restaurant (relative to schools that are within 0.25 of a mile). There is no relationship between the school obesity rate and distances of a quarter or half mile from a fast food restaurant and no effect of full-service food restaurant availability. For the sample of mothers, the studies find that living within half a mile of a fast food restaurant increases the probability of gaining more than 20 kilograms during pregnancy by 2.5 percent. The authors interpret the smaller effects on women as evidence that they are less constrained by travel than the ninth graders.

Another study examined the relationship between proximity to fast food restaurants and supermarkets to BMI for a sample of individuals from Marion County, Indiana (Indianapolis) (Chen et al., 2009). Unlike most previous studies, this study attempted to control for the fact that an individual's choice of where to live may be affected by the availability of different foodstores and restaurants.³⁰ Results of this study show that proximity to fast food restaurants has a small positive impact on BMI (Chen et al., 2009). In contrast, proximity to a grocery store has a small negative impact on BMI. The sizes of the total effects were less than half of a BMI point but were larger for people who lived very close to a store or restaurant.

Another study found that neighborhood environment could be an important determinant of BMI and obesity (Katz et al., 2007). The Moving-to-Opportunity demonstration project from the U.S. Department of Housing and Urban Development (HUD) used a random assignment methodology to study the effects of different public housing policies on families. Families living in high poverty public housing projects in five U.S. cities were randomly assigned to one of three groups: 1) an experimental group that received mobility counseling and a Section 8 public housing voucher that could only be used in census tracts with low poverty rates; 2) another experimental group that received a Section 8 voucher that could be used in the traditional way, without any geographic restriction; and 3) a control group that received no new assistance. Results showed that adults in the treatment groups had lower probabilities of obesity relative to the control group (Katz et al., 2007). While this study indicates there may be some neighborhood effects on obesity, it does not directly show an effect of food access on obesity. The reduction in obesity could have been due to other neighborhood or personal effects that were correlated with the move to a better neighborhood (e.g., better access to parks or less psychological distress).

³⁰The study also accounts for spatial dependence across administrative units.

The Relationship Between Consumption of Specific Foods, Obesity, and Diet-Related Diseases

Part of the goal of improving access to healthy and affordable food is to reduce obesity and diet-related diseases among populations that are adversely affected by these health conditions. With respect to obesity, it may be counterintuitive to think that a lack of access to any food is related to obesity—clearly the problem is too much food. The hypothesized causal pathway between lack of access and body weight is that some populations cannot get healthy food options and thus rely on energy-dense options that may cause weight gain. If healthier food is as available and as inexpensive as energy-dense food, it is hypothesized that consumers will substitute away from energy-dense foods to healthier foods and reduce the risk of obesity. As noted earlier, there is scant causal evidence to either support or refute this hypothesis. There are, however, a number of studies that explore the relationship between consumption of specific foods (fruits and vegetables, whole grains, low-fat milk, and beverages) and obesity and diet-related diseases. Since these specific foods are often the foods lacking in underserved areas (with the exception of beverages), this research is relevant to the question of how lack of access affects obesity and diet-related diseases.

Consumption of specific foods and their effects on obesity

It is hypothesized that because of their high fiber content and, in the case of whole grains, their improved glycemic control, fruits, vegetables, and whole grains could increase satiety so that consumers who increased their intake of these foods would substitute away from other foods that may be more energy-dense. Such a substitution would either stabilize total caloric intake or possibly reduce it. With respect to the fat content of milk, it is hypothesized that consumers who choose low-fat milk instead of milks with higher fat content would have lower caloric intake and lower BMI.

There is only weak support for these hypothesized relationships in the literature.³¹ In the case of fruit and vegetable consumption, cross-sectional data show that people who eat more fruits and vegetables have lower BMI. But cross-sectional data cannot distinguish whether consuming more fruits and vegetables causes lower BMI since those who eat more fruits and vegetables may be more health conscious, more likely to exercise, and more likely to have lower BMI relative to those who do not. Intervention and longitudinal studies have shown that increased fruit and vegetable intake may lead to small decreases in BMI, but some studies even show that increases in body weight can occur with increased consumption of fruits and vegetables because total caloric intake increased.

The case of whole grains is similar to that of fruits and vegetables. Relative to refined grains, greater intake of whole grains provides little or no benefit for weight management.

Cross-sectional evidence with respect to consumption of low-fat versus whole milk shows differences in preference across race and ethnicity that do not seem to be explained by availability or price. Hispanic and Black consumers are more likely to drink whole milk and White consumers are more likely to drink low-fat milk. The evidence also suggests that low-fat

³¹This section draws heavily on a review of the literature presented by Dr. Richard Mattes, Purdue University, at the IOM Workshop on the Public Health Effects of Food Deserts (Mattes, 2009).

milk consumption is not associated with lower BMI. In fact, among children, consumption of low-fat milk was linked to weight gain.

The relationship between beverage consumption and obesity has also been extensively studied. Calories consumed from beverages as a portion of Americans' total energy intake have almost doubled in the past 40 years, so much so that in 2002, 21 percent of total energy intake is from beverages (Duffey and Popkin, 2007). It is hypothesized that beverages provide less satiety than solid foods. As a result, increased calories consumed as beverages may not lead to reductions in calories from solid food and in fact may be consumed in addition to whatever calories come from solid foods leading to increased energy intake and weight gain. A summary of research suggests that beverage consumption is associated with increased energy intake, weight gain, and BMI. But there is less research from longitudinal studies or randomized controlled trials to establish the causality of beverage consumption and weight gain.

Obesity is a complex problem with many causes. Evidence presented here suggests that while some studies find a correlation between food accessibility and BMI and obesity, the causal pathways are not well understood. Lack of access to specific nutritious foods may be less important than relatively easy access to all other foods. "Food swamps" may better explain increases in BMI and obesity than "food deserts."³² Increasing access to specific foods like fruits and vegetables, whole grains, and low-fat milk alone may not make a dent in the obesity problem. Many of the stores that carry these nutritious foods at low prices also carry all the less healthy foods and beverages as well. Without also changing the dietary behaviors of consumers, interventions aimed at increasing access to healthy foods may not be successful in addressing obesity.

Consumption of specific foods and their effects on diet-related disease

Not all of the relationships between specific healthy foods and diet-related diseases like diabetes, cardiovascular disease and cancer are well-understood, but some broad conclusions can be drawn.³³ First, plant-based foods like fruits, vegetables, and nuts and whole grains are linked to reduced risk of cardiovascular disease. Diets high in saturated fat, trans fat, or refined sugars are linked with higher risk of diabetes and cardiovascular disease. Sugar-sweetened beverages increase the risk of obesity, diabetes, and cardiovascular disease. The evidence of how these foods relate to risks of cancer are not as clear cut and varies across types of cancers. For example, consumption of nonstarchy vegetables and fruits probably protect against cancers of the mouth, pharynx, and larynx and of the esophagus and stomach (see IOM, 2009, for a more thorough discussion).

The link between plant-based foods and whole grains to lower risk of CVD is relevant to questions about food accessibility. The lack of these foods in consumers' diets due to lack of access could plausibly contribute to increased risk of CVD, especially if other foods high in saturated and trans fat are relatively more accessible and inexpensive.³⁴ The link between sugar-sweetened beverages and increased risk of obesity, diabetes, and CVD may be less of a question about food access since these beverages are almost

³²Rose et al. (2009) introduced the term "food swamp" to characterize areas with an abundance of less healthy food options in contrast to "food deserts" that lack healthy food options.

³³This section draws heavily from a presentation by Dr. Frank Hu, Harvard University, at the IOM Workshop on the Public Health Effects of Food Deserts.

³⁴This is a hypothesis that could be empirically tested.

omnipresent—in supermarkets, corner stores, vending machines, and many other food and nonfood retailers.

Summary

There is clear evidence that the food environment is associated with the kinds of foods that people eat. But most studies are cross-sectional and cannot make causal links. A few studies have examined food intake before and after healthy options for food become available (either within existing stores or because new stores open). These studies show mixed results. Some show a small but positive increase in consumption of fruits and vegetables and other nutritious food, while others show no effect.

There is little evidence that shows that increased consumption of healthy foods such as fruits and vegetables, low-fat dairy, or whole grains leads to lower BMI or reduced risk of obesity. Stronger evidence suggests that the consumption of beverages, especially sweetened beverages, is linked with increases in BMI and obesity. Several studies find that the proximity of fast food restaurants and supermarkets are correlated with BMI and obesity, but most of these are cross-sectional studies. One study that attempts to control for the correlation between individual's preferences for foods and their choice of residential location shows that the proximity to a large grocery store is negatively linked to BMI and the proximity to fast food restaurants is positively linked to BMI, but both of these effects are small. In the case of obesity, easy access to all food may be a more important factor than lack of access to specific relatively nutritious foods. Increased access to healthy foods alone, without decreased consumption of all other foods, will likely have little impact on obesity among subpopulations of concern.

Studies that go beyond correlation and try to map out causal relationships between the food environment and diet and health outcomes are rare. In order to disentangle these relationships and to ultimately improve the design of interventions that may reduce the impact of access barriers, improvements in research are needed. Better models that relate the food environment to diet and health are needed to disentangle causal relationships and define tests of which factors may be most important in explaining the relationships (e.g., availability or price). Experimental studies that can isolate the effects of changes in the food environment to diet and health outcomes could help. Taking advantage of natural experiments or quasi-experiments where naturally occurring comparison groups or areas can be used to uncover causal pathways would be useful. Longitudinal data that can be used to determine changes in diet and health over time are also needed to improve what is known about the relationships between food environment and dietary health.

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Food Access and Its Relationship To Food Choice

Policymakers are concerned about people with limited access to healthy food because they believe it may influence food shopping and spending behavior, the prices of food faced by people in areas with limited access, and the types of foods purchased and consumed. This chapter examines these economic consequences of limited access. Food shopping behaviors for participants of the Supplemental Nutrition Assistance Program are summarized.³⁵ The chapter also considers food spending behavior for SNAP participants with different levels of access to supermarkets, examining the types of foods that SNAP participants purchase based on their access to supermarkets. Finally, the chapter analyzes data on the price of selected similar foods across different food retail outlet types.

Food Shopping Behavior for Participants of SNAP

SNAP serves as the foundation of America's national nutrition safety net for low-income families. In November 2008, more than 31 million persons participated in the program and received an average benefit of \$115. Benefits are targeted to the purchase of food for home use and are redeemed through more than 175,000 authorized stores.

Access to a variety of high quality and affordable foods is essential to meet the program's mission of improving food security, reducing hunger, and providing access to a healthful diet and nutrition education. Of particular concern are households who live in rural areas or low-income urban neighborhoods where access to stores that offer such quality and variety at reasonable cost may be limited. During the mid-1990s, USDA's Food and Nutrition Service implemented a research agenda to address questions about food access among SNAP and other low-income households. While these data are from the 1990s, they provide a foundation for exploring store access. At the same time, care should be taken to view these findings in the historical context in which they were generated. Several relevant changes have occurred during the last 15 years. For example, both the number and profile of authorized stores have changed. At the same time, there has been an increase in the percentage of SNAP benefits used in superstores and supermarkets. SNAP eligibility rules with respect to vehicle ownership are now less restrictive, which may expand store access.

In order to participate in SNAP, stores must apply for authorization and demonstrate that they meet established eligibility criteria. These criteria address the nature and extent of food business conducted; the volume of SNAP sales that can be reasonably expected; as well as the business integrity of the store applicant (7 CFR 278.1 (b)). The first criterion is operationally defined in terms of 1) a store's food sales volume in relation to overall sales and/or 2) inventory of staple foods and the variety of products available within specified staple food categories.

³⁵On October 1, 2008, the Food Stamp Program changed its name to the Supplemental Nutrition Assistance Program (SNAP). Because all of the research discussed in this section was conducted prior to the name change, most program references are to the Food Stamp Program.

These broad criteria enable FNS to authorize a wide variety of store types and sizes in many locations so that participants have a range of food shopping options. Table 5.1 compares the percentage of authorized retailers and benefits redeemed by store type in Fiscal Years (FY) 1994 and 2008.

Store types are defined in terms of the dollar value of annual gross sales and product lines offered. Supermarkets are defined as foodstores that provide a full range of foods and have \$2 million or more in annual gross sales. Large groceries have annual sales between \$500,000 and \$2 million, while small grocery stores have annual sales of less than \$500,000.³⁶ Convenience stores provide a more limited range of foods, usually excluding fresh produce. Specialty stores primarily sell one or two product lines, such as produce, meats, or baked goods. Examples of other store types include nonprofit food buying co-op stores and combination grocery/other stores.

The largest category of stores in both FY 1994 and FY 2008 is convenience stores; they accounted for 27 and 35 percent of all authorized stores, respectively. In contrast, the majority of program benefits are spent in supermarkets or other large stores³⁷ – 77 percent in FY 1994 and 87 percent in FY 2008. These data exemplify the rise in the use of superstores for SNAP participants. On the other hand, redemptions at medium-sized grocery stores have decreased since 1994.

SNAP benefit redemptions in relation to where participants live

Historically, much of the research on food deserts has focused on geographic proximity to food retailers. While this work offers one perspective on store access, another is to examine where low-income families actually shop. Mantovani and Welsh (1996) report that food stamp shoppers tended to use their benefits outside of the ZIP Code in which they live. This pattern was

³⁶The 2008 data include a category for medium sized stores. For this classification, stores with sales of \$1 million to \$2 million are large, \$250,000 to \$1 million are medium, and less than \$250,000 are small.

³⁷In FY 1994, this category included supermarkets and large grocery stores. In FY 2008, the category includes supermarkets, superstores, and large grocery stores.

Table 5.1
Percentage of Authorized Retailers and SNAP Redemptions by Category FY 1994 Versus FY 2008

Store type	Authorized retailers		Benefits redeemed	
	FY 1994	FY 2008	FY 1994	FY 2008
			<i>Percent</i>	
Supermarkets	15	12	77	47
Superstores	na	8		37
Large grocery stores ¹		2		2
Medium grocery stores	25	6	11	2
Small grocery stores ²		9		2
Convenience stores	27	35	4	4
Combination stores ³	16	17	3	2
Farmers' markets	<1	<1	<1	<1
All other	17	9	5	2
Total	100	98	100	98

¹In FY 1994, data for large grocery stores and supermarkets was combined.

²In FY 1994, data for small and medium grocery stores was combined.

³This category includes stores such as independent drug stores, dollar stores, and general stores.

na =not applicable.

Source: USDA, FNS calculations based on 1994 and 2008 administrative data on SNAP redemptions.

more noticeable in rural areas, where recipients shopped in relatively larger population centers. Even in urban areas, however, households traveled beyond their neighborhood supermarkets to more affluent areas and/or to other low-income ZIP Codes to access stores offering items of particular interest, such as fresh fruits and vegetables or ethnic products.

FNS also surveyed nationally representative samples of participants, eligible nonparticipants, and near-eligible nonparticipants with questions about shopping patterns and access to stores in the National Food Stamp Program Survey (Ohls et al., 1999). Like other surveys of this kind, a disproportionate number of long-term participants were included, and determinations of eligibility could only approximate the criteria applied by the program.

Ohls et al. (1999) reported that nearly 90 percent of each low-income group used supermarkets as their main foodstore. Even among participants who reported that they usually did not shop at supermarkets, all but 2 percent reported that they sometimes used such stores.

Among program participants, the average distance to the nearest supermarket was 1.8 miles. In contrast, the average number of miles to the store used most often by participants and eligible nonparticipants was 4.9 miles. A similar study that used electronic benefits transfer (EBT) redemption data in the State of Maryland also found that SNAP participants redeemed benefits at stores farther than the nearest SNAP food retailer (Cole, 1997). This study found that in Maryland, the average distance traveled to redeem SNAP benefits was 2.7 miles, but the average distance to the nearest store was 0.3 miles. These data suggest low-income households typically bypassed nearby supermarkets to use stores farther from home.

Thirty-eight percent of participants and 34 percent of eligible nonparticipants reported that they did not shop in their neighborhoods. About half of each group said this was because there was no store nearby. Average distance to the most frequently used store among those reporting no neighborhood retailers was higher than the average distances reported by the overall participant and eligible nonparticipant samples. The average reported distance to the most frequently used store was 9.2 miles for participants with no neighborhood stores, compared to an average of 4.9 miles for the overall sample of food stamp households.

EBT transaction patterns

FNS has continuously tracked benefit redemption by store in the aggregate. With the introduction of EBT systems, it became feasible to examine shopping patterns at the household level. Maryland was the first State to operate EBT Statewide and provided FNS an opportunity to track the frequency, location, dollar value, and timing of household food purchases (Cole, 1997). Supermarkets comprised just 17 percent of authorized food stamp stores in Maryland at the time of the study. However, 44 percent of Statewide food stamp purchases occurred in supermarkets, and 72 percent of benefits were used in supermarkets. On any given day in the month, the supermarket percentage of total daily redemptions throughout the State was roughly constant. The same pattern occurred for other store types. This conflicts with the expectation that recipients make their large purchases in

supermarkets early in the month and fill in with smaller buys at other store types during the rest of the month.

More recently, FNS analyzed a national sample of EBT transaction data that was linked to store and household characteristics (Cole, 2005). Participants spent most of their food stamp benefits in supermarkets. Supermarkets accounted for 64 percent of all EBT purchases and 83 percent of the dollar value of food stamp benefits redeemed. Over 46 percent of food stamp households shopped exclusively at supermarkets, while less than 6 percent never shopped in supermarkets. The latter families were concentrated among households receiving the minimum monthly benefit, \$10 or less.

Shopping patterns did not vary substantially across community characteristics. The average number and dollar amount of purchases among households in counties with persistent poverty mirrored the national averages. The percentage of households with no supermarket purchases was almost the same in areas with persistent poverty (6 percent) as in areas without (5 percent). Similarly, the data show little difference across urban, suburban, and rural households. The percent of food stamp benefits redeemed in supermarkets ranged from 80 percent among rural families to 85 percent among households in suburban areas.

The aggregated redemption data for FY 2008 show that a majority of benefits are spent in large stores: 87 percent of food stamp benefits were redeemed in superstores, supermarkets, or large grocery stores. Only 4 percent of benefits were redeemed in convenience stores, and another 4 percent were redeemed in small to medium grocery stores.

Spending on Different Food Groups and Access to Supermarkets

The analysis now addresses the questions of what foods people buy and how access may influence purchase behavior. Using national data from the NFSPS, Rose and Richards (2004) examined the effects of limited access to supermarkets on the amount of fruit and vegetable purchases. Access to a supermarket was defined by three variables—distance to store, travel time to store, and car ownership. The study found that limited access to a supermarket was negatively related to the purchase of fruits and vegetables, but only the effect on fruits was statistically significant.

This analysis uses the same data used by Rose and Richards (2004) to examine the amount of food from different food groups purchased per week by SNAP participants. The study by Rose and Richards (2004) is extended in three ways. First, fruits and vegetables are separated into canned and noncanned forms. Limited access to a supermarket is hypothesized to exert greater effects on the purchase of noncanned produce than canned produce since many smaller grocery stores and convenience stores sell mostly canned, but not necessarily fresh fruits and vegetables. Additionally, potatoes and dried beans are treated as a separate vegetable category. The analysis also examines purchases of milk and other dairy products. Like fresh produce, milk and dairy products are perishable, so that milk purchases are hypothesized to be negatively affected by limited access to a supermarket.

Second, survey respondents were also asked whether they did their major food shopping at a supermarket as well as the frequency at which they shopped for food. The analysis combines these two variables to develop three mutually exclusive categories of access to a supermarket: major food shopping was not at a supermarket, no matter how frequently shopping was done; major food shopping was at a supermarket but shopping was infrequent (less than once in 2 weeks); and major food shopping was at a supermarket and was conducted at least once every 2 weeks. The measure of shopping frequency is intended to capture difficulty in getting to a store—if stores are relatively close and the costs (both time and travel costs) are low, then it is expected that respondents will shop more frequently. But if costs to getting to a supermarket are high, we would expect respondents to make less frequent trips to the supermarket.

Third, the extension to the Rose and Richards study accounts for the censored nature of food expenditures. In a given week, some households may not make any purchase of the food groups in question. To accommodate this data issue, the analysis employs the Tobit censored regression model, as discussed later.

Data

Data for examining supermarket access on food purchases are drawn from the NFSPS, conducted by Mathematica Policy Research, Inc. for USDA's FNS. The NFSPS employed computer-assisted personal interview (CAPI) methods to collect data on household food purchases among food stamp recipients between June 1996 and January 1997. Respondents reported their 7-day food use (some households were asked to provide four-day records), which included data on both the quantities and prices of food used as well as expenditures on food at home and away from home. This is the only USDA survey in which household food use (quantity and expenditure) data were collected since the 1987-88 Nationwide Food Consumption Survey. Social, demographic, and economic characteristics of households were also collected.

Data such as the National Health and Nutrition Examination Survey (NHANES) could be used to model food consumption, but the NHANES data do not include measures of food retail access. Further, it is not feasible to link NHANES data with geographically identifying data that could be used with more direct measures of access to food retailers (e.g. distance to supermarkets, number of supermarkets in the area, and the variety of food markets in the area).

In total, 1,109 in-person interviews were completed from the SNAP list frame, and 1,069 households provided complete information on quantity and expenditure data. After excluding households with missing information, the final sample totals 860 households.

There are more than 2,000 foods recorded in NFSPS, and they are aggregated according to the research focus of the project. Insufficient intake of foods rich in fiber and calcium (such as fruits, vegetables, and dairy products) is a major dietary deficiency facing Americans, especially the low-income subpopulation (Lin, 2005). The analysis hypothesizes that households with

limited access to supermarkets tend to spend proportionally less of their food budget on perishable foods, such as fresh fruits, fresh vegetables, and dairy products, than households that shop mainly at supermarkets. This study focuses on household purchases of five food groups—dairy products, noncanned fruits, noncanned vegetables, canned fruits, and canned vegetables.

The NFSPS collected data on access to and shopping at supermarkets. NFSPS respondents were asked if they did their food shopping at supermarkets, whether they had private vehicles or public transportation for food shopping, the distance and travel time to the stores in which they shopped, and the frequency of food shopping. Most of these variables are highly correlated. Only 7 percent of the sample households (64 out of 860) indicated that they did not shop mainly at supermarkets (table 5.2). Among those who shopped mainly at supermarkets, 27 percent (218 out of 796) shopped less than once in 2 weeks. In this study, three mutually exclusive categories are specified to signify limited access to a supermarket: major food shopping was not at a supermarket, no matter how frequently shopping was done; major food shopping was at a supermarket but shopping was infrequent (less than once in 2 weeks); and major food shopping was at a supermarket and was conducted at least once every 2 weeks. This three-part measure of access is an individual measure of access and not an area-based measure of access like those used in the previous chapter.

Tobit censored regression model

On any given week, some food stamp households did not purchase a particular food group. Therefore, a cluster of zero consumption values for a particular food group is observed in the data—making it necessary to estimate a censored regression model. Any statistical procedure that does not account for zero observations produces inconsistent parameter estimates. Tobin (1958) was the first to propose a censored normal regression model (Tobit model) to deal with censored data in regression, which can be expressed as below

$$(1) \quad \begin{aligned} q_i &= x'\beta_i + \varepsilon_i && \text{if } x'\beta_i + \varepsilon_i > 0 \\ &= 0 && \text{if } x'\beta_i + \varepsilon_i \leq 0, \quad i = 1, 2, \dots, n, \end{aligned}$$

where q_i denotes the endogenous variable, x is the vector of exogenous variables, and ε_i is the error term. The Tobit procedure was used to estimate 6 censored purchase equations.

Results

Six separate Tobit equations are estimated to examine the relationship between limited access to a supermarket on household purchases of fruits, vegetables, and milk. Fruits are disaggregated into canned and non-canned forms; vegetables are disaggregated into canned, potatoes and beans, and noncanned vegetables. Supermarket access is represented by a set of categorical variables: major food shopping was not at a supermarket, no

Table 5.2

Descriptive statistics of the NFSPS respondents

	Supermarket shopping			
	Total	Frequent shopper	Infrequent shopper	Not shop at
Sample	860	578	218	64
Average purchase	<i>Pounds per week</i>			
Noncanned vegetables	3.73	3.93	3.32	3.30
Canned vegetables	2.06	2.05	2.14	1.79
Potatoes and beans	2.95	3.05	2.92	2.10
Noncanned fruits	5.92	6.23	5.38	4.94
Canned fruits	1.59	1.66	1.51	1.19
Milk and dairy products	12.29	12.71	12.31	8.52
Proportion consuming	<i>Percent</i>			
Noncanned vegetables	85	86	83	78
Canned vegetables	69	67	73	70
Potatoes and beans	82	83	81	81
Noncanned fruits	83	85	80	78
Canned fruits	42	42	43	36
Milk and dairy products	97	97	98	94
Mean values of explanatory variables:				
Per capita income (\$/month)	305			
Meal number (# meals prepared from food purchase)	48			
	<i>Percent</i>			
Four day (sample report only 4-day purchase)	8			
Asian (sample)	1			
Black (sample)	39			
Native American (sample)	1			
Hispanic (sample)	13			
White (sample)	46			
Single-headed (sample with one head)	34			
Child (sample with children under 18)	56			
Elderly (sample with senior > 60)	27			
Less than high school (head without HS diploma)	46			
High school (head with HS diploma)	38			
College (head attended college)	16			
Rural (living in rural area)	15			
West	38			
South	20			
Midwest	24			
Northeast	18			
Spring	24			
Summer	24			
Fall	29			
Winter	23			

Source: USDA, ERS calculations based on 1996-97 National Food Stamp Program Survey data.

matter how frequently shopping was done; major food shopping was at a supermarket but shopping was infrequent (less than once in 2 weeks); and major food shopping was at a supermarket and was conducted at least once every 2 weeks (the reference group). The results are shown in table 5.3.

As expected, households that did not shop mainly at a supermarket tended to purchase significantly smaller amounts of noncanned vegetables, noncanned fruits, and milk than households that shopped frequently at a supermarket. Households that did not shop at a supermarket also purchased less canned fruits and vegetables as well as potatoes and beans, but the differences are not statistically significant at the 10-percent level. Compared to households that shopped frequently at a supermarket, infrequent supermarket shoppers purchased less of the six food categories in question, but the differences are not significant.

As indicated earlier, underconsumption of fruits, vegetables, and milk is a major dietary deficiency facing Americans, especially low-income Americans. The results suggest that food stamp recipients who did not shop at a supermarket purchased less of these already under-consumed foods than recipients who shopped frequently at a supermarket.

The Tobit results also point to other important determinants of food purchases. The number of meals (number of people and number of occasions) prepared from the weekly food purchases, as expected, positively affects the purchased amounts of the six food groups. Household purchases of these six food groups appear to vary by race and ethnicity. Compared with Whites, Asian and Hispanic households tend to buy more noncanned vegetables and noncanned fruits but less of canned vegetables and potatoes and beans. Black households tend to purchase less milk and potatoes and beans than Whites. Households with children purchase less noncanned vegetables but more canned fruits and milk than households without children. Households with elderly individuals buy more noncanned vegetables than households without elderly members. Sample members are grouped into three education categories—less than high school, high school graduate, and attended college. No differences are found across these education levels. Per capita income (within the low-income sample of SNAP participants) is not associated with differences in the purchases of any of the six food categories.

Price Differentials and Store Format

Another important consequence of limited access to foodstores is that consumers may face higher prices for food at the retail outlets that are available. As Chapter 5 noted, higher prices in some stores or areas may be due to lower volume of sales, higher fixed costs, or other reasons. This section compares prices of three selected goods—milk, ready-to-eat cereal, and bread—which are sold in almost all types of food retail outlets. There is not enough detailed information to compare prices in areas with limited access with those with better access. Instead, price variation is examined across store type—grocery, convenient, discount, and other stores.

Table 5.3
Tobit results

	Vegetables			Fruits		Milk
	Non canned	Canned	Potatoes Beans	Non canned	Canned	
Intercept	0.76	0.38	1.52 **	0.79	-5.95 ***	7.05 ***
Meal number	0.06 ***	0.02 ***	0.04 ***	0.07 ***	0.04 ***	0.13 ***
Four day	0.55	-0.97 **	0.27	-0.38	-0.97	-0.84
Income per capita	0.00	0.00	0.00	0.00	0.00	0.00
Asian	3.43 **	-2.91 **	-3.37 ***	6.76 ***	-1.00	-5.50 *
Black	0.25	0.27	-1.07 ***	0.12	-0.60	-5.60 ***
Native American	-0.01	-0.04	-0.60	0.13	-0.17	-3.61
Hispanics	1.09 *	-1.90 ***	-1.15 **	4.03 ***	0.24	-1.78
Single-headed	-0.23	0.41	0.34	0.17	-0.20	1.48 **
Child	-1.20 **	0.35	0.14	0.42	1.98 ***	4.33 ***
Elderly	0.98 **	-0.31	-0.36	0.84	-0.57	0.07
High school	-0.26	0.24	-0.21	0.17	0.52	-0.02
College	0.68	-0.12	-0.22	1.30 *	0.71	-0.79
Rural	-0.43	0.04	0.14	0.18	-0.33	-1.25
West	0.31	1.08 ***	1.09 ***	-0.79	0.91	0.90
South	0.06	-0.18	-0.94 **	-0.12	0.44	-0.47
Midwest	-1.00 *	0.16	-0.51	-1.27	0.35	-0.26
Spring	0.42	-0.46	-1.12 **	0.67	1.20	-1.92 *
Summer	1.07 *	-0.10	-0.33	2.08 ***	0.19	-1.29
Fall	-0.44	-0.06	-0.18	-0.98	0.29	-1.27
Did not shop at a supermarket	-1.32 **	-0.07	-0.28	-1.88 **	-0.47	-2.54 **
Shopped infrequently at a supermarket	-0.60	-0.08	-0.28	-0.86	-0.13	-0.07
Scale	4.72	3.13	3.78	7.12	5.97	9.59

Significance levels: ***, **, and * denote 1, 5, and 10 percent, respectively.

Source: USDA, ERS Tobit model estimations based on 1996-97 National Food Stamp Program Survey data.

Literature review

Many studies have examined price disparities across income class, store format, and accessibility (Andreyeva et al., 2008; Block and Kouba, 2006; Broda et al., 2009; Chung and Myers, 1999; Hayes, 2000; Hendrickson et al., 2006; Latham and Moffat, 2007; Talukdar, 2008). A limitation of these studies is their use of observed prices in a regional setting rather than actual prices paid on a national level. Kaufman et al. (1997) provides a review of literature on food price disparity dating back to the 1960s and identifies the complexities of undertaking such research.

Andreyeva et al. (2008) replicated a 1971 study of food availability and price in New Haven, Connecticut. Their findings show improvement in availability and price since 1971. Findings indicate differences across store types—grocery stores were approximately 4 percent cheaper than convenience stores for a basket of goods. The study also found that high-income areas faced higher prices than low-income areas.

Block and Kuoba (2006) compared prices for a market basket of goods in different types of stores in the Austin and Oak Park sections of Chicago. Austin is a lower-middle-class African-American community that borders Oak Park, an upper-middle-income suburb. They find mixed results. Discount supermarkets showed the lowest prices. Independent grocery stores had higher prices for packaged goods than chain supermarkets, but lower prices for fresh items.

Broda et. al (2009) analyzed actual consumer purchases and found that poor households pay less for food items they purchase than households with higher incomes—a 10-percent increase in income roughly induces a modest 0.1-percent increase in prices paid per food item. They also found that poor households tend to shop more frequently at discount stores and supercenters. Even after controlling for household characteristics and product fixed effects, the study found that poorer households pay a lower price even in stores of the same retail chain.

Chung and Myers (1999) conducted a survey in the Twin Cities metropolitan area to determine how store type (nonchain/convenience store versus chain/supermarket) and neighborhood quality (measured by percent of households under the poverty level within a zip code) affects price of a food market basket. They conclude that store type is more important in driving price disparities than the geographic location of a household—the premium for shopping at a convenience and/or nonchain store outweighs the premium for shopping in a poor neighborhood. Limitations to their methodology include the way missing price values were treated. When price for a selected item is missing, the least expensive brand/size product (e.g., an in-store brand in its largest package size) was used. When a selected item was not available in the store, the sample mean price was used. Additionally, the use of regional data based on “sticker prices” (those listed on the shelf) as opposed to actual transaction prices at the national level do not control for promotional purchases (e.g., on-sale and coupon use).

Hayes (2000) analyzed prices in New York City to establish if prices in low-income neighborhoods were indeed higher than those in more affluent neighborhoods. The study concludes that the mean price for a market food basket is 2 percent higher in more affluent neighborhoods although the means are not significantly different. Even after controlling for the price of on-sale items and generic branding, the prices in low-income neighborhoods were not significantly different than in more affluent neighborhoods. The author does acknowledge that it is possible that the quality of food items purchased by the poor is below that of the items purchased by the more affluent.

Hendrickson et al. (2006) studied prices of selected Thrifty Food Plan foods in four Minnesota communities with higher than average poverty (two rural and two urban). The study examined prices offered in grocery stores in

these communities for the TFP foods and compared their prices with those of the TFP Market Basket Price (MBP). If a food was found in the grocery store, the price of the lowest price version of the food (price per pound) was recorded. The study found that in the two urban areas, 6 and 9 out of the 19 foods studied were more expensive than the TFP MBP. In the two rural areas, 2 and 4 of the 19 foods studied were more expensive than the TFP MBP. Over all of these communities, the prices per pound of fresh produce were equal or less expensive than the TFP MBP price. Although this study uses the lowest price per pound product in the store for a selected food, it still only uses the available price instead of the actual paid price. Further, the TFP MBP is a national price average so it is not clear if the prices in the Minnesota communities studied are different from the TFP MBP because prices in the neighborhoods are different or because the State or region has different prices.

Mantovani et al. (1997) examined information on MBP for each store in a national sample of stores authorized to redeem SNAP benefits. Market basket quality was measured in terms of the availability of acceptable items as guided by a USDA publication on buying quality food (1975). This analysis focused on product availability and cost in areas with different concentrations of poverty. In urban areas, market basket costs in supermarkets and large grocers were nearly equivalent across levels of poverty. Prices were less at “other” stores located in high-poverty areas than those in lower poverty areas. In rural areas, market basket costs were consistently similar in higher and lower poverty areas.

Latham and Moffat (2007) study prices of a market basket of goods across store types in low and higher income neighborhoods of Hamilton, Ontario, Canada. They find that prices at supermarkets in low income areas were similar to prices at areas that were not low income. Prices were higher, however, at variety stores, which offer fewer groceries but more nonprescription drugs, tobacco products, and other products, operating in low-income areas.

Talukdar (2008) investigated prices faced by the poor for both food and nonfood items in Buffalo, New York, and surrounding suburban neighborhoods. The study found that the inner-city neighborhoods experience a weakened competitive market leading to cost-inefficient “corner stores” which have a 6-7 percent premium over regional or national chain grocery stores. Even after controlling for economies of scale and competitive environments, prices were 2 to 5 percent higher in the poorest neighborhoods.

This study extends the literature by analyzing actual consumer purchases at a national level, rather than observed “sticker prices” in certain localities. Furthermore, the study will focus on particular food items rather than representative “food baskets,” enabling the pricing models to control for specific product attributes such as milk fat and whole grain, as well as for market factors such as promotional on-sale prices and coupon use. The study also borrows from a recent analysis conducted in conjunction with ERS, which explores actual prices paid by consumers across different income levels (Broda et al., 2009).

Table 5.4

Descriptive statistics of variables used in price analysis

Variables	Definition	Fluid milk		RTE cereal		Bread	
		Convenience store	All other	Convenience store	All other	Convenience store	All other
Price	Unit value (expenditure net of any promotions divided by the corresponding quantity), cents per ounce	2.47	2.59	16.17	16.71	8.67	9.03
Income	The ratio of household income over the federal poverty level; where income is the midpoint of the income class	3.57	3.83	3.59	3.73	3.18	3.73

Market shares (percent of purchase occasions)

Grocery store	Purchase occasion at grocery store	73		67		72	
Convenience store	Purchase occasion at convenience or drug store	5		2		1	
Discount store	Purchase occasion at supercenter or club warehouse	17		20		17	
Other stores	Purchase occasion at other store	5		10		9	
Promotional sale	Purchase made on-sale or with a coupon	27	18	69	36	19	23
Spring	Purchase in spring (Jan-Mar)	27	26	27	26	26	25
Summer	Purchase in summer (Apr-Jun)	24	25	23	25	24	25
Fall	Purchase in fall (Jul-Sept)	25	25	28	26	26	25
Winter	Purchase in winter (Oct-Dec)	25	24	22	23	24	24
East	Northeastern census region	28	20	26	18	22	20%
Central	Midwestern census region	33	24	29	26	35	24
West	Western census region	11	20	19	22	13	20
South	Southern census region	29	35	26	35	29	36
Urban	Purchase in urban area	81	77	85	77	78	77
Pint	16 oz. used as midpoint (0 - 24 oz.)	2	1	--	--	--	--
Quart	32 oz. used as midpoint (25 - 48 oz.)	4	6	--	--	--	--
Half gallon	64 oz. used as midpoint (49 - 96 oz.)	26	33	--	--	--	--
Gallon	128 oz. used as midpoint (> 97 oz.)	68	60	--	--	--	--
Skim	Less than 0.5g of fat*	18	24	--	--	--	--
Low-fat	Less than 4.7g of fat (includes 0.5%, 1%, 1.5%, 2%)*	58	54	--	--	--	--
Whole	8g of fat*	24	22	--	--	--	--
Size	Continuous quantity (1 oz. - 81 oz.)	--	--	15.18	17.58	--	--
Whole-grain	Identified as a whole-grain product	--	--	60	52	13	21
Small size	16 oz. used as midpoint (0 - 18 oz.)	--	--	--	--	25	27
Medium size	20 oz. used as midpoint (19 - 22 oz.)	--	--	--	--	44	33
Large size	24 oz. used as midpoint (> 22 oz.)	--	--	--	--	31	40
No. observations		55,000	978,414	14,759	660,650	9,873	876,944
		1,033,414		675,409		886,817	

Source: USDA, ERS calculations based on 2006 Nielsen Homescan Panel data.

Data

The data source for investigating price differentials by store type is the 2006 Nielsen Homescan panel data. The panelists constitute a random sample that is representative of the U.S. population and provides purchase information of food items for at-home consumption. Each household is supplied with a scanner device that the panelist uses at home to record grocery items purchased at all retail outlets. The household either scans the Uniform Product Code (UPC) or a designated code for random-weight purchases for each food item. Each purchase records the date, the quantity purchased, expenditures for that quantity, promotional information including whether or not the item is on sale, and detailed product characteristics.

Total enrollment in the Homescan panel for 2006 was over 37,000 households, but to avoid would-be data problems resulting from incomplete reporting, only those households that reported purchases for at least 10 months were included. Panelists report total expenditures and the quantity of food purchased. Prices are derived as unit values – the ratio of reported expenditures, net of any promotional and sale discounts, to the reported quantities for each purchase record.

Each purchase record is identified by store type (grocery, convenience, discount, and others),³⁸ day of purchase, whether the purchase was made with a discount, and an array of product attributes. Each panelist also provided data on his or her social, economic, and demographic characteristics, including income, household size, and place of residence.

This study examines the prices of the three most popular healthy food items purchased by Homescan panelists at convenience stores and also at grocery stores—fluid milk, ready-to-eat cereals (RTE cereals hereafter), and bread.³⁹ For milk, attributes include fat content (nonfat/skim, low-fat, or whole) and container size (pint, quart, half gallon, or gallon). Buttermilk, soy, and flavored milk are not included in the analysis. For cereals and bread, attribute data include container size and whether it is a whole grain bread or cereal. Rolls, buns, muffins, and other sweetened breads, such as cakes and donuts, are excluded from the data set. Although the three aforementioned foods examined in this study could be considered loss leader products,⁴⁰ the model controls for in-store promotions and coupon use. Table 5.4 provides a list of variables constructed from the data to be used in the empirical estimation with descriptive statistics.

Hedonic pricing model

The analysis of price differences at grocery stores and convenience stores is carried out using the hedonic model, which is based on Lancaster's (1966) characteristics demand theory that consumers derive utility from the characteristics or attributes inherent in a good or service. The price consumers pay for a good is the sum of the values consumers assign to the good's attributes, as shown below.

$$(2) \quad P_i = \alpha_0 + \sum_{r=1} \alpha_r MKT_{rit} + \sum_{s=1} \beta_s PRO_{sit} + e_i$$

³⁸Homescan does not differentiate between the sizes of grocery stores (i.e., large specialty grocers, such as Whole Foods, and large grocers, such as Publix, Giant, and Safeway, are all considered grocery stores). Discount stores include large supercenters such as Super Wal-Mart and Super Target and warehouse stores.

³⁹These are the most frequently purchased goods at convenience stores for all consumers, not just low-income consumers. We considered studying prices of fruits and vegetables and other "healthy" food options across store outlet type, but the sample of purchases was too small (i.e., not enough of these types of goods were purchased from convenience stores to study their prices).

⁴⁰Loss leader pricing of products is a marketing strategy in which retailers set low prices for particular "loss leader" products, typically below or at cost, to attract customers into the store to buy other products.

Table 5.5

Hedonic results

Variable	Fluid milk		RTE cereal		Bread	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Constant	2.419***	0.025	22.879***	0.220	6.338***	0.137
Income	0.024***	0.002	0.334***	0.016	0.317***	0.008
Convenience	0.129***	0.031	5.839***	0.775	0.620***	0.200
Discount	-0.202***	0.016	-0.720***	0.114	-0.351***	0.063
Other	-0.188***	0.030	-2.351***	0.150	-1.334***	0.061
On sale	-0.508***	0.016	-3.695***	0.106	-1.669***	0.065
Spring	0.026***	0.005	-0.310***	0.036	-0.314***	0.017
Summer	-0.035***	0.005	-0.035	0.040	-0.262***	0.016
Fall	-0.034***	0.004	-0.128***	0.032	-0.190***	0.016
East	-0.417***	0.044	0.297	0.210	0.640***	0.120
Central	-0.437***	0.027	-0.226	0.171	-0.067	0.121
West	-0.210***	0.035	1.110***	0.168	1.254***	0.193
Urban	0.019***	0.019	0.644***	0.113	0.323***	0.100
Income*conv	-0.008	0.005	-0.289***	0.043	-0.153***	0.045
Pint	4.213***	0.173	--	--	--	--
Quart	1.988***	0.042	--	--	--	--
Half gallon	0.983***	0.026	--	--	--	--
Skim	-0.087***	0.015	--	--	--	--
Low-fat	-0.062***	0.013	--	--	--	--
Pint*conv	0.896***	0.181	--	--	--	--
Quart*conv	0.072	0.069	--	--	--	--
Halfgal*conv	-0.429***	0.056	--	--	--	--
Skim*conv	-0.095**	0.045	--	--	--	--
Low-fat*conv	-0.053**	0.027	--	--	--	--
Whole-grain	--	--	0.068	0.046	1.592***	0.042
Size	--	--	-0.366***	0.009	--	--
Size*conv	--	--	-0.373***	0.045	--	--
Small	--	--	--	--	4.986***	0.091
Medium	--	--	--	--	0.478***	0.100
Small*conv	--	--	--	--	-2.181***	0.387
Medium*conv	--	--	--	--	0.404**	0.199
No. of obs.	1,033,414		675,409		886,817	
R-squared	0.511		0.159		0.268	

Source: USDA, ERS hedonic regression model estimations based on 2006 Nielsen Homescan Panel data.

where P_{it} is the price paid by the i -th household in time t ; MKT_{it} represents a set of market factors such as income (a measure of neighborhood store and product quality), type of store, promotional offering, season, region, and urbanicity of purchase; PRO_{it} represents product attributes; and e_{it} is the error term. Interaction terms between convenience store purchases and product attributes, as well as income, allow for the testing of additional price differentiations observed in convenience stores.

Results

Milk, RTE cereals, and bread are three of the most frequently purchased items at both convenience stores and grocery stores by Homescan panelists. The hedonic model is specified in linear functional form so that estimated coefficients represent price premiums or discounts. The hedonic results are summarized in table 5.5. The R-squared is 51 percent for milk, 16 percent for RTE cereals, and 27 percent for breads. These goodness-of-fit measures are quite high for cross-sectional studies, implying that the data fit the model reasonably well. “Grocery” is treated as the reference store in the model so that the estimated coefficient for “Convenience” measures the price difference between the two types of stores. Specifically, a positive (negative) coefficient for “Convenience” store indicates that consumers pay a higher (lower) price at a convenience store than at a grocery store. Income is included to capture store, product, and neighborhood quality attributes unobserved in the data. In particular, a household’s income is expected to be associated with the quality of shopping venue and product offering, which, in turn, would be reflected in the price paid.

Fluid milk

The price of milk is expressed as cents per fluid ounce (128 ounces in a gallon). The estimated constant term suggests an average price of 2.42 cents per ounce (or \$3.10 per gallon) for whole milk in a gallon container sold in a grocery store in the Southern United States in the winter. The results suggest that the same milk is sold at a price 0.13 cents per ounce higher at a convenience store, or about 5 percent above the grocery store price. As expected, consumers pay a lower price at discount stores, such as Wal-Mart, at an average of 0.2 cents per ounce below the grocery store price. The estimated coefficient for “Income” (a measure of store and product quality) is significant but small, indicating that the price of milk in a grocery store increases only slightly with income. Additional variation in price associated with income in a convenience store (measured by the interaction between “Income” and “Convenience”) is found to be insignificant.

Differences in milk prices between convenience and grocery stores vary by container size and fat content, as indicated by some significant coefficients for the interaction terms between convenience store and milk type. Adding the estimated coefficient for the container size “Pint” (i.e., 4.21 cents) to the constant term of 2.42 cents helps determine the average price (cents/oz) of a pint of whole milk sold in a grocery store in the Southern United States in the winter (6.63 cents/oz or \$1.06/pint). The same pint of milk is sold for 1.03 cents more (0.13 + 0.90) at convenience stores, or about 16 percent more than in a grocery store. A half gallon of whole milk was priced at 3.40 cents/

oz (2.42 + 0.98) at grocery stores, but there was actually a price discount (0.3 cents/oz) for such milk sold at convenience stores.

More than a quarter (27 percent) of milk purchases at convenience stores was associated with a promotion (i.e., sale or coupon use), compared with 18 percent of all purchases recorded elsewhere (table 5.4). When milk was purchased under a promotion with a discount, the discount averaged about 20 percent below the regular price. This price discount of 20 percent is quite large, compared with the 5-percent price premium for convenience store milk over grocery store milk, suggesting that the use of a coupon or promotional shopping habits could effectively lower the price of milk purchased at a convenience store or grocery

RTE cereals

RTE cereals were priced at an average of 22.87 cents/oz in a grocery store (in the Southern United States and in the winter), or about \$4 per box in its average container size reported in table 5.4. Consumers paid 5.84 cents/oz (25 percent) more at convenience stores. As expected, a lower unit price is associated with larger packaging. The interaction between the packaging size and a convenience store purchase modeled by the variable “Size*conv” (-0.37) in combination with “Size” (-0.37) indicates that price of cereal relative to packaging size falls twice as fast in a convenience store (-0.74) as in a grocery store (-0.37), signifying that size has more influence on price in a convenience store.

Like milk, RTE cereal in a grocery store increases in price with the affluence of the neighborhood, as measured by household income. However, the interaction term between income and convenience store is negative and significant (-0.29) and must be interpreted in conjunction with the income variable (0.33). This suggests less price variation in convenience stores relative to store and product quality, as measured by income.

In general, whole-grain cereals command a higher price, although the price differential is quite small. A surprisingly large proportion (69 percent) of convenience store RTE cereals were purchased under a promotional discounted price, compared with the share reported for those purchased elsewhere (table 5.4). The average discount is 3.69 cents/oz, which is 16 percent of the regular price. Clearly, purchasing items on sale or using a coupon can effectively offset the higher price that consumers face at convenience stores.

Bread

Bread in its largest 24-ounce size was priced at an average of 6.34 cents/oz at grocery stores and about 0.62 cents (about 10 percent) more at convenience stores. When bread was purchased on sale or with a coupon, the average price dropped to 4.67 cents/oz (26 percent of the regular price). Prices of bread also varied greatly by package size, and unlike whole-grain RTE cereals, whole-grain bread commanded a large and significant price premium, averaging 1.59 cents/oz (or 25 percent of the price of non-whole-grain breads). Like the case of milk, price differentials between convenience store bread and grocery store bread varied by package size. The estimated

coefficients indicate that medium- and large-sized bread (constituting 76 percent of convenience store purchases) was priced higher in a convenience store than in a grocery store. Yet, bread sold in a small package size was priced lower in a convenience store.

As with RTE cereal, the variable “Income” was used as a measure of neighborhood store and product quality. The results indicate that the effect of income on grocery store prices (0.32) is about twice that of the effect on convenience store prices (0.32 – 0.15). This again points to less price variation across neighborhood store and product quality (income) for convenience store purchases relative to grocery store purchases. Higher household income increases the probability that a household will choose to shop at a specialty foodstore, which tend to maintain higher prices on average.

Discussion

Grocery stores generally stock a multitude of product offerings that present consumers with choices of brand, size, quality, and other product attributes. This results in greater price disparity for particular food items. Convenience stores have more limited intra-product choices. Therefore, consumers face a relatively constricted price range in convenience stores as compared with grocery stores. Access to a grocery store allows consumers to choose from a wider array of products, thereby allowing consumers to choose items whose prices fall within their budgets.

The analysis of price variation for similar goods across different store types shows that prices are higher, on average, at convenience stores than they are at grocery stores, and this finding is confirmed in the literature (Broda et al., 2009). Relatively easy access to convenience stores and smaller food retailers in some neighborhoods may lead to higher prices for food for people who live in those neighborhoods. But this argument assumes that people who live in these neighborhoods do not shop at large stores or search for sale items. Broda et al. (2009) use 2005 Nielsen Homescan data to address the effects of access to different types of stores on overall shopping expenditures and prices paid by lower income consumers. The analysis does not directly consider access to stores or shopping patterns but instead focuses on differences across household income levels.

Broda et al. (2009) show that across all income levels, 52-57 percent of all food purchases are made at grocery stores. Spending on food at convenience stores is a very small portion of shoppers’ food budgets, even for those at the lowest income levels. Those with the lowest incomes (from \$5,000 to \$11,999) spend 2 to 3 percent of their total food expenditures in convenience stores, while the highest income consumers (annual income over \$100,000) spend only 0.7 percent of their total food expenditures at convenience stores. Low-and middle-income households (incomes between \$5,000 and \$49,999) spend 20-22 percent of their food dollars at supercenters, where prices are lower. Households with incomes over \$70,000 spend 13-17 percent of their food dollars at these types of stores. Clearly, lower income consumers shop at outlets offering lower prices.

Examining prices paid for specific goods (through the Universal Product Code of the good purchased) across household income level, Broda et al. (2009) find that while households with incomes below \$8,000 per year may pay 0.5 to 1.3 percent more for their groceries than households earning slightly more, those earning between \$8,000 and \$30,000 pay the lowest prices for groceries. Households with the highest incomes, with earnings over \$100,000, pay the greatest amount for groceries, between 2-3 percent higher than poorer households. These results suggest that the poor do not pay higher prices for food.

One caveat to these results is that the Broda et al. (2009) study does not directly address access issues as it is only approximated by household income level. The study does not have information about the costs consumers face to get to food retail outlets, which could be greater for those who live in areas with limited access.

Summary

For SNAP to meet its mission, it is essential that participants have access to foodstores offering good quality, variety, and reasonable prices without the participants encountering undue burden. As a whole, participants live close to an authorized retailer, which is often a supermarket or large grocery store. More than 90 percent of participating households spend at least some of their benefits in a supermarket, and close to 90 percent of all benefits are redeemed in supermarkets or large grocery stores. Food stamp recipients reported being largely satisfied with the stores in which they shop most frequently. Studies of SNAP participant access and shopping patterns reviewed here indicate that most SNAP participants have access to supermarkets and large grocery stores. These findings, however, do not eliminate the possibility that access may be challenging for some participants and nonparticipants in some places.

The analysis of food purchases suggests that SNAP participants who did not shop mainly at a supermarket purchased less noncanned fruit, noncanned vegetables, and milk than SNAP participants who shopped frequently at a supermarket. SNAP participants who did not shop at a supermarket also purchased less canned fruits and vegetables than others, but the differences are not statistically significant. Overall, the results suggest that lack of access to a supermarket is associated with lower levels of expenditures on some foods that are important for healthy diets.

This analysis of food purchasing behavior, like the majority of studies on the topic, only shows associations between access and food purchases, not whether access differences actually cause differences in food purchasing. It is possible that those who do not have access to supermarkets or other sources of healthy foods would not buy these foods if their access was better. To determine a causal impact, longitudinal data or information that is related to access but not to food purchasing behavior would be needed.

It appears that only two studies have used longitudinal data to try to determine differences in purchasing behavior over time as the degree of access changed (Wrigley et al., 2003; Cummins et al., 2005). These studies were conducted in the UK, and both considered changes in shopping

behavior and food intake when a new supermarket was opened in an underserved area.⁴¹ Results from Wrigley et al. (2003) showed that a sizable number of residents in both studies switched their main shopping source to the new store, more walked to and from the store than before, and fewer took buses, taxis, or someone else's car due to the change in access. Cummins et al. (2005) also found that when access improved, many shoppers switched to a new store, more walked to the new store, and fewer traveled to the store using someone else's car.

This study's demand analysis does not consider the relative food prices of these groups of foods that survey participants face. Those with limited access could face higher prices of noncanned fruits and vegetables, which could impact their purchase behavior. The analysis attempted to incorporate prices and estimate a demand system, but the results were not reasonable, possibly due to the rather limited size of the sample.

Another limitation of the analysis of food purchasing behavior is that the sample includes only participants of SNAP. Not all those who are eligible for the program choose to apply and receive benefits. Those who do, tend to be poorer and have lower incomes than those who do not. But it is possible that some poor people choose not to participate because they do not have good access to stores where they can redeem benefits or to stores where they want to buy foods. Thus, the analysis could underestimate the differences in access on food purchasing behavior by not including those who do not participate in SNAP because of access limitations.

Households with limited access to supermarkets may rely more on fast food or carryout restaurants to satisfy their needs for foods. It has been documented that foods from fast food restaurants are generally lower in nutritional quality (Lin et al., 1999). Therefore, a greater reliance on fast food could adversely affect the diet and health of those who have limited access to supermarkets. Future research should be conducted to study the effect of limited access to supermarkets on food purchases at commercial foodservice outlets.

The results for estimating price differentials between grocery stores and convenience stores are consistent with a priori expectations that consumers pay more for food at a convenience store than at a grocery store. Likewise, neighborhood quality, as measured by household income, affects prices positively, but to a lesser magnitude for those purchases at a convenience store. An important finding, however, is that on-sale purchases and coupon use are frequently reported at convenience stores. The price discount afforded by on-sale purchases or coupon use is quite large and can compensate for the higher price registered at convenience stores. Frugal shopping habits can effectively overcome the price disadvantage at convenience stores. Of course, frugal shopping habits can also be effective when shopping at grocery stores.

Analysis by Broda et al. (2009) is consistent with the idea that frugal shopping habits can overcome high prices. This study finds small differences in expenditures at different food retailers across income levels. It also finds that, in general, the poor do not pay more for food. The study finds that households earning between \$8,000 and \$30,000 per year pay the least

⁴¹Findings on food intake changes from these studies are summarized in Chapter 4.

for groceries, while the poorest consumers, those with household incomes below \$8,000, pay between 0.5 to 1.3 percent more for their groceries than households earning slightly more.

With respect to price analyses, Homescan panelists may under-report some items purchased at a convenience store due to on-the-go consumption (e.g., fresh produce and ready-to-eat snacks). Prices reported by Homescan panelists are nationally representative, but the results may not apply to local areas with specific characteristics, such as areas affected by Hurricane Katrina.

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The Economics of Supermarket and Grocery Store Location

There has been little consideration of the economics behind the variation in food access across areas. It is important to understand the economic conditions that may contribute to food deserts—that is, the costs that food retail businesses face and the choices available to consumers who want to buy foods. This chapter outlines an economic framework for considering food access and why some areas may have limited access. This framework considers the consumer and demand factors, business and supply factors, and the market conditions that interact to create differences in the food retail environment across areas and subpopulations. The chapter then provides a broad overview of the history of supermarket development that captures how food retailers have responded to different demand, supply, and market conditions. ERS, through the National Poverty Center at the University of Michigan, commissioned a paper to consider the economic framework of food deserts (Bitler and Haider, 2009). This chapter draws heavily from that paper.

Consumer Behavior and Demand Factors of Food Access

Food in general is considered to be a normal good—that is, demand for it increases as income increases. Given that food is a normal good, it should not be surprising that high-income areas have relatively more foodstores and restaurants than low-income areas. Price is also a major determinant of food demand. The higher the price of a food, the lower the quantity demanded. On the other hand, the higher the price of a substitute food, the higher demand will be for that food item. Given the budget constraints of low-income consumers and the prices of some specific foods, low-income consumers may substitute higher priced goods with lower priced goods (e.g., hamburger for steak or canned fruits for fresh fruits).

Travel costs and time costs of acquiring food as well as the time costs of preparing foods are also likely to affect demand for particular foods. The convenience of eating restaurant food or a prepared meal versus eating at home may be an important part of demand for food. Even for foods prepared at home, there may be relatively greater time costs than those for prepared foods or takeout foods. Consumers may value the convenience of a fast food or prepared meal more because it does not require spending much time to prepare.

Demand for some foods could be affected if individuals do not know which foods are healthy or unhealthy or if individuals do not know how to use or prepare some foods. Tastes for different foods, or preferences as economists call them, may also drive demand and store location. For example, foodstores that sell many Asian or Hispanic food products are often located in areas where there are high concentrations of people of Asian or Hispanic descent, presumably because demand for those foods is high in those areas.⁴²

⁴²This is a bit of a chicken and egg problem—people of a specific ethnic descent may choose to live in an area where they have relatively easy access to the foods they wish to consume. We discuss this further later in this chapter.

Consumers choose where to live and thus, choose the food environment available to them. Clearly, the choices of the poor, especially those living in extreme poverty, are constrained by their budgets. But even among the poor, there are choices in where to reside. This choice is an aspect of food access that is not well considered in the literature. Not accounting for residential choice limits the ability to assess whether limited access to affordable and nutritious food affects food shopping, diet, and health outcomes. If two people are equal in all other manners, the one who places a high value on access to a large supermarket is probably more likely to live in an area where those things are available relative to another who values food-related amenities less and perhaps other amenities more.

Food Retailer Behavior and Supply Factors of Food Access

In general, supply is driven by the costs of input goods—in this case, the land, materials, machines, and labor needed to build and operate a grocery store and the costs of products to stock the shelves. As these costs increase, supply decreases. Economic theory considers fixed costs (costs that do not change as the quantity of output changes, such as the land and materials needed to build a store) and variable costs (the costs of operating that change as the quantity of output changes). Differences in fixed or variable costs across areas could impact the types of stores and products available.

Food retailers that face higher fixed costs will either need to charge a higher price for goods sold or limit the range of products sold (Bitler and Haider, 2009). Fixed costs faced by food retailers probably vary greatly by the type of area. In dense urban areas, land prices may be higher and zoning requirements of local governments may be more cumbersome and costly to meet relative to less dense suburban and rural areas. Consequently, it is likely that the fixed costs in urban areas are greater. Further, the volume of sales in a store could affect how much fixed costs matter to firms. For example, stores that serve a higher volume of consumers (either in the number of consumers or in terms of the amount they purchase) will be able to spread fixed costs over more people and prices may be lower than in stores that serve lower volumes of consumers. This could explain why some rural, less populated areas do not have stores or why some foods may not be stocked in low-volume stores, especially foods that perish.

If fixed costs drive store location decisions or the types of products sold, then the fixed costs should be higher in low-income areas if these areas are underserved. Within urban areas, for example, low-income areas are likely to have lower land prices than high-income areas. In this case, it would be surprising to find that land costs leave some poor areas without access. It is possible that zoning requirements or security costs are higher in poor areas and thus more important for stores to locate in those areas (regardless of size) (Bitler and Haider, 2009).

In the United States, supermarket competition within a market region may be characterized by a small number of chain supermarkets accounting for a large share of the market sales and a large number of smaller “fringe” stores, which account for lower total market sales (Ellickson 2005 and 2007; Smith 2004 and 2006). Ellickson (2005 and 2007) argues this is

consistent with an endogenous fixed-cost economic framework, as when large food retailers incur (take on) fixed costs to keep competitors from entering the market. Such fixed costs could come in the form of offering a larger variety of products (increasing shelf space and improving distribution systems), carrying higher quality products (e.g., organic products), or paying advertising costs to differentiate from competitors. The smaller fringe stores do not incur these costs but survive by being more densely distributed (e.g., small corner stores that offer convenience over variety or quality) and/or by gaining business from consumers who may not value quality or variety as much, or who perhaps cannot afford to. Ellickson (2005 and 2007) finds evidence that this model may describe the supermarket landscape across the United States.

One major variable cost for operating a foodstore is the cost of hiring workers. Poor areas are often areas with relatively lower wages, which should reduce the costs to operate a store, all else equal. King et al., (2004) find that stores serving low-income shoppers (stores with greater shares of revenue from SNAP participants) have significantly lower payroll costs as a percentage of sales than stores that do not serve as many low-income shoppers.

King et al., (2004) find that operating cost structures of stores with higher portions of total revenues from SNAP redemptions are different than those of other stores. For example, the stores had lower labor costs but also lower sales margins, and they were more likely to be supplied by wholesalers than to be part of a large chain with its own supply chain. However, overall operating costs for these stores were not different than other stores.⁴³

Economies of scale, economies of scope, and economies of agglomeration may also explain why product availability is differentially concentrated across areas or stores (Bitler and Haider, 2009). Economies of scale, which is when the costs of operating a store decrease as store size increases, and economies of scope, which is when the costs decrease as more product variety increases, suggests that larger stores that offer greater variety can do so and offer lower prices. Both factors may account for the ability of larger stores to survive more easily than smaller stores. For example, if wholesale costs to stock store shelves are lower for larger stores because they can buy in bulk and buy a greater variety of products more cheaply, larger stores may be able to lower prices and smaller stores may not be able to compete. This does not explain, however, why larger stores do not locate in low-income areas.

In a competitive marketplace, firms selling the same products may have a disincentive to locate near each other. But this may not always be the case. Economies of agglomeration, where the costs of operating a store are lower when a store is located near other stores (e.g., because of roads or distribution systems), may explain why stores are concentrated in some areas and not in others.

The Market

The market is where consumers and suppliers meet, their interactions determining the prices paid and the products bought and sold. The most

⁴³Fixed costs were not considered in this study.

basic economic models assume that markets are perfectly competitive and that food retailers and consumers do not have control over price. In such a case, it is possible that if demand is sufficiently low, retailers would not be willing to supply products because they could not sell them or could only sell them at higher prices.

It is possible that food retailers actually have some market power, especially in settings where there are few competitors. If so, then retailers would have an incentive to increase price and restrict quantities to increase profits. Supply-side conditions, such as high fixed costs or economies of scale, could lead to food retailers having market power (Bitler and Haider, 2009).

It is possible that the supply-and-demand conditions are such that the market does not operate efficiently—that some intervention could be implemented that would improve circumstances for both retailers and consumers. A market failure could arise, if for example, there is poor information on the part of suppliers about the foods that consumers in an area will demand (for a given price). For example, if the models that supermarkets use to predict sales in an area do not adequately capture potential sales in low-income areas as some have suggested, better information on the potential sales could lead to more stores or products offered in those areas (Drake, 2009; Policy Link, 2007).

Supermarket “redlining,” which has been suggested as a possible reason some low-income or minority areas lack larger stores, could also constitute a market failure. Economic theory suggests that if markets are competitive, a retail firm that does not discriminate should have an incentive to locate in an area that is, except for its minority status, otherwise the same as any other area served by a supermarket. That is, the market would tend to reward firms that locate in otherwise underserved areas because there is less competition, at least in the short run. In the long run, nondiscriminating firms will enter the area until no more firms can be supported by the population. If firms lack good information on the true purchasing power or demand for food in areas with concentrations of racial or ethnic minorities, then this market failure is one potential reason why firms do not locate in these areas.

It is also important to note that housing market discrimination could limit the ability of minorities to move to areas that may have better access to food. Legal discrimination in housing and lending markets (which existed until the Fair Housing Act of 1968) and illegal discrimination since then (Turner and Skidmore, 1999; Turner et al., 2002a; Turner et al., 2002b; Wyly and Holloway, 1999) could potentially limit residential choice of affected groups, which could contribute to disparities in supermarket access.

Economic theory suggests that either supply conditions or demand conditions could lead to variation across areas in store locations, the types of stores available, and the products and prices offered within stores. Unfortunately it is difficult to determine how much either supply conditions or demand conditions affect store location and the types of foods that are offered because they are determined simultaneously. Monitoring price could help. For example, if the price of some nutritious foods in underserved areas is high but the prices of other nutritious foods are cheaper, it is likely that demand-side factors are driving differences in availability (Bitler and Haider,

2009). Likewise, understanding more about cost differences of suppliers in different areas could also help determine if supply side factors are to blame. Finally, it may be also be useful to consider the markets for other goods and services in low-income areas. Many areas that are underserved by supermarkets may also be underserved by other businesses, such as banks or health care services. Understanding whether such businesses face similar costs or similar demand for products as food retailers might help explain the lack of supermarkets and other businesses in general (Bitler and Haider, 2009).

Broad Trends in the Supermarket and Food Retail Environments

Very broadly, grocery retail has gone through three major changes (innovations) in the past century: the rise of chain grocery stores over independently owned stores, the rise of supermarkets that offered an increased number and variety of products; and the rise of supercenters that continued the trend to even larger stores offering more and more products (Ellickson, 2005; Tedlow, 1990). In each of these cases, suppliers found ways to decrease the costs of production in order to bring lower prices to consumers. Chain grocery stores used integration of manufacturing and wholesaling to cut out middlemen and offer lower prices (Ellickson, 2005). The middle of the 20th century saw a rise in automobile use, interstate highways, and movement of residences and businesses to the suburbs where large tracts of land were available for relatively lower costs. Supermarkets grew in size and carried an increasing variety of products (Tedlow, 1990). The advent of computerized logistics and inventory systems integrated with the supermarkets themselves occurred during the 1980s and 1990s and provided the catalyst for the most recent trend toward supercenters. Ellickson (2005) shares evidence of this growth—in 1980, the average store carried 14,145 products; by 2004, the average store carried over 30,000 products. Reliance on their own distribution and inventory systems along with larger store sizes allowed supercenters to charge lower prices. Wal-Mart, which is now the Nation’s largest retailer of grocery products, is one model of this type of format.

Competition spurred by this latest trend to supercenters has contributed to other developments among more traditional supermarkets. Some retailers target middle and higher income consumers—often offering specialty products or primarily organic products (e.g., Whole Foods) (Drake, 2009). Other retailers have offered their own line of premium store brands and organic store brands to tap into the more health-conscious consumers (e.g., Kroger’s Naturally Preferred or Giant Food’s Nature’s Promise lines) (Martinez and Kaufman, 2008).

Hard discount stores, which target bargain and low-income shoppers, have also developed. These stores are typically smaller than other supermarkets (typically between 10,000 to 14,000 square feet, compared with an overall average store size of 48,000 square feet), offer more private label brands and fewer national brands, and offer fewer product size options. Many of these stores operate in underserved or low-income areas. Examples include:

- Save-a-Lot (a subsidiary of SuperValu, Inc.) operates 1,200 stores, including 4 in Prince Georges County, Maryland, and 1 store in Coahoma County, Mississippi, a persistently poor county in the Mississippi Delta region.
- ALDI stores (a German discount retailer which opened its first U.S. stores in Southeastern Iowa) have 1,000 stores in 29 States.
- Fresh and Easy Neighborhood Markets (a subsidiary of Tesco, the UK's largest retailer) opened two stores last year in low-income areas of Los Angeles (Compton and Eagle Rock).
- Food4Less (a subsidiary of the Kroger Co.) recently opened a store in Englewood, an impoverished neighborhood on the southwest side of Chicago.

Food retail has also expanded to retailers that have not focused on food in the past. This “channel blurring” has occurred among pharmacies, which typically carry snack and convenience foods and increasingly carry refrigerated and frozen items, and among dollar stores (such as Family Dollar and Dollar Store) (Martinez and Kaufman, 2008; Sharkey and Horel, 2009). Warehouse clubs (e.g., Costco and Sam’s Club), which offer a limited variety of food products and larger or bulk sizes, have also expanded into food markets, serving primarily small businesses and middle-upper-income consumers (Martinez and Kaufman, 2008).

Finally, grocery stores and supermarkets also compete with restaurants and other sources of food away from home. Almost half of all food spending in the United States is for food away from home (48.9 percent in 2006) (Martinez and Kaufman, 2008).

Given these competitive forces, why is it that some areas lack access to a supermarket or large grocery store? The range of reasons offered include some that are identified in this chapter and others that have been summarized elsewhere.⁴⁴ Many apply specifically to urban areas, but some apply to rural areas as well. Examples include the following:

- Zoning and regulatory approval processes
- The need to secure land sites large enough for stores
- Environmental remediation and/or demolition of current structures
- Higher construction and operating (e.g., rent, real estate taxes, security costs) costs in urban areas
- Lower access (to customers and to distribution chains), visibility, or traffic flow and less space for parking in urban areas relative to suburban areas
- Local politics, where officials and groups may have competing goals for development

Despite these potential hurdles, large, high-density populations in underserved urban areas and less competition are two factors that may make

⁴⁴See Drake, 2009; Policy Link, 2008; Food Marketing Institute, 1998.

underserved areas attractive for food retail development (Food Marketing Institute, 1998).

Summary

Economic theory can help explain why some areas may have limited access. Consumer behavior and demand-side issues, such as lack of knowledge of the nutritional benefits of foods or food retailer behavior, and supply-side issues, such as different fixed costs for developing a store in an underserved area, may explain variation across areas in the types of foods offered and the stores that offer them. Further research is needed to determine which factors may be driving differences in access. This research could explore how differences in fixed and operating costs of different areas may account for variation in access to different types of stores or different products within stores. Research could also consider how consumer knowledge and preferences and the time cost tradeoffs affect consumer decisions of which foods to eat and whether to make or to buy prepared foods or restaurant meals. Research on price variation at the local level and spatial demand models could also be used to help determine which factors contribute to differences in access to food retailers.

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Community Food Projects

Nationwide analyses look for solutions that address large segments of the population. Community food projects (CFP) are projects in which low-income communities develop their food systems. CFP are by nature small and comprehensive within geographical places, with deep roots and a broad array of impacts on individual communities. The Community Food Projects Competitive Grant Program (CFPCGP) at USDA's Cooperative State Research, Education and Extension Service funds innovative demonstration food projects that lead to food system changes unique to the communities they serve. These small projects can reduce the negative impact of areas with limited access to affordable and nutritious food, thus making community the appropriate unit of analysis.

Community Food Security

The CFPCGP was designed to address issues of "community food security." Community food security incorporates the participation of local communities in developing innovative approaches that foster local solutions for feeding low-income families. This strategy encourages a greater role for the entire food system, including local agriculture, and represents a proactive approach to fighting hunger, economic and social justice, and environmental stewardship.

Unlike the charity model, which provides emergency food as a short-term solution, the community food security concept addresses the long-term need of communities to obtain a safe, culturally acceptable, nutritionally adequate diet through a sustainable food system that maximizes community self-reliance and social justice (Hamm and Bellows, 2003). Community food security projects also address the broader well-being of the community, that is, its economic, social, and environmental issues.

Legislative authority

The CFPCGP was established through Authority Section 25 of the Food Stamp Act of 1977, as amended in 1996 and by Section 4125 of the Farm Security and Rural Investment Act of 2002 (Pub. L. No. 107-171) (7 U.S.C. 2034), and further amended by Section 4402 of the Food, Conservation and Energy Act of 2008 and the Food and Nutrition Act of 2008 (Public Law No. 110-234) (7 U.S.C. 2034). This law authorized a program of Federal grants to support the development of community food projects at a funding level of \$5 million annually through FY 2012.

Community food projects competitive grant program

Food is a very basic need. Seeing this need, community leaders all over the country have begun to organize their communities around food access. This is especially true in low-income communities where food sources often are most scarce. The primary goals of the CFPCGP are to:

- Meet the food needs of low-income individuals;
- Increase the food self-reliance of low-income communities;
- Promote comprehensive responses to local food, farm, and nutrition issues; and
- Meet specific State, local, or neighborhood food and agricultural needs.

Projects can address needs relating to infrastructure improvement and development, planning for long-term solutions, or the creation of innovative marketing activities that mutually benefit agricultural producers and low-income consumers

Current CFPCGP status

CFPCGP was funded for \$1 million in 1996, \$2.5 million for 1997-2001, and \$5 million beginning in 2002 (current legislation). Since 1996, 290 projects have been funded in 48 States. Currently, three types of projects are funded each year, each type for 1 to 3 years:

- Planning projects, funded at \$10,000 to \$25,000, provide seed money for communities beginning to address their community food security issues. Planning projects are a separate type of project started in 2006 and represent 20 to 30 percent of the funded projects, but only 3 to 5 percent of the funding.
- Training and technical assistance projects, averaging \$100,000 to \$300,000, assist organizations in applying for community-based or planning projects and with running grants once awarded. T&TA projects represent about 15 to 20 percent of the funded projects and approximately 10 percent of the funding.
- The community-based food projects are funded at \$10,000 to \$300,000. CFP projects represent about 50 to 60 percent of the projects funded and 85 percent of the funds.

The community food projects

Because the community food projects are designed to solve local problems, they vary considerably based on local needs. Their specificity is both a major strength and a challenge for evaluating them at a national level—and for describing how they contribute to addressing issues within areas with limited access to affordable and nutritious food.

The following are examples of the types of issues that are addressed within CFP. These were extracted by Pothukuchi (2007) in a study of projects' self-reported evaluation of performance on goals and objectives. The study reflects summary data of grantee reports from 42 CFPs funded between 1999 and 2003.

Issues addressed in Community Food Projects

- **Healthy food availability:** Increase the availability of healthy, locally produced foods, especially in impoverished and underserved

neighborhoods, through food assistance programs, backyard and community gardens, grocery stores, farmers’ markets, Community Supported Agriculture shares, food buying clubs, and other resources.

- **Healthy diets:** Encourage the adoption of healthy diets by providing culturally and age-appropriate training and experiences for youth and adults in food production, preparation, and nutrition.
- **Nutrition program participation:** Enroll eligible residents in government nutrition programs such as SNAP, WIC (Special Supplemental Nutrition Program for Women, Infants, and Children), and the Farmers’ Market Nutrition Programs.
- **Local food marketing:** Increase local markets for small- and family-scale farms, including direct marketing and purchases by local institutions and businesses.
- **Sustainable agriculture:** Support agricultural practices that protect air, water, soil, and habitats; promote biodiversity; reduce energy use; promote reuse and recycling; and treat animals humanely.
- **Food-related entrepreneurship:** Support on- and off-farm value-added and processing enterprises, especially smaller operations and those owned by women and minorities.

Table 7.1

Community Food Projects Competitive Grant Program Activities, 2006

	Percent
Youth/school gardening or agricultural project	81
Promoting local food purchases	73
Food access and outreach	57
Entrepreneurial food and agriculture	53
Community food assessment	47
Farm to cafeteria	47
Farmers’ market	47
Food policy council/network	47
Job skills training	47
Training and technical assistance	47
Community gardens	43
Community-supported agriculture	43
Micro-enterprise/Entrepreneur skill training	43
Emergency food collection and distribution	37
Farm/Grower cooperative	37
Restoration of traditional foods/agriculture	27
Community or incubator kitchen/Value-added Production/Processing	26
Immigrant/Migrant farm project	16
Food-buying cooperative	14

Source: USDA, CSREES calculations based on Abi-nader, 2007.

- **Farm worker conditions:** Promote safe and fair working conditions for farmers, farm workers, and other food workers, such as those in processing plants and wholesale and retail operations.
- **Food heritages:** Honor and celebrate diverse food cultures and traditions in the community.
- **Local food system awareness:** Develop greater awareness and appreciation among residents of the value of local foods and food heritages to encourage more locally based eating.
- **Integration of food in community processes:** Systematically integrate food system issues into community and regional planning and other community institutions and processes to promote public health, economic vitality, social equity, and ecological sustainability.
- **Food system participatory planning:** Engage community residents and organizations in collaboratively assessing food needs, and devising and implementing actions to meet needs.
- **Food democracy:** Increase residents' awareness of and voice in food-related decisions at different levels of government.

The goal of addressing these issues is to bring communities to a higher level awareness of their community food system so that awareness leads to action, deficits and assets are assessed,; resources are examined, and potential solutions to problems are tried and tested. Community involvement can be a potent force in overcoming food access issues.

One way to see how these issues are addressed within CFP is to look at the national level output reports. The CFPCGP works with grantees to develop and implement a program-wide evaluation. Currently, grantees voluntarily report common activities (Common Output Tracking Form) across their projects. The latest analysis from 2006 enumerated 19 project-type activities reported by 51 of a possible 65 projects (table 7.1). The projects are comprehensive and have many component activities. The percentages in the table refer to the share of projects that report having managed or participated in the activity. It is hoped that the combination of these activities leads to systems change within a community and that the multi-pronged approach to getting more food into the community increases food security for the long term. The net sum of these activities is to reduce the impact of limited access to food. Here are some examples of how the combinations of different activities have been implemented:

“This kind of systems thinking guides the CFPCGP and is evident in the projects that have received funds. In places as different as Lubbock, Texas and Green Bay, Wisconsin, the CFP has played a key role in building comprehensive approaches to multiple problems. The South Plains Food Bank of Lubbock uses its 5 ½ acre farm to produce food for the food bank. The farm also serves as a demonstration site for sustainable farming practice, a youth training and job site, and a community-supported agriculture facility. In Green Bay, the Brown County Task Force on Hunger identified the region’s large Hmong population as the group most

Examples of Community Food Projects by Type of Project

Food Assessments

Fresno Fresh Access Project, Fresno Metropolitan Ministry, Fresno, CA,
www.fresnometroministry.org

Community Tradition, Foods, and Future, Legacy Cultural Learning Center,
Muskogee, OK, www.legacycultural.org/artwellness

Food Policy Councils

Food Access and Food Justice in New Orleans: Rising above the Waterline,
New Orleans Food and Farm Network, www.noffn.org

*Educating State Legislative Leaders and CFP Grantees about Policy Options
that Support Community Food Systems, National Conference of State
Legislatures, www.ncsl.org*

Youth Programs

Healthy Harvests Initiative: Building Boston's Food Security from the Ground Up,
The Food Project, Lincoln, MA, www.thefoodproject.org

Food for Life, Youth Farm and Market Project, Minneapolis, MN,
www.youthfarm.net

Entrepreneurial Food and Agriculture Activities

*Appalachian FoodNet Project and Rural Food Centers Project, Appalachian
Center for Economic Networks, Athens, OH, www.acenetworks.org*

*Building an Integrated Sustainable Food System, Appalachian Sustainable
Development, Abington, VA, www.apsusdev.org*

Urban Agriculture

*Integrated Development Through Urban Agriculture, Nuestras Raices, Holyoke,
MA, www.nuestras-raices.org*

*Neighborhood Urban Agriculture Coalition, Greensgrow, Philadelphia, PA,
www.greengrow.org*

Rural Producers

*Tribal Fish Market Connection Project, Ecotrust and Columbia River Inter-Tribal
Fish Commission, Portland, OR, www.ecotrust.org*

*Patchwork Family Farms: Value-added Processing for Community Food
Security, Missouri Rural Crisis Center, Columbia, MO,
www.inmotionmagazine.com/rural.html*

Community Gardens

*Urban Detroit Agriculture and Education Project, Capuchin Soup Kitchen,
Detroit, MI, www.cskdetroit.org.*

For detailed descriptions of these projects, see appendix D.

at risk for food insecurity. The Hmong benefit from small business and enterprise mentoring that allows them to develop farm- and food-related micro-businesses. Self-sufficiency and self-help are putting people on the road to food security.” (Healthy Food Healthy Communities, 2006).

Examples of community food projects

There are many types of CFPs, including food assessments, food policy councils, youth projects, entrepreneurial food and agriculture activities, urban agriculture, rural producers, and community garden projects. This section describes the general goals and structures of these types of CFPs (see box, “Examples of Community Food Projects by Type of Project”). Detailed descriptions of these projects are given in appendix D.

Food assessments

A community food assessment (CFA) is a way for a community to identify both its challenges and its resources around food and to use food as a tool for community development. Of 51 projects reporting on the COTF in 2006, 24 percent had conducted CFAs. An assessment of the local food system is a way to bring the whole community together around a single issue that matters to everyone—food. A CFA can motivate people to make change to improve food access. It serves the goals of the CFPCGP by involving low-income community members in becoming aware of and analyzing the food system and by making community members part of the solution. Two food assessments funded by CFPCGP are listed in the box and detailed in appendix D.

Food policy councils

Food policy councils (FPCs) may take many forms but typically are commissioned by State or local government, with participation from diverse stakeholders engaged in food and agriculture. They foster a more comprehensive and coordinated approach to addressing food system issues by bringing together stakeholders to develop and implement solutions. FPCs play various roles, including educating officials and the public, making policy recommendations, improving coordination between existing programs, and starting new programs. FPCs help identify ways that governments can mobilize existing resources or shape policy to improve the food system (Winne, 2008).

FPCs have sometimes been the focus of applicants who see the need to address policy issues early on in their community food work. Other grantees have found that they need an FPC to address barriers confronted during the operation of their project. Projects have often run into local ordinances or legislative barriers and have formed formal and informal policy groups to deal with these issues. For example, a project in Washington State established a market garden on public land only to find that legislation disallowed marketing from the land. The amendments to the CFPCGP legislation in 2002 put an added emphasis on funding planning and policy activities within the program. Examples of Food Policy Councils projects funded by CFPCGP include a food policy council in New Orleans,

Louisiana, and a nationwide policy project funded to educate State legislators about food systems issues and CFP grantees about policy issues.

Youth projects

Some CFPs are specifically targeted toward youth. The goals of these projects are often educational—providing agricultural, nutrition, meal preparation, and culinary training to young people. A basic idea of these projects is to strengthen the connections between youth and the foods they eat. Two examples of youth-focused CFPs are the Healthy Harvests Initiative and the Food for Life program.

Entrepreneurial food and agricultural activity

The goals of these types of projects are to build the capacity of communities to develop and promote their own agricultural activities. The projects often involve entrepreneurial training, technical assistance in expanding local markets, developing and producing value-added products or infrastructure development. Examples of projects that have served rural and low-income communities include the Appalachian Center for Economic Networks in Athens, OH, and Building an Integrated Sustainable Food System in Abington, Virginia.

Urban agriculture, rural producers, and community gardens

These types of projects offer support for developing commercial gardens and food production for sale or for home consumption in underserved urban or rural areas. Funds are used for developing capacity to grow, sell, and market food for commercial enterprises or to grow and prepare food for at-home consumption. The projects cover a wide range of areas and communities.

Lessons Learned

Annually, national experts are selected as peer reviewers for the CFPCGP. Reviewers select the most meritorious proposals through a competitive process for funding. The reviewers are people who run community food projects, work in academia, or do similar work and know what works in communities. Through the years, lessons have been learned about what tends to work in communities and what does not. These lessons include project development issues, challenges faced by CFPs, and general lessons about community food security work. Some of the lessons learned include the following:

Project Development

- Projects must be “community-based,” not “community-placed” to be successful in the long term. A number of projects in the early years of the program represented institutions’ “good ideas” about what would bring more food into the community. These “top-down” projects tend not to work. A classic version of a top-down project is building a community garden without gaining consensus from the community. Projects must come from the community and must be a solution to their perceived needs for improving food security in their community.

- Three years is a very short time to develop a project that is going to be sustainable and economically viable. Often, more than three years is needed.
- The program requires that projects become “self-sustaining” without defining the term. Sustainability has many definitions. The sustainability of projects must be interpreted loosely. In some cases, it can be interpreted as meaning economically self-sustaining. For example, a youth farmstand would have to make enough money from selling produce to allow the project to move into the future. But another way to view sustainability of a youth education program is that the skills learned by youth will stay with them into the future and increase their ability to be self-sufficient.
- Feedback reviews from unsuccessful grant applications for CFPCGP have led to successful subsequent applications. Projects are improved considerably by acting on review comments.
- Small community organizations must build leadership within their organizations to ensure that food projects can continue beyond the guidance of one charismatic leader.

Challenges

- In several projects, securing available land for community gardens was only the first problem. Requirements to test the health of the soil and remediate soil for contaminants presented further challenges. One project turned this experience into a community outreach initiative. Youth gardeners became leaders in the community through their efforts to test neighbors’ soil so that their gardens would be free of contamination as well.
- Some projects unexpectedly encountered local ordinances that interfered with plans (see earlier Washington State example).
- Land access for food production and transportation to gardens and foodstores were major hurdles for many projects. City-owned lands could be taken after soil remediation, sending projects back to the beginning.

Programmatic lessons

- Immigrant populations are a force in the community food security movement. Many groups come from agrarian backgrounds and eagerly approach the promise of growing familiar foods and marketing to fellow immigrants. Farmers’ markets create viable local food sources for the broader community and an economic foothold for new immigrant populations. The “new” fruits and vegetables introduced by immigrants are a nutritional asset for the American diet.
- Native American and Native Hawaiian projects are stimulating interest and reviving deep connections to traditional foods among these groups, and they are offering elements of native diets that may be healthier options than alternative foods currently consumed.

- Projects employing youth in community food projects are finding that they are successfully engaging the future leaders in the community food security movement.
- Corner stores are seen as a potential tool for improving the diets of low-income residents of communities with limited food access. Corner stores tend to not have the resources to make the transition to selling more fresh foods. One project found that corner stores could not afford the refrigeration necessary, their regular suppliers did not handle fresh produce, and they lacked the expertise to handle fresh produce.
- Community food projects by nature are dynamic and change to adapt to the ever-changing environment. The CFPCGP has had to be flexible to allow projects to adapt to change.
- Community food projects frequently have unexpected outcomes. One unexpected outcome is that community gardens have been seen to reduce crime in the vicinity of gardens. A project in a public housing unit was adopted by a park service adjacent to the garden. After the garden came into existence, crime and vandalism rates dropped significantly in the park area, encouraging the park service to continue the project.
- Food can be a powerful community organizing tool. Ethnic foods can provide strong bonds between community members that help lead to unity in solving other community issues. A disintegrating infrastructure in Holyoke, Massachusetts, led community leaders to start building gardens to grow ethnic foods, which progressively led to farmstands, small farms, and ethnic festivals. Youth gardens in Boston, Massachusetts, fostered better relationships between generations and racial groups. Native American groups found power in advocacy as their awareness of traditional foods increased through community food assessments with elders and they learned how traditional foods could be restored in their communities. Community gardens can break down isolation and bring people out into the community for positive interaction, which often results in reduced crime rates.

Community food projects are small, community-driven attempts to address the problem of food access in low-income communities. CFP projects often grow from frustrations stemming from poor access to food sources. A frequent first step is assessing what exists, as well as, what is missing in the community. Knowledge of what assets exist often strengthens a community's collective confidence to tackle problem solving.

When communities come together to address their community food security issues, their solutions often go beyond food access to include social, economic, and environmental issues as well. Food is an attractive community development tool. A community food security approach to fighting food access problems is a viable way to make a difference in small, yet significant ways for those individual communities that are affected by a lack of access to food. Modest grants for communities across the Nation have given people the incentive they need to build solutions that match the needs of the community. The goal of the CFPCGP has been to build capacity in communities to achieve food security and to demonstrate model programs that may be adopted in other communities across the country.

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Policy Options

A variety of programs and policies to reduce the effects of limited access to affordable and nutritious food have been implemented or considered across the country. This chapter discusses broad categories of these programs and highlights examples that either have been implemented in an area or are under consideration. Many of the programs have been initiated at the community, local, or State levels, some with Federal support (as described in the previous chapter), but often only with support from localities, States, or private sources. Where available, evidence of the effectiveness of programs that have already been implemented is considered, although there is not a substantial literature from which such evaluations can be drawn. The chapter concludes with some broad guiding principals for setting policy priorities. It is suggested that a variety of demonstration projects might be a feasible way to begin efforts to decrease the effects of limited access to food and to simultaneously learn more about what works and what does not.

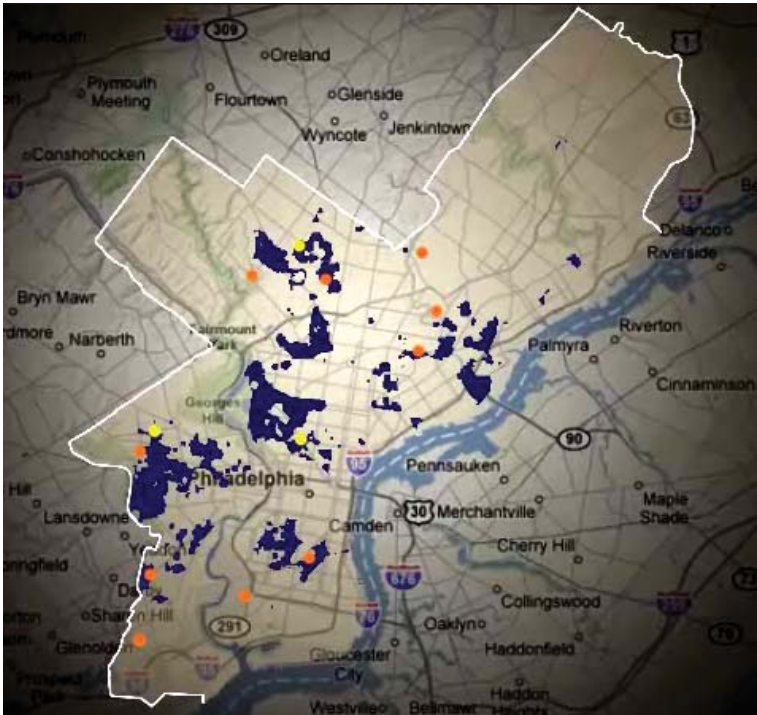
Incentive Programs To Entice New Stores or Improve Existing Stores

The discussion at the end of Chapter 6 described broad trends in supermarket and foodstore markets. These trends have had major impacts on where supermarkets of different types locate and the prices that consumers face. The trends also exhibit the market forces that drive food retailers to adjust their store formats, production costs, and location decisions. For example, the rise of nontraditional retailers in food retail (supercenters and large discount stores like Wal-Mart, Costco, or Super Target), which offer foods at prices that are 8 to 27 percent lower than at large supermarket chains, has changed the competitive environment and has likely led to decreases in the average prices of foods for consumers (Leibtag, 2006). These stores are not typically located in urban areas and may not be accessible in all rural areas either. Thus, those outside of the reach of these large stores may be less affected by the price benefits of the stores. On the other hand, several major supermarkets have subsidiaries tailored specifically to cater to low-income and bargain shoppers, for example, Save-A-Lot, ALDI, and Food-4-Less stores. Often these stores locate in low-income neighborhoods or underserved rural areas. They serve as examples of market-driven alternatives--meaning that the retailers sees a gap in a market where they can profitably operate and adjust their business models to fit the needs of the consumers, in this case, low-income consumers and discount shoppers.

Some traditional grocers have opened stores in more densely populated areas (although not necessarily low-income areas), adapting their store models to fit into smaller spaces. Further, many other nontraditional retailers, such as pharmacies and dollar stores, have expanded into food retail as well (Sharkey and Horel, 2009). Smaller corner stores and convenience stores that already serve areas without access to a supermarket have also expressed interest in offering more nutritious foods in their stores (Gittelsohn, 2009). These stores are sometimes unwilling to take the risk of offering these foods when there is uncertainty about whether they can sell enough of them (Gittelsohn, 2009).

Map 8.1

Locations of new or planned foodstores in Philadelphia through Pennsylvania Fresh Food Financing Initiative



Blue areas represent the areas of greatest need, which have low supermarket sales, low income, and high rates of deaths due to diet-related diseases. The orange dots represent stores that have been opened under the Pennsylvania Fresh Food Financing Initiative. The yellow dots represent stores funded by the program that are under construction.

Source: Figure provided courtesy of Robert Wood Johnson Foundation and The Food Trust, <http://www.rwjf.org/files/newsroom/profiles/foodtrust/>

There are many other examples of grocery stores that have opened stores or expanded service in underserved areas (see, for example, Food Marketing Institute, 1998).

As explained in Chapter 6, both cost factors for food retailers and demand factors for consumers may leave some areas underserved by food retail stores or types of food retail stores. If cost factors keep food retailers from developing new stores or expanding services in existing stores (e.g., if fixed costs of obtaining land and permits for building a new store are higher in these areas), then efforts to reduce these costs or to subsidize development of new or expanded stores may be effective policy solutions.

Many localities and some States have utilized a number of methods to entice new stores to open in these areas or to improve existing stores. These efforts range from financing for new large-scale supermarkets, to small incentives offered to existing stores to stock healthier foods, such as gift cards at fruit and vegetable wholesalers. This section highlights a few of these efforts. Previously published studies provide very good detail about the potential benefits and the hurdles of different approaches and the strategies that can be used to ensure successful store development (Policy Link, 2007; Food

Marketing Institute, 1998). Less has been published about the potential drawbacks of these approaches. Two examples of potential drawbacks that have not been explored are the use of tax revenues to encourage grocery stores when other uses of the revenues could be more beneficial to low-income areas or the degree to which changes in competition faced by existing stores could affect the local market.

One program to encourage development of new supermarkets or other grocery stores in underserved areas is the Pennsylvania Fresh Food Financing Initiative. This program provides grants of up to \$250,000 or loans of up to \$2.5 million per store when the infrastructure costs or credit needed to develop a new store in an underserved market are not available. The initiative is a public-private partnership involving the State of Pennsylvania, The Food Trust, the Greater Philadelphia Urban Affairs Coalition, and the Reinvestment Fund (TRF). The State appropriated \$30 million and TRF gave \$90 million for the program. Thus far, \$41.8 million in grants and loans have funded 58 stores and 1.4 million square feet of retail space (Weidman, 2009). Figure 8.1 shows the location of new or planned foodstores in Philadelphia funded through this partnership. A study to evaluate the impact of the opening of a large supermarket in one underserved area in Pennsylvania is underway. Illinois, Louisiana, New Jersey, and New York are also currently considering similar funding programs.

A number of Federal financing and incentive programs have been used to encourage new store development. These programs exist primarily to spur community development (not just supermarket development) in areas that lack mainstream investment (Federal Reserve System and Brookings Institution, 2008). The services provided through these programs include grants and low-interest financing, tax incentives, and training or technical assistance in community development. The programs have varying goals, including improving labor market opportunities and housing options and spurring development in low-income areas. Often, they include financing or cooperation with State and local governments. Examples of these programs include New Market Tax Credits, Community Development Block Grants (CDBG), the Empowerment Zone Program, the Environmental Protection Agency's Brownfield program, and the Department of Housing and Urban Development's Section 108 Loan program. For examples of how these programs have been leveraged to improve food availability in communities, see Policy Link (2007).⁴⁵

Improvements to already existing stores have also been used to address food accessibility in underserved areas. Modifications to such existing stores include increasing the availability of nutritious food, decreasing the availability of less healthy food, changing the relative prices of both of these types of foods, or changing the physical layout of foods within stores (Gittelsohn, 2009). These improvements are at a smaller scale than new store development, and, thus, can be less time consuming and much less expensive. Store improvements such as these have been applied in a number of settings (e.g., Baltimore Healthy Stores, Apache Healthy Stores, tiendas in North Carolina and California).

New York City has recently implemented a program to improve food offerings within small stores or bodegas throughout the city, which are

⁴⁵This chapter also discusses the CDBG program in considering housing policy options.

often much more plentiful and convenient in underserved communities than large grocery stores or supermarkets. The Healthy Bodega Initiative recruited bodegas to increase their offerings of low-fat milk and, eventually, fruits and vegetables. The city also provided promotional and educational materials to entice consumers to purchase the new offerings and to encourage bodegas to participate. About 1,000 bodegas were recruited for the low-fat milk campaign, and 450 bodegas were recruited for the fruit and vegetable campaign. Participating bodegas experienced increases in sales of low-fat milk and of fruits and vegetables (Nonas, 2009).

The changes in the WIC food packages currently being implemented in States may have an impact on the feasibility of increasing nutritious food options in small grocery stores and corner stores. The new food packages include greater incentives to purchase low-fat milk and whole grains, and vouchers for purchasing fruits and vegetables. Each State is required to adopt the new food packages by October 2009. The new food packages may provide increased and steady demand for these foods in stores in neighborhoods with high concentrations of WIC participants and may encourage operators of small stores to offer healthier food options. A pilot program implemented in New York State showed that the vegetable and fruit vouchers were popular among stores that accepted the WIC vouchers (New York State Department of Health, 2007).

During the 1990s, USDA's Food and Nutrition Service pursued a research agenda to address questions about food access among SNAP participants and other low-income households (see Chapter 5). The agency concurrently implemented three projects to identify strategies for improving access in underserved areas. Activities included a conference with experts who shared their ideas for increasing food access among low-income Americans (Koralek, 1996), along with two studies. The studies examined successful supermarkets in low-income, inner-city communities (O'Connor and Abell, 1992) and identified widely used means to improve consumer food access in underserved neighborhoods (CRP, 1998).

Two key themes emerged from the conference and were reinforced by the two descriptive studies:

- Proximity to a supermarket is generally regarded as critical to ensuring access to a variety of reasonably priced foods.
- There are desirable alternatives to traditional supermarkets as a means of ensuring food access.

The conference focused on bringing supermarkets to low-income communities through careful, cooperative planning and troubleshooting that starts with sound market research (Koralek, 1996). Adequate funding was identified as a key issue, and several private and public sources of support were discussed. These sources ranged from commercial banks with community development subsidiaries to grant and loan programs sponsored by Federal agencies. Participants in the conference, as well as findings from an FNS study (O'Connor & Abell, 1992), emphasized the importance of community buy-in for supermarket development. Introduction of a supermarket not only provides new products and services but also creates

jobs and helps to keep money in the community. These points can be used to obtain support from a mayor or city council when it comes to handling zoning, tax, and other issues. Buy-in from consumers will affect the ultimate success of the business, so matters of location, preferred store type, and other consumer interests should be addressed up front.

Desirable alternatives to traditional supermarkets include food cooperatives, urban agriculture, farmers' markets, public markets, smaller independent stores, and transportation hubs. Each has its own challenges but can contribute to a community's capacity to provide its own food.

Community-Level Interventions

Another type of intervention to increase the availability of healthy foods is through community-level programs, such as farmers' markets, community gardens, or mobile carts or trucks that sell fruits and vegetables. These options for improving the food environment are often less expensive, require less space, and can be quicker to implement than programs that encourage new store development. These programs typically operate on a more limited scale (e.g., seasonally or only 1 day a week) or in the case of community gardens can require large time commitments on the part of consumers. The goal of these interventions is to give consumers more options for purchasing nutritious food by increasing the supply of these foods. Often these interventions include nutrition and food education components or incentives to consumers to increase demand for nutritious food.

There are many, many examples of farmers' markets, community gardens, mobile carts, or other similar community-level interventions implemented in underserved areas. This analysis cannot cover them all but highlights an example from New York City as one of the more comprehensive plans that has been implemented. Also discussed is the use of SNAP benefits at farmers' markets, as it involves a component of the largest U.S. food and nutrition assistance program and could potentially be a lever with which the Federal efforts could increase access.

In addition to the Healthy Bodegas initiative, the City of New York has implemented two other community-level initiatives to increase access to fruits and vegetables. One initiative is to increase the number of farmers' markets in underserved neighborhoods and increase their use by residents through the Health Bucks program. The Health Bucks program offers \$2 coupons for the purchase of fresh fruits and vegetables at participating farmers' markets. Health Bucks were used as a tool to introduce consumers to farmers' markets, generating business for producers and helping reduce food access barriers for consumers. The program was expanded specifically for SNAP participants, with an additional \$2 Health Buck offered for every \$5 spent using EBT at the farmers' market. Through this program, EBT sales at farmers' markets more than doubled from \$40,000 in 2007 to over \$89,000 in 2008 (Nonas, 2009). The program is being expanded into upstate New York as the Fresh Bucks program.

In addition to the farmers' market and Health Bucks program, the city is also in the process of implementing a "Green Cart" program, which is intended to increase the number of mobile carts that sell fresh produce, especially

in underserved areas. Green Cart vendors are subject to the same permit process as other vendors, except they are restricted to operate in underserved areas and sell only fresh produce under the NYC Green Cart umbrella. The program is still recruiting vendors, a process that has been more difficult than expected (Nonas, 2009). To aid in the recruitment process, private foundation grants are being used to offer low-cost microloans to finance carts for vendors.

Another mechanism to increase use of farmers' markets among underserved communities and populations is through SNAP. The percent of SNAP-authorized stores comprised of farmers' markets has been consistently low. With widespread implementation of EBT systems during the late 1990s, the presence of farmers' markets among authorized retailers declined. This may be explained by the need for access to electricity in order to use the typical point-of-sale EBT equipment. Over the last several years, however, the number of participating farmers' markets has grown. In FY 2008, there were 753 farmers' markets authorized to participate in the program, up from 253 in FY 2000. Several factors contributed to this increase, including the increased popularity of these markets among the general population. In addition, FNS has endorsed a number of local and State initiatives to provide access to benefits through wireless point-of-sale equipment or scrip alternatives. With provisions in the 2008 Farm Bill, USDA's Agricultural Marketing Service will set aside 10 percent of the approximately \$5 million in competitive grants funding for FY 2009 for new EBT projects at farmers' markets.

Farmers' markets and community gardens have sprung up in many places, including in underserved areas. There is much knowledge about how such programs can successfully operate and become sustainable for long periods (see, for example, Fisher, 2009 and Smiley, 2009). There are often benefits of the programs that are harder to measure, such as increasing community and social capital or keeping ethnic and minority populations in touch with their cultural culinary heritage. The programs can also serve as educational opportunities for teaching about horticulture, nutrition, and farming and growing practices. There is, however, little evaluation of their effectiveness in terms of changing shopping behavior, diet, and diet-related outcomes for consumers.

Transportation-Related Improvements

In contrast to bringing the stores to people, an alternative approach is to bring the people to the stores. Programs that improve public transportation routes from areas with limited access or provide transportation subsidies to low-income individuals or subsidized supermarket shuttle services could be effective ways to reduce access problems. Transportation improvements such as these have some advantages, depending on characteristics of the areas. First, as the analysis in Chapter 2 showed, supermarket access may also be a problem for low-income people who live outside of low income areas. In cases where those with access problems are dispersed, transportation interventions may be more efficient than new store development since targeting an area for a store to locate to reduce access problems for this group would be difficult (relative to areas where there are high concentrations of low-income people with access problems). If public

transportation in the area already exists, it may not be too expensive or take as much time to change or add routes that could be used to improve access to stores. A transportation subsidy given to those with limited access may enable consumers to access foodstores that better fit their budgets. Such improvements could also help consumers access other services that may be lacking in their area (such as banks or health care providers).

Using the NFSPS survey data and data from the Louisiana Neighborhood Environment and Consumption Survey (LANECS), Rose et al. (2009) estimated travel costs for different transportation modes and across areas in New Orleans that had poor or good access to supermarkets. This exploratory exercise considered both out-of-pocket travel costs and time costs for the different travel options for grocery shopping.⁴⁶

Not surprisingly, a taxi was the most expensive option (\$66.60 per month), while a bus was \$38.70, a ride from a friend or relative was \$21.90, and walking was \$21.00.⁴⁷ Driving one's own car was the least expensive method for getting to the store (\$5.90 per month). The study also considered differences in time costs for New Orleans residents living in areas with poor access to supermarkets (defined as census tracts more than 2 kilometers from a supermarket), compared with the time costs for those living in areas with good access (defined as census tracts within 2 kilometers of a supermarket) (Rose et al., 2009). The average difference in travel cost between areas with poor access and areas with good access was \$10.58 per month—meaning that SNAP participants in poor-access areas of New Orleans had total travel costs (both time and out-of-pocket costs) that were on average (across mode of transportation) almost \$11 higher than those in areas in New Orleans with good access.

To improve access to supermarkets for low-income households, a transportation benefit in conjunction with SNAP benefits for participants who do not own cars and who have poor access to a supermarket could be considered (provided a satisfactory method for assessing access levels for participants is already available and could be implemented). SNAP benefits for people who live in areas with poor access could include a transportation subsidy (on top of the food benefit) that could be used to compensate for out-of-pocket costs to getting to a supermarket. For example, the city of Madison, WI, recently proposed to offer monthly bus passes at a discounted rate of \$27.50 (originally \$55) to people eligible for SNAP (Rose, 2009).⁴⁸ Another option could be to deduct transportation costs from total income for applicants with limited access to supermarkets, which would effectively give a larger benefit to these households (Rose et al., 2009).⁴⁹

Further exploration into the feasibility and costs and possible reactions of consumers to such transportation interventions is needed. If better public transportation options are made available, it would be useful to project how many people would use them. If transportation costs are deducted from income for SNAP applicants, it would also be useful to know the percentage of participants who would use their additional benefits to access better stores and more nutritious food, or who would simply buy more of the same foods from the same stores.

⁴⁶The time cost estimates use the hourly minimum wage to value time. See table 5 in Rose et al., 2009, for details.

⁴⁷Costs are to the nearest supermarket by mode of transport based on approach by Feather, 2003. Costs for each mode were weighted using the distributional data on the mode of transportation.

⁴⁸The program is partially intended to offset the effect of an increase in fares on low-income individuals.

⁴⁹This would not increase benefits for households that already receive the maximum benefit.

SNAP Retailer Policy

Retailers authorized to participate in SNAP must sell staple foods for home preparation and consumption. In addition, the store must offer for sale, on a continuous basis, three different varieties of foods in each of four staple food categories, with perishable foods in at least two categories; or have more than 50 percent of total gross sales in staple foods. Most stores are authorized under criterion a. A store technically can meet this criterion with a small number of items that meet the variety and perishable requirements.

As part of an overall review of existing regulations, USDA will review the current provisions for retailer depth of stock. The goal remains to balance access to a sufficient number of neighborhood stores with availability of a continuous supply of required foods.

There is some previous research on the relative tradeoffs of restricting small stores from SNAP authorization and from increasing access to large grocery stores or supermarkets (Feather, 2003). At the time of the study, (pre-EBT card implementation), there was concern about the amount of fraud in small stores authorized to receive SNAP benefits. The study, which valued and compared the benefits (costs) of restricting access for small stores and increasing access to large stores for participants, showed that access to a new store would result in a gain of \$2.78 to \$7.76 per participant, per month, depending on store location in relation to the participant location and the value of the cost of travel time. On the other hand, the loss to participants of restricting store access to only supermarkets and large grocery stores was estimated between \$4.16 and \$8.78 per participant, per month.

Housing and Community Development-Related Policy

State and local governments make most of the zoning and land-use planning decisions that determine the relationship of residential to commercial land uses. Yet, research shows many planners do not actively or systematically plan their communities' food access the way they plan access to services and facilities like transportation, parks, hospitals, or schools (Pothukuchi and Kaufman, 2000).

Some planning by units of local government is in direct response to Federal mandates and can be influenced by shifts in Federal policy. For example, when developing or rehabilitating public housing, public housing agencies are required by Federal regulation to choose sites that are accessible to commercial services. Chapter 3 of this study finds segregated, low-income areas are more likely to lack adequate food access than other areas. The characteristics of those areas are consistent with those of areas having large public housing developments, though further study is necessary to establish any potential links between low-access and public housing. If public housing and low-access are linked, the U.S. Department of Housing and Urban Development has existing regulatory authority to require future developments be sited closer to opportunities to access healthy food.

Another example of a Federal opportunity to encourage local governments to plan for communities' food access is the Community Development Block Grant program. Federal regulations specifically lay out the following goals:

increased access to quality public and private facilities and services, and access to capital and credit for development activities that promote the long-term economic and social viability of the community. Communities could be encouraged to incorporate healthy food systems planning in the required Consolidated Plans they submit that lay out their plans for the use of grant funds.

No changes to Federal rules governing programs like public housing and Community Development Block Grants would be needed to encourage food systems planning at the local level. Encouraging local governments to plan does not dictate specific policies, but instead allows communities to devise solutions specifically tailored to the community.

Anti-Poverty Policy

Chapter 3 provided analysis of the factors correlated with whether an area has limited access to affordable and nutritious food. Findings showed that some household characteristics are associated with greater risk of low access. Household characteristics such as low educational attainment, low employment levels, and reliance on public assistance were found to be the most influential determinants (in addition to low-income, upon which the analysis was conditioned). Federal anti-poverty programs, such as the Earned Income Tax Credit, Temporary Assistance for Needy Families; and food and nutrition assistance programs, such as SNAP, WIC, and the school meal programs are targeted to households with these characteristics. These programs often have goals to encourage and support employment and to offer income support, food, and better nutrition. Thus, some of the populations for which a food access policy intervention may be targeted already receive public assistance from these general anti-poverty programs. If these programs are successful in raising incomes, employment prospects, and educational opportunities, then low-income populations may be able to access better foods as well.

Summary

This chapter outlined the types of policy options that could be considered to reduce the effects of limited access to affordable and nutritious foods. A formal evaluation of the benefits and costs of these policy interventions was beyond the scope of this study. There are, however, some broad overarching guidelines to consider if future policy interventions are needed.

The analysis in chapter 2 shows that the number of people that are likely affected by limited access is small. Further, data on shopping patterns and prices actually paid show that many, but perhaps not all, low-income consumers have strategies for finding stores that offer the products they want at lower prices. Both of these findings suggest that a large-scale, national-level program may have difficulty addressing what are likely to be quite localized pockets of limited access.

The analysis in Chapter 2 and from other studies (Sparks et al., 2009; Apparicio et al., 2007) also shows food access may be a problem for some low-income families who live outside of areas with high concentrations of poverty. This observation is also important for policy considerations because

the type of intervention that may be effective in areas with concentrated poverty are probably different than the type of interventions that may be effective if the population with limited access is more geographically dispersed. For example, improving existing stores or enticing new stores or farmers' markets to areas where the population with limited access is concentrated may be an effective solution. On the other hand, if those who lack access are more dispersed, it may be more effective to improve transportation options or provide transportation subsidies for this population to travel to stores rather than encouraging new stores.

It is difficult to discern the degree to which supply-side and demand-side factors contribute to differences in store access (Bitler and Haider, 2009). Yet, making this determination is critical for understanding the types of policy interventions that may be needed.

On the demand side, the key question is if better access to affordable and nutritious food is provided, will people buy these foods? Evidence is mixed (see Cummins, 2005; Wrigley, 2003; Gittelsohn, 2009; Ayala et al., 2009). These studies show small increases or no changes in consumption of healthy foods in areas where access was improved. Related evidence suggests that price subsidies for fruits and vegetables can increase consumption of these foods for low-income consumers in general, but the effects are small and consumption is still below recommended levels (Dong and Lin, 2009). It is possible that demand for more nutritious foods like fruits and vegetables may also be driven by the time costs associated with preparing and cooking them, especially considering the relative convenience and price of alternative sources of foods. It is also possible that some consumers may not know the nutritional benefits of such foods. Some may also lack familiarity with preparation and the taste of these foods. If either of these is true, then increasing access through supply-side factors alone (e.g., enticing new stores) will not change food purchasing and dietary habits. A public health campaign to promote healthier eating and cooking habits may be more effective. Or, a program that gives low-income consumers incentives to purchase more fruits and vegetables, such as the Healthy Incentive Pilot that is being planned by FNS, could be more effective in increasing demand for these foods. If the time-cost tradeoffs are the major determinants behind lower demand, then such products as already-cut-and-cleaned fruits and vegetables or healthier prepared food options may be useful. There are usually price premiums for these prepackaged alternatives, however.

If supply-side factors, such as high fixed costs for new store development in low-income areas or restrictive zoning policies, are an obstacle for larger food retailers, then local policies toward zoning or government programs (at the Federal, State, or local level) that subsidize these costs for stores may be effective. There is some evidence that overall operating costs of stores serving low-income consumers are similar to those of other stores (King et al., 2004). But it is still possible that high fixed costs (as opposed to operating costs) could be barriers to entry for stores trying to locate in underserved areas.

Either of these demand or supply factors could be a market failure—that is, the market is not operating efficiently such that a government intervention could make the market operate more efficiently in a way that everyone

benefits. But again, there is not enough information to tell if there is a market failure on either the demand or supply side (see Bitler and Haider (2009) for a more complete discussion).

It is also important to differentiate between general issues faced by low-income neighborhoods and only those relevant to the supply of healthy foods. Many low-income neighborhoods may also lack access to banking services, health care services, and well-functioning public schools (Federal Reserve Bank and Brookings Institute, 2008). A supermarket can be a politically popular development for a low-income neighborhood because it provides for a most fundamental need—food (Rose et al., 2009). On the other hand, other services and businesses may be more important for a community (Bitler and Haider, 2009).

Chapter 4 summarized research on the effects of interventions on food shopping and consumption of specific foods. Given the rather modest findings, it is important to have realistic expectations about the potential effects of policy interventions on diet and, particularly, on more distal outcomes such as high BMI, obesity, and diet-related diseases. More proximate outcomes, such as shopping patterns and food intake, are more likely to be affected by any policy to increase access than more distal outcomes like obesity because there are so many other factors that contribute to obesity and because increased consumption of healthy foods may not lead to weight loss.

Given the lack of understanding about the actual causes of differences in access to food, it is tenuous to consider large-scale, national-level policy interventions. One possible approach, however, is to fund a number of demonstration projects throughout the country that use different approaches to reducing the effects of limited access to food. Projects could be appropriately tailored to fit the access issues facing a community—considering the specific needs of low-income people and the communities in which they live. The projects funded could vary in size and scope as appropriate—for example, incentives for the development of large-scale supermarkets or smaller projects like the Community Foods Projects that are already underway. Some of the demonstrations could operate through SNAP—for example, a transportation benefit for SNAP participants or a deduction of transportation costs for participants in determining benefit levels could be implemented in a variety of settings. Expansions to programs that focus on broader community development goals besides attracting food retailers could also be considered (such as CDBGs or New Market Tax Credits).

Regardless of the types of projects that may be considered, an important component of the projects should include formal evaluations of the benefits and costs of interventions. In some cases, randomized trials could conceivably be conducted; for example, transportation subsidies could be randomly assigned to SNAP participants who face access barriers. In other cases, this kind of evaluation would not be possible. Instead, the collection of longitudinal data on changes in shopping behavior or dietary intake (or whatever the desired outcome change is) for affected populations is important. Also important to consider are opportunities to conduct natural experiments or quasi-experimental designs in which comparison areas

or populations are used as a benchmark control to the intervention area or population. It may also be possible to tailor interventions specifically to people who already have diet-related diseases and who have difficulty accessing foods they need to manage their diseases. For example, diabetes patients under clinical care could be randomly assigned coupons for farmers' markets or coupons for healthy options at supermarkets to determine if increasing access was an effective way to manage the disease.

Chapter 4 and Rose et al, (2009) raised the possibility that food swamps and not food deserts may be more of a factor in BMI and obesity concerns. If it is the case that energy-dense foods are too easily accessed, then policy interventions may need to reduce the incentive to eat less healthful foods or reduce access to these foods. This could be much more difficult because even stores stocking the healthiest of options also stock the least healthy options. Taxing less healthy foods (e.g., soda or sweetened beverages) is one example of such a policy, but these taxes inherently have distributional tradeoffs that must also be considered.

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Future Research Needs

Progress has been made in characterizing the problem of food deserts and in describing their consequences for affected populations. Many aspects of food deserts, however, are not well defined or understood. This chapter outlines future research needs for each of these aspects of food deserts. It first focuses on conceptual and measurement issues of food access. These were discussed in greater detail in Chapters 1 and 2. Next, it considers the research issues for determining the causes of limited access, which were discussed in Chapter 6. Finally, it highlights future research considerations for understanding the economic and health consequences of limited access.

Conceptualizing and Measuring Food Access and the Food Environment

A variety of concepts and methods have been used to measure access to affordable and nutritious food. But because of the breadth of sources of both nutritious and less nutritious foods and the complexity with which consumers make choices about where to shop, what to eat, and how much time to devote to these and other food-related activities, it is very difficult to fully measure and characterize food access for consumers.

Existing studies almost exclusively consider access to stores from consumers' homes and ignore the potential access to food that consumers have because they travel to school, work, or other activities. Future research should consider how people fit grocery and food shopping into their daily activities and travel patterns. It will also be important to consider how these activities and patterns expose people to food environments outside of their neighborhoods and how this may affect their shopping and diet.

Most of the research that has been conducted focuses on an area-based concept of access. Area-based concepts are important because cross-sectional evidence suggests that the food and neighborhood environment has a strong correlation to food intake and to some diet-related health outcomes and because individual factors alone cannot explain all the differences in diet and health. The findings from the national-level assessment of access to supermarkets and the discussion in Chapter 1 suggest that an individual-based concept of access may be as important. That is, some low-income people do not live in areas with concentrated poverty, but still may lack the resources or transportation to access affordable food. Further clarification of both individual measures of access and area measures of access is needed. Studies that offer both types of measures could be useful. For example, it would be useful to understand the degree to which individuals who report access limitations (such as those in the Current Population Survey-Food Security Supplement CPS-FSS) live in areas that may be considered low-access areas.

It is clear from the research that some areas and individuals have relatively less access to some food retailers than other areas and individuals. This is useful information which highlights issues of equity and areas where policy

interventions or private store development may be targeted. But it is not clear whether these relative deprivations in access to food constitute an absolute inadequacy of access to food. That is, just knowing that an area has less access to food than another area may not be enough to say that access is inadequate and thus, whether policy-interventions may be necessary. This is not to say that there are no areas where access is inadequate. Rather, such a designation has not yet been systematically considered to make such judgments. Further conceptual clarification of the adequacy of food access is needed in order to do so.

Actually measuring food access, even when the key conceptual constructs are well-defined, will require a great deal more data. National-level assessments, such as those conducted in Chapter 2, are important for monitoring broad characteristics of the food environment in the U.S. The use of supermarkets and large grocery stores as proxy measures of the availability of affordable and nutritious food is a feasible way to operationalize a measure of access on a broad national scale. Such stores typically offer competitive prices and have greater variety of foods. But examining only large supermarkets and grocery stores inevitably understates the sources of food available to consumers, since food is available from many other retailers and from restaurants and because consumers do not limit their food shopping to stores near their homes. Thus, national-level assessments can only go so far.

It may be more feasible to collect indepth information on food availability, prices, and consumer shopping and travel behavior systematically across a few local areas so that concepts and measures of access can be further defined and studied. Tools like the Nutrition Environment Measures Survey and indepth studies that have included complete enumeration of stores in an area and even collected information on the contents of shelves of stores within an area (for example, Rose et al., 2009; Sharkey and Horel, 2009) could be used. Surveys of individual consumers' food shopping, preparation, and consumption patterns could be a part of such studies. Such surveys may also include questions of access limitations like those collected in the CPS-FSS or the National Food Stamp Participant Survey.

It would also help to know the prices of goods because while some goods may be available, their prices may be so high that they are not reasonably affordable. Data collected by the Bureau of Labor Statistics to compute the Consumer Price Index, or data from Nielsen's Homescan panel could be linked to food availability data (Bitler and Haider, 2009).

On a national level, it may be more feasible to use direct questions about food access and the food environment to understand the extent of the problem. Questions on whether households had enough to eat and if not, why, that were once a part of the Current Population Survey's Food Security Supplement could again be included on the annual survey. These questions may need to be modified to elicit more information about access limitations. But they could be useful in monitoring changes and trends in the number of Americans affected by limited access to food sources on a national level. The NFSPS is another model for collection of individual level measures of access to food. This survey collected much more extensive data on consumer shopping behavior and data on modes of travel to stores, travel times and distances, types of foods purchased, and consumer opinions

about food shopping options. Other surveys of individuals and households could consider asking more questions about food shopping and consumption behavior, including questions on the kinds of stores at which major shopping is conducted, the distance to the stores and the time and costs required to reach them, and the modes of transportation used to get the stores. National-level surveys such as the National Health and Nutrition Examination Survey (NHANES) or the Consumer Expenditures Survey could be used for this purpose. NHANES also collects food intake data and information on BMI and other diet-related health outcomes for individuals and could be used to better understand the economic and health consequences of food access (a point discussed later in this chapter). Individual questions of mobility limitations (e.g., for the elderly or disabled) could also be considered.

Understanding the Causes of Limited Access

It is possible that supply-side factors, such as the costs firms face to open new stores, or demand-side factors, such as a lack of information about the health benefits of some foods, or both could lead to variation in access across areas and in the types of retailers or types of foods sold in areas. Future studies should consider how supply or demand factors differ across areas in ways that could lead to differences in access to food retailers and restaurants. There is some research on the cost factors affecting food retailers (King et al., 2004). The operating costs of supermarkets that serve relatively larger portions of low-income consumers are not greater than those that serve fewer low-income consumers, but it is not clear if there may be differences in fixed costs of developing supermarkets or stocking healthier food alternatives. In a similar way, further exploration into demand-side factors—why consumers choose the foods they buy and the stores and restaurants from which they buy could also help determine the causes of variation in food access across areas. Such studies would require going beyond the usual factors that economic studies consider in demand analysis, such as income, education, and price. Although data could be difficult to collect, more information is needed on consumer knowledge of nutrition, food preparation, tastes, and variations of such across different subpopulations. Understanding the time, price, and nutritional tradeoffs of cooking at home versus eating at restaurants or eating prepared meals would also be beneficial for understanding how some areas may be saturated with some types of food outlets but lacking in others.

Another potential approach to understanding product availability and market prices is to apply spatial demand models to food access. These models (Capozza and Van Order, 1978) consider not only the costs for suppliers but also the transportation costs for consumers to get to different stores as determinants of spatial distribution of stores and prices. Applying these models would require better data on transportation costs to stores (Bitler and Haider, 2009).

Understanding the Economic, Diet, and Health Consequences of Limited Access

The causal pathways linking food access to shopping and consumption behavior and the effects of these behaviors on diet-related conditions like body weight, diabetes, or cardiovascular disease are not well understood.

Methodological and data improvements could make it possible to go beyond cross-sectional relationships to isolate the effects of access, or changes in access, on shopping and consumption behavior separately from the effects of individual preferences for foods or other goods and services, which also may affect shopping and food intake decisions.

Natural experiments and quasi-experiments, such as the UK studies in Glasgow and Leeds, could be conducted in the United States where new stores or improved stores become available. Instrumental variable approaches that try to consider the effects of access separately from decisions about choices of where to live could also be used to better understand the effects of access on shopping, diet, and diet-related health outcomes (see, for example, Chen et al., 2009). Studies that use cross-sectional variation in prices of foods, individual characteristics, and neighborhood characteristics could help sort out how these factors interact to affect food shopping and food intake. Finally, there is little consideration of the effects of time costs on decisions of where to shop for food, what to eat, and where to eat it. More consideration of the time tradeoffs of different consumption and shopping choices is needed.

Cross-sectional data sets like NHANES and the American Time Use Survey could be further exploited to uncover the causal links. Doing so may require linking geographical data to the individuals or households in these surveys so that aspects of food access and the food environment can be linked to food intake or time-use data.⁵⁰ Localized data on food prices from Nielsen is being linked with the NHANES survey by National Center for Health Statistics staff and used by ERS staff to better understand how price variation affects food consumption decisions. The 1996 National Food Stamp Participant Survey collected a wealth of information on food access, food shopping behavior, travel costs and time costs of food shopping, and food use (see Chapters 2 and 5). This survey is over 10 years old. An updated version of the survey could be considered to help improve understanding of food access issues. In addition to providing more recent data, additional information on food access, food shopping, and food use could be collected in an updated round, including complete information for both SNAP participants and eligible nonparticipants. It may also be feasible to oversample individuals who live in areas that have low access to supermarkets to provide greater sample size to study those who live in areas with low access.

Longitudinal data on both consumer shopping and food intake and on the food environment could help tease out the causal pathways between access and consumption by linking changes in the food environment to changes in shopping or food intake. Currently, none of the national-level surveys collect detailed longitudinal data on consumer shopping or food intake. Given the lack of national longitudinal data on food shopping and food intake, it may be more feasible to add questions on intake of a few important foods (e.g., the frequency of eating fruits and vegetables or whole grains) to existing longitudinal surveys such as the Panel Study of Income Dynamics, the National Longitudinal Survey of Adolescent Health, or the Early Childhood Longitudinal Surveys. These longitudinal surveys or others, such as the Survey of Income and Program Participation, could also ask basic questions

⁵⁰The estimates of time spent traveling to grocery stores across distances from supermarkets in tables 2.8 and 2.9 used such linked data.

of whether households have enough food and if not, why, such as those questions that were at one time part of the CPS-FSS.

In addition to understanding where stores choose to locate, it is also important to know why people choose to live where they live. Economic studies have considered the values consumers place on different amenities of neighborhoods, such as availability of parks or the quality of public schools. Not much is known about how consumers value such amenities as supermarkets or restaurants. Low-income individuals are more constrained in these choices than high-income individuals. Even less is known about how lower income and other subpopulations value different amenities and about how social networks may affect location decisions. Further research on residential choice could help further the understanding of how differences in income, preferences, and price affect the way consumers sort into areas with different levels of access (see Bayer et al., 2004).

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Appendix A

Access to Affordable and Nutritious Food: Understanding Food Deserts

Workshop Agenda

Waugh Auditorium
Economic Research Service
1800 M Street, NW
October 9, 2008

- 8:00 – 8:30 Check-in and continental breakfast
- 8:30 – 9:00 Welcome, Introductions, and Goals of the Workshop
Laurian Unnevehr, Food Economics Division, ERS
Shelly Ver Ploeg, Food Assistance Branch, ERS
- 9:00 – 10:30 Session 1: Defining and Conceptualizing Areas of Low
Access to Affordable and Nutritious Food
Chair: Robert Gibbs, Farm and Rural Household Well-
Being Branch, ERS
Lois Morton, Iowa State University
Diego Rose, Tulane University
Joel Gittelsohn, Johns Hopkins University
- 10:30 – 10:45 Break
- 10:45 – 12:00 Session 2: Implications of Low Access for Food and
Nutrition Assistance
Programs
Chair: Steve Carlson, Food and Nutrition Service,
USDA
Carol Olander, Food and Nutrition Service, USDA
Anne Bartholomew, Food and Nutrition Service, USDA
Joel Berg, New York City Coalition Against Hunger
Lorette Picciano, Rural Coalition
- 12:00 – 12:45 pm Lunch at ERS
- 12:45 – 1:30 Luncheon Address: Food Deserts and Diet and Health
Outcomes
Judith Wylie-Rosett, Albert Einstein College of Medicine
and the American Heart Association
- 1:30 – 3:00 Session 3: Community Efforts to Reduce the Impact of
Areas of Low Access
Chair: Elizabeth Tuckermanty, Cooperative State
Research, Education, and Extension Service, USDA
Joel Gittelsohn, Johns Hopkins University

LaDonna Redmond, Institute for Community Resource
Development, Chicago, IL

Pamela Roy, Farm to Table & the New Mexico Food and
Agriculture Policy Council

Ken Meter, Crossroads Resource Center, Minneapolis,
MN

3:00 – 3:15

Break

3:15 – 4:45

Session 4: Roundtable Discussion of Program and Policy
Options

Chair: Neil Conklin, Farm Foundation

Tim Hammonds, Food Marketing Institute

John Weidman, The Food Trust

Andy Fisher, Community Food Security Coalition

Kami Pothukuchi, Wayne State University

4:45

Closing and Adjourn

Neil Conklin, Farm Foundation

Appendix B

Box B.1

Measures of Access Used in Food Desert and Related Studies

1) Algert, Susan J., Aditya Agrawal, and Douglas S. Lewis (2006). "Disparities in Access to Fresh Produce in Low-Income Neighborhoods in Los Angeles." <i>American Journal of Preventive Medicine</i> 30(5): 365-370.	
Area Studied Pomona, CA	Measure of Access Divided food stores in Pomona as having a "variety" of produce or "limited produce" based on onsite inspections, telephone interviews regarding produce content, or inference from store description. Stores selling four or fewer produce items were counted as "limited" while those serving more than four were counted as having a "variety" of produce. Access was measured by distance from a store offering a variety of produce. Addresses of food pantry clients were geocoded. Those living outside of a "walkable" distance to a store selling a variety of produce (0.8 km or about a 15 minute walk) were highlighted as not having access to a variety of produce.
2) Alwitt, Linda F., and Thomas D Donley (1997). "Retail Stores in Poor Urban Neighborhoods." <i>The Journal of Consumer Affairs</i> 31(1): 139-164.	
Area Studied Chicago, IL	Measure of Access Examined number of retail stores of different types and sizes in "poor" ZIP Codes. Poor ZIP Codes are defined as: 1) poverty rate in highest quartile of ZIP Codes in Chicago, 2) lowest quartile of high school graduation rate, 3) lowest quartile of labor force participation, and/or 4) highest quartile of unemployment rate. Store size was defined by the number of employees.
3) Apparicio, Philippe, Marie-Soleil Cloutier, and Richard Shearmur (2007). "The case of Montréal's missing food deserts: Evaluation of accessibility to food supermarkets." <i>International Journal of Health Geographics</i> 6(4).	
Area Studied Montreal, Canada	Measure of Access Measured access by proximity (nearest supermarket), diversity (number of supermarkets within 1,000 meters), and variety in terms of food and prices (mean distance to the three closest, different chain-name supermarkets). Supermarkets were defined as grocery stores associated with one of the seven major chains in Quebec.
4) Baker, Elizabeth A., et al. (2006). "The Role of Race and poverty in Access to Foods That Enable Individuals to Adhere to Dietary Guidelines." <i>Preventing Chronic Disease: Public Health Research, Practice, and Policy</i> 3(3).	
Area Studied St. Louis, MO	Measure of Access Supermarket audits were used to assess "healthy food" availability in stores, where healthy food was defined by USDA dietary intake guidelines. A checklist of 78 canned, fresh, or frozen fruits and vegetables were used by auditors. Availability of lean, low-fat and fat-free meat, poultry, and dairy products was also considered. Composite score for each supermarket was developed based on these audits. The composite scores were then divided into tertiles of high, medium, and low availability. Census tracts were divided by racial composition (greater than 75% African-American, greater than 75% White, and mixed) and poverty level (less than 10% poor, 10-20% poor, and greater than 20% poor).
5) Berg, Nathan, and James Murdoch (2008). "Access to grocery stores in Dallas." <i>International Journal of Behavioural and Healthcare Research</i> 1(1): 22-37.	

Area Studied Dallas County, TX	Measure of Access Mapped all of the mainline chain grocery stores in Dallas County and then counted how many stores were within a 1-mile radius of neighborhood Census block groups. The study linked this geospatial data with neighborhood income levels, poverty levels, and racial composition.
6) Blanchard, Troy C., and Thomas Lyson (2006). "Access to Low Cost Groceries in Nonmetropolitan Counties: Large Retailers and the Creation of Food Deserts." <i>Journal of Regional Studies</i> .	
Area Studied Mississippi	Measure of Access A food desert is classified as having no supermarkets or supercenters within a 10-mile radius of a ZIP Code centroid (with exceptions for highways). A supermarket classification was based on having 50 or more employees and a supercenter classification was based on NAICS category 452910.
7) Horowitz, Carol R., et. al. (2004). "Barriers to Buying Healthy Foods for People With Diabetes: Evidence of Environmental Disparities." <i>American Journal of Public Health</i> 94(9): 1549-1554.	
Area Studied East Harlem and Upper East Side, New York City	Measure of Access Classified stores as desirable if they had at least one item of the following five and undesirable if it had none of the items: (1) Diet soda (1-L or 2-L size) (2) 1% fat or fat-free milk (1-quart, half-gallon, or 1-gallon size) (3) High-fiber bread, low-carbohydrate bread, or both high-fiber and low-carbohydrate bread (defined as 2 g or more fiber, 10 g or less carbohydrate per slice, or both) (4) Fresh fruits (5) Fresh green vegetables or tomatoes.
8) Block, Daniel and Joanne Kouba (2005). "A comparison of the availability and affordability of a market basket in two communities in the Chicago area." <i>Public Health Nutrition</i> 9(7): 837-845.	
Area Studied Austin and Oak Park in Chicago, IL	Measure of Access The study compared item availability, price, and quality of food in 10 different types of foodstores in Austin (poor and African-American) and Oak Wood (upper-middle class and diverse races). Item availability was calculated by how many items a store stocked from a food list based on the USDA's Thrifty Food Plan. Price was calculated from the items in the food basket and the average price from all stores was assigned if an item was not sold at that store. Quality rating was subjective and only given two options, "satisfactory" or "poor." The 10 store types were national and regional chain markets, independent supermarkets, independent groceries, chain drug stores, gas stations, liquor stores with food, chain convenience stores, dollar stores, and specialty stores.
9) Block, JP, RA Scribner, KB DeSalvo (2004). "Fast food, race/ethnicity, and income: a geographic analysis." <i>American Journal on Preventive Medicine</i> 27(3): 211-7.	

Area Studied New Orleans, LA	Measure of Access The study geocoded all fast food restaurants and used a 1 mile and 0.5-mile radius as buffers around Census tracts to determine "shopping areas" in each tract. Fast food restaurant density was calculated by the number of fast food restaurants per square mile. Fast food restaurants have two or more of the following characteristics: expedited food service, takeout business, limited or no wait staff, and payment tendered prior to receiving food. These data were then compared with neighborhood characteristics, such as percentage Black population and low income.
10) Bodor, J Nicholas, Donald Rose, Thomas A Farley, Christopher Swalm, and Susanne K Scott. "Neighborhood fruit and vegetable availability and consumption: the role of small food stores in an urban environment." <i>Public Health Nutrition</i> 11(4): 413-420.	
Area Studied Four Census tracts in central-city New Orleans	Measure of Access Adequate access was calculated by two components; distance from the household to a foodstore and the instore availability of healthy items. The study included all stores selling food within the four Census tracts and all supermarkets within 5 km of the tract borders. Trained observers determined instore availability by calculating the linear shelf space devoted to fruits and vegetables and the number of fresh produce varieties available. Neighborhood availability was then determined by summing all of the shelf space devoted to fresh fruits and vegetables in all small food stores within 100 m of the household residence.
11) California Center for Public Health Advocacy, PolicyLink, and UCLA Center for Health Policy Research (2008). Designed for <i>Disease: The Link Between Local Food Environments and Obesity and Diabetes</i> .	
Area Studied California	Measure of Access Retail Food Environment Index (per adult): Total number of fast food restaurants and convenience stores divided by the total number of grocery stores and produce vendors within a given radius of the person's home. The radius used was 0.5 miles for urban areas and 5 miles for rural areas.
12) Clarke, Graham (2002). "Deriving Indicators of Access to Food Retail Provision in British Cities: Studies of Cardiff, Leeds, and Bradford." <i>Urban Studies</i> 39(11): 2041-2060.	
Area Studied Cardiff, Leeds/Bradford (UK)	Measure of Access The study used GIS to map store locations. A circle with a 500-meter radius was drawn around each multiple/co-op store, which represents the maximum walking distance. Potential food deserts were only the areas that met the Carstairs indices of multiple deprivation and only had a few, small independent stores. The Hansen accessibility and spatial interaction model take into account the location and size (30,000, 60,000, and 90,000 square feet) of store in relation to its customers and social class structures.
13) <i>Examining the Impact of Food Deserts on Public Health in Chicago</i> . Mari Gallagher Research & Consulting Group (2006).	

Area Studied Chicago, IL	Measure of Access Food Balance Score: average distance (blocks) to any mainstream food venue divided by the average distance to a fringe food venue (includes fast-food). A mainstream food venue is a grocery store and a fringe food venue is everything else, such as convenience stores and fast food restaurants. The study compared food ratio scores and their impact on Years of Potential Life Lost (YPLL) and BMI outcomes, holding education, income, and race constant.
14) <i>Examining the Impact of Food Deserts on Public Health in Detroit</i> . Mari Gallagher Research & Consulting Group (2007).	
Area Studied Detroit, MI	Measure of Access Food Balance Score: average distance (blocks) to any mainstream food venue divided by the average distance to a fringe food venue. A mainstream food venue is a grocery store and a fringe food venue is everything else, such as convenience stores and fast food restaurants. Researchers manually classified store types based on appearance and items they sold. Diet-related death data are used to calculate Years of Potential Life Lost, a statistic that measures the total number of life years lost due to premature death per 100 people in a population from a certain cause. The Food Balance Score was then compared with the YPLL statistic in each neighborhood.
15) Guy, Cliff, Graham Clarke, and Heather Eyre (2004). "Food retail change and the growth of food deserts: as case study of Cardiff." <i>International Journal of Retail and Distribution Management</i> 32(2): 72-88.	
Area Studied Cardiff, UK	Measure of Access The study measured the spatial distribution of multiple and co-op grocery stores (healthy food stores) using electoral divisions as the geographical unit. Areas with a high deprivation are considered food deserts, and this was calculated by the Welsh Index of Multiple Deprivation (IMD). IMD includes income, employment, health, education, housing, and geographic components.
16) Hendrickson, Deja, Chery Smith, and Nicole Eikenberry (2006). "Fruit and vegetable access in four low-income food deserts communities in Minnesota." <i>Agriculture and Human Values</i> 23: 371-383.	
Area Studied Four urban and rural communities in Minnesota	Measure of Access The study used a survey based on the Thrifty Food Plan to measure the average price per pound of a food item, how much of the food item was offered, and the quality of the food item. Quality was determined by expiration dates on packaged food and by the opinion of surveyors for produce items. Consumer focus groups also revealed what residents thought of the availability, quality, and price of food.
17) Hosler, Akiko, et. al. (2008). "Assessing Retail Fruit and Vegetable Availability in Urban and Rural Underserved Communities." <i>Preventing Chronic Disease</i> 5(4). http://www.cdc.gov/pcd/issues/2008/oct/07_0169.htm . Accessed December 4, 2008.	

Area Studied Urban and rural areas in New York State	Measure of Access Instead of categorizing stores based on business type (such as a gas station or supermarket), businesses were labeled as a fruit and vegetable stores if they stocked at least two types of fresh fruit and at least three types of fresh vegetables. There were three types of fruit and vegetable stores: super produce stores, year-round produce stores, and seasonal produce stores. Fruit-for-snack stores were stores that carried at least one type of ready-to-eat fresh fruit but didn't meet the fruit and vegetable measure.
18) Sharkey, Joseph R. and Scott Horel (2008). "Neighborhood Socioeconomic Deprivation and Minority Composition Are Associated with Better Potential Spatial Access to the Ground-Truthed Food Environment in a Large Rural Area." <i>The Journal of Nutrition</i> 138(3): 620-627.	
Area Studied 6-county rural region in Texas	Measure of Access The study calculated the distance to the nearest foodstore from the population-weighted center of each CBG and then examined associations among deprivation, minority composition, population density, and distance to foodstore.
19) Kaufman, Phil R. (1999). "Rural Poor Have Less Access to Supermarkets, Large Grocery Stores." <i>Rural Development Perspectives</i> 13(3): 19-25.	
Area Studied Lower Mississippi Delta (36 rural, high-poverty counties)	Measure of Access Net accessibility is the ratio of available large grocery store sales to potential food spending by households in a ZIP Code-based area (region broken up into quartiles). The stores in the study all have annual sales of \$500,000 or more.
20) Morton, Lois Wright and Troy C. Blanchard (2007). "Starved for Access: Life in Rural America's Food Deserts." <i>Rural Realities</i> 1(4): 1-10.	
Area Studied Rural Iowa	Measure of Access Low access: 50% of population lives more than 10 miles from large foodstore (supermarkets or supercenters). Food Desert: All residents live more than 10 miles from large foodstore Large foodstores are large supermarkets and supercenter.
21) Short, Anne, Julie Guthman, and Samuel Raskin (2007). "Food Deserts, Oases, or Mirages? Small Markets and Community Food Security in the San Francisco Bay Area." <i>Journal of Planning Education and Research</i> 26: 352-364.	
Area Studied San Francisco, CA (Bayview, Mission, Central East Oakland)	Measure of Access The study measured accessibility by distance (mapping), affordability and nutritional adequacy (market basket analysis), cultural acceptability (types, variety and quality of goods carried and characteristics that may affect the shopping experience), and quality (produce observation) for small (less than 3,000 sq ft) full-service foodstores. Instead of measuring overall community access, the study measured whether small full-service stores can enhance access to food compared with chain and large supermarket availability.
22) Smoyer-Tomic, Karen E., John C. Spence, and Carl Amrhein (2006). "Food Deserts in the Prairies? Supermarket Accessibility and Neighborhood need in Edmonton, Canada." <i>The Professional Geographer</i> 58(3): 307-326.	

Locations of Food Access Studies

Local/ State:

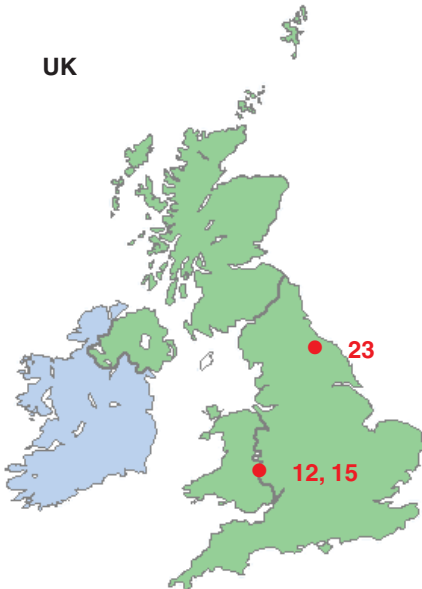
Regional/ Nation:

- 1-Pomona, CA
- 2-Chicago, IL
- 3-Montreal, Canada
- 4-St. Louis, MO
- 5-Dallas County, TX
- 6-Mississippi
- 7-New York, NY
- 8-Chicago, IL maps
- 9-New Orleans, LA
- 10-New Orleans, LA
- 11-California
- 12-Cardiff, UK

- 13-Chicago, IL
- 14-Detroit, MI
- 15-Cardiff, UK
- 16-Minnesota
- 17-New York
- 18-Texas
- 19-Lower MS Delta
- 20-Iowa
- 21-San Francisco, CA
- 22-Edmonton, Canada
- 23-Leeds, UK
- 24-Detroit, MI
- 25-Detroit, MI

- 26-South USA
- 27-USA
- 28-USA
- 29-USA
- 30-USA
- 31-UK
- * 26-31 not shown on maps

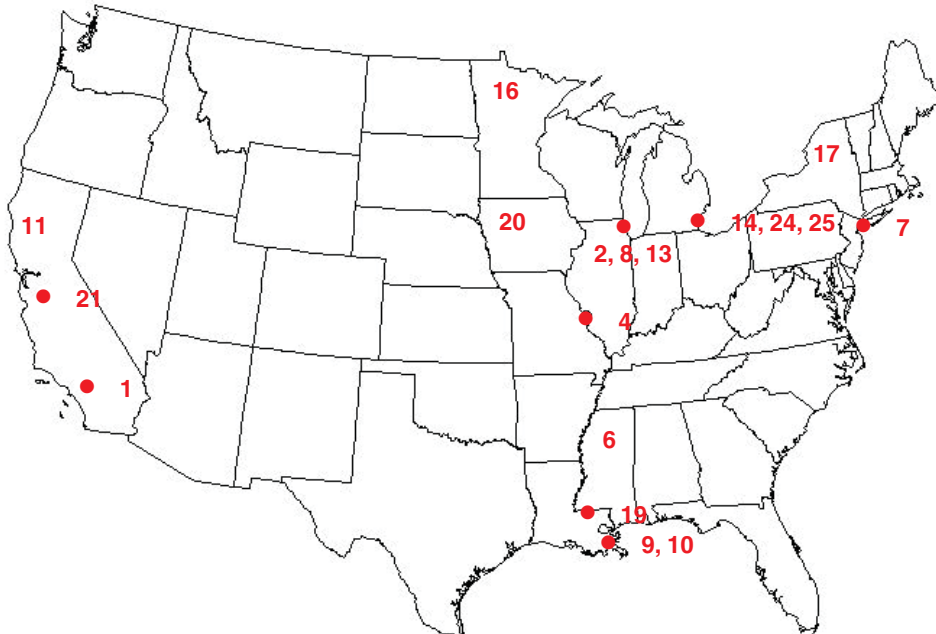
UK



Canada



USA



Appendix C

Methods, Supporting Tables, and Maps for National-Level Analysis of Supermarket Access

I. Methods

Store Directory Development. The directory of authorized SNAP foodstores was merged with the TDlinx listing of supermarkets to take advantage of the strengths found in each source. SNAP-authorized stores that did not match with the TDlinx directory were examined in detail. After reviewing SNAP stores classified as either SM (supermarkets) or SS (superstores) in the 2006 listing, it was concluded that many of the SNAP superstores did not meet the same criteria as the industry supermarkets.⁵¹ To further sort through which of the SNAP stores met the definition of a supermarket, researchers examined the annual total sales and food sales of all SNAP stores classified as SM and SS that did not match with TDlinx supermarkets. Stores that did not meet the annual \$2 million in sales requirement or that did not have significant food sales were eliminated. Researchers used the Trade Dimensions *Marketing Guidebook* (2008) to verify where food sales data were unavailable or not current. Online sources, such as company Web sites and other online sources for additional information about a store's annual sales and the kinds of foods sold, were checked. By combining the two store listings and using outside sources for verification, researchers obtained a more comprehensive national list of supermarkets and supercenters.

The combined list of supermarkets was converted into a GIS-useable format by geocoding the street addresses into store point locations. In many instances, the two databases referenced the same store, while in other instances the geocoded location differed. To address near-matches, researchers employed a proximity analysis and an automated matching system to analyze similarities in store names and addresses and location. Some manual data analysis was also performed to identify points in the two data sets that were the same supermarket. The resulting data set included all of the more than 34,000 TDlinx store locations, as well as an additional 6,000 SNAP store locations (all of which had annual sales above \$2 million and did not match a TDlinx store). The final combined data set included locations for 40,108 supermarkets and supercenters nationwide.

Walking and Driving Distances Measures of Access. Walking access measures a range of distances for which it is feasible to walk to a supermarket, while drivable distance measures a range of distances for which it is feasible to drive to a supermarket. Researchers developed a time-based distance measure equivalent for both walking and driving. A walking speed of 2 miles per hour was assumed; thus, "high" access would equal a 15-minute walk, or one-half mile in distance. For drivability, researchers assumed a point-to-point driving speed of 40 miles per hour; thus, a walking distance equivalent to "high" access based on driving is 10 miles (40mph x 0.25 hours). These measures were extended to obtain driving time-equivalent distances for "medium" and "low" access.

⁵¹ SNAP-authorized stores were, for the most part, self-classified by the applicant. A large number of SNAP superstores are known to carry some packaged foods but are less likely to include fresh fruit and vegetables or fresh meat products.

The walkability range is categorized as high, if a supermarket is within a half mile; medium, if a supermarket is between one-half and 1 mile; and low, if the nearest supermarket is more than a mile away. Obviously, whether walking to a supermarket is feasible or not depends on more than just distance—it could also depend on whether the individual is capable of walking that distance, whether there are safe sidewalks on which to walk and controlled intersections, and whether there are other barriers, such as crime that may make walking to a store dangerous. Furthermore, the measures of distance are all Euclidian, or straight-line distance, which may not represent the actually distance that must be walked to access a supermarket. Despite these limitations, this definition of walkability is grounded in the literature. Algert, Agrawal, and Lewis (2006) defined access to stores selling a variety of produce as a walkable distance of 0.8 km., or about a 15-minute walk. Apparicio et al. (2007) measured supermarket access proximity by the number of stores within 1,000 meters, or about 0.6 miles. In a study by the California Center for Public Health Advocacy and the UCLA Center for Health Policy Research (2008), a store radius of 0.5 miles was used to determine adequate access in urban areas.

In rural areas, a drivability measure of access is also used. Drivability is categorized as either high, if a supermarket is within 10 miles; medium, if a supermarket is between 10 and 20 miles; and low, if a supermarket is greater than 20 miles away. The drivability range is not as well grounded in the literature as is the walkability range. Sharkey and Horel (2009) used a walking distance of 1 mile, and driving distances of 3, 5, and 10 miles to measure foodstore proximity in six rural counties in Texas. Morton and Blanchard used any distance outside of 10 miles to describe areas with limited access (2007). Kaufman (1999) found access to a supermarket involved a trip of more than 30 miles for 70 percent of low-income households in a 36-county area of Mississippi, Louisiana, and Arkansas. Researchers know of no other studies that have systematically characterized rural areas as having access to stores or not. The categorization is admittedly somewhat arbitrary, but is not thought to be unreasonable for illustrating national-level trends.

Use of a Kernel Density Function to Define Low-Income Areas. Two criteria were used to identify low-income neighborhoods and communities: a household income had to equal 200 percent or less of the Federal poverty threshold, and, for a given geographic area, at least 40 percent of the population had to meet that criterion. Because the geographic areas consisted of uniform 1-sq.-km. grids, a systematic search criterion was used, where for each grid, the population of adjacent grids extending 3 km. in all directions was used to test whether at least 40 percent of the total population within the search area met the poverty threshold requirement. This procedure is a type of the kernel density function. Its primary purpose here is to test each grid within the context of adjacent grids for meeting the low-income area criteria. The kernel density function also serves to smooth the observed variation in population income, resulting in contiguous (less fragmented) low-income and non-low-income geographic areas, in which the population within these areas is more similar than dissimilar with respect to the income thresholds applied.

While the choice of search area to use is not empirically derived, researchers experimented with different search areas and observed the resulting plots of low-income areas. An effort was made to avoid applying search criterion less than 3 km., in which results gave highly fragmented (pixilated) areas, interspersed with many higher income areas. Conversely, the use of a large search criterion, such as 5 km., resulted in very large low-income areas that included many higher income populations within it. In determining the kernel density search area, these factors and outcomes were considered.

II. Tables.

Table C.1

National levels of access households living in higher income areas: walking and driving distances¹

Access level	Number of square-kilometer grids	Share of total square kilometer grids	Total higher-income area persons, by access level ²	Share of total higher-income area persons, by access level	Number of low-income persons in higher-income areas, by access level	Share of total low-income persons in higher-income areas, by access level
		Percent	Millions	Percent		Percent
Walking:						
High	57,209	1.0	47.6	22.8	10.6	24.4
Medium	148,359	2.6	68.0	32.6	13.9	32.2
Low	5,433,305	96.4	92.8	44.5	18.8	43.3
Subtotal	5,638,873	100.0	208.3	100.0	43.3	100.0
Driving:						
High	3,776,567	67.0	205.2	98.5	42.4	97.9
Medium	1,292,894	22.9	2.8	1.3	0.8	1.9
Low	569,412	10.1	0.3	0.1	0.1	0.2
Subtotal	5,638,873	100.0	208.3	100.0	43.3	100.0

¹Includes low-income households living in higher-income areas.

²Areas defined according to ERS criteria. See text for details.

Sources: Census of Population, 2000 and ERS-compiled 2006 supermarket directory.

III. Figures.

Measuring Access Using Cumulative Density Functions (CDFs). In the area-based analysis, researchers first separated the U.S. population into one of three urbanicity types (urban, urban clusters, and rural) to compare access to supermarkets among areas having similar levels of built environment. For each urbanicity, low-income areas were compared with non-low income areas, as well as for three additional vulnerable subpopulations. Within each urbanicity-subpopulation class, distance was measured to the nearest supermarket for each grid. All grids were ranked according to distance, from closest to farthest. The corresponding populations of the ranked grids were tallied and accumulated. The resulting distances and corresponding cumulative share of total population were plotted in a cumulative density function (CDF) chart, in which for any point on the curve(s), distance (measured on the horizontal axis) and its corresponding cumulative share of population (measured on the vertical axis) can be determined.

Figure C.1. plots separate CDFs for each of the three urbanicities: urban areas, urban clusters, and rural areas. The vertical axis shows the cumulative share of the total U.S. population, with the horizontal axis indicating distance to the nearest supermarket. Using CDFs, one can examine the CDF curves of two or more subpopulations for potential access inequalities. Large differences in access appear as gaps between the individual CDF curves. The overall shape of individual curves also reflects the range of access experienced for a given share of the population or subpopulation. Access curves initially having very steep slopes and gradually flattening at the top indicate superior access relative to access curves that have a more gradual slope extending to the upper right corner of the chart. These differences can be seen in figure C.1., where dotted vertical lines demarcate distances of 0.5 and 1.0 miles, indicating high, medium, and low access for each of the three urban categories. The intersections of the horizontal lines on each curve indicate the corresponding share of the total population for each urban category. Accordingly, 74.4 percent of the urban population was within 1 mile of the nearest supermarket. Access in urban clusters was only slightly lower, where 64.9 percent of the population had a supermarket within 1 mile. In contrast, rural populations had considerably lower levels of access. Only 12.4 percent of the rural population was within 1 mile of a supermarket. This result is not unexpected, due to the much greater spatial dispersion of the rural population and its greater dependence on owned-vehicle transportation.⁵²

Similar CDF charts are presented below for selected urbanicity-subpopulation combinations.

⁵²In the analysis of rural area access to supermarkets, we employ both walking and driving distance criteria. We do not show the drivable distance on figures that include urban and urban cluster areas because very few people in these areas are outside of 10 miles of a supermarket (in fact, almost all are within 4 miles, as shown in figure 3.1).

Figure C.1
Supermarket access by urbanicity for the total population

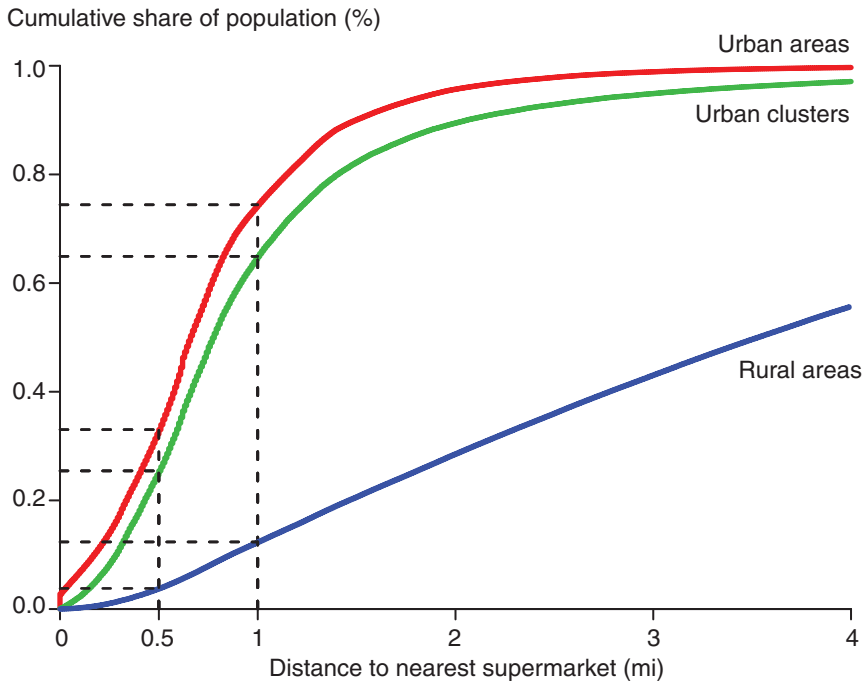


Figure C.2
Access to supermarkets by urbanization level for non low income areas

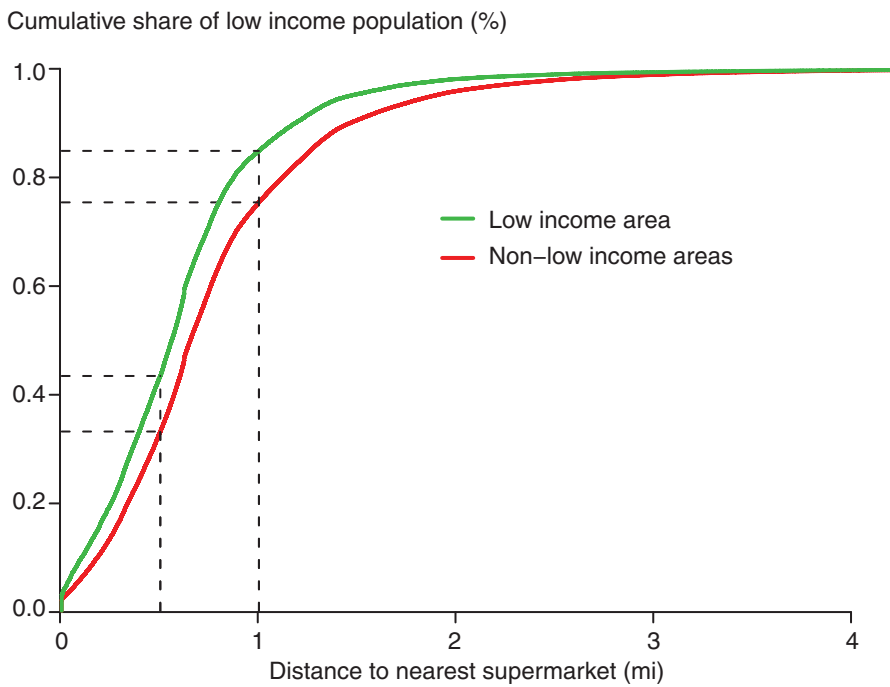


Figure C.3
Supermarket access for low-income individuals in low-income and non-low-income areas within urban areas

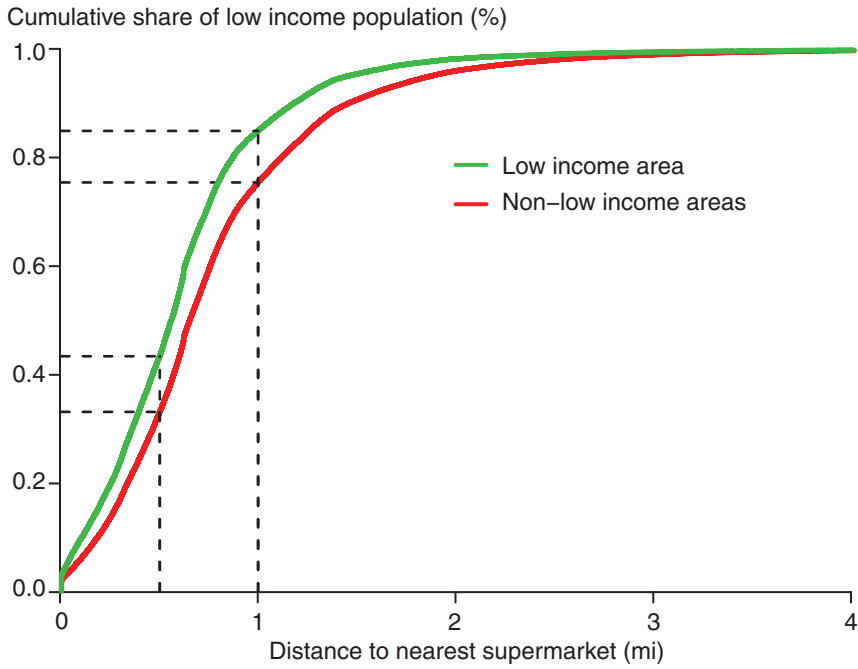


Figure C.4
Supermarket access for households without vehicle by low-income and non-low-income areas within rural areas

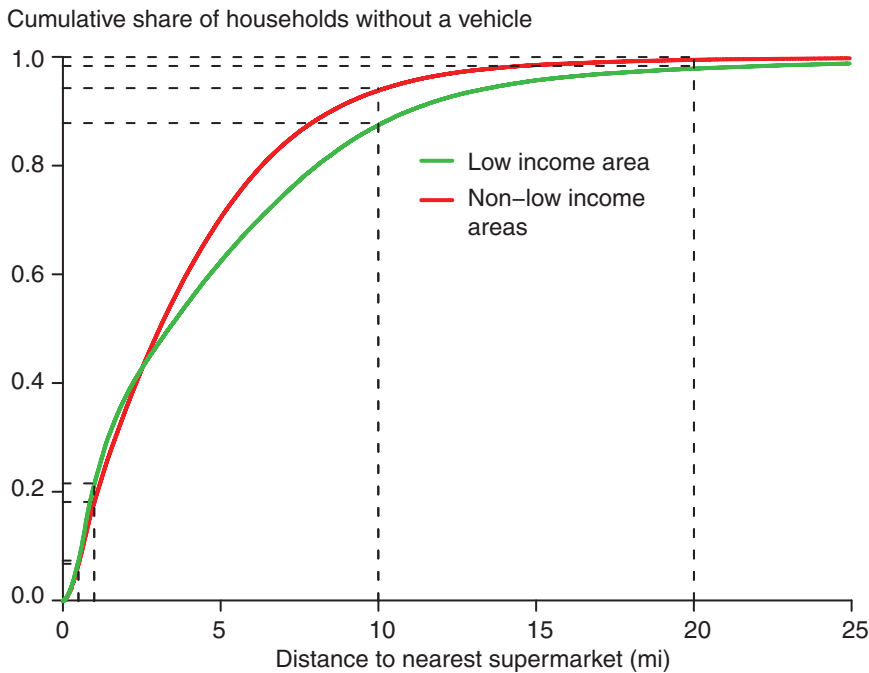


Figure C.5
Supermarket access for non-White individuals by low-income and non-low-income areas within rural areas

Cumulative share of non-White population

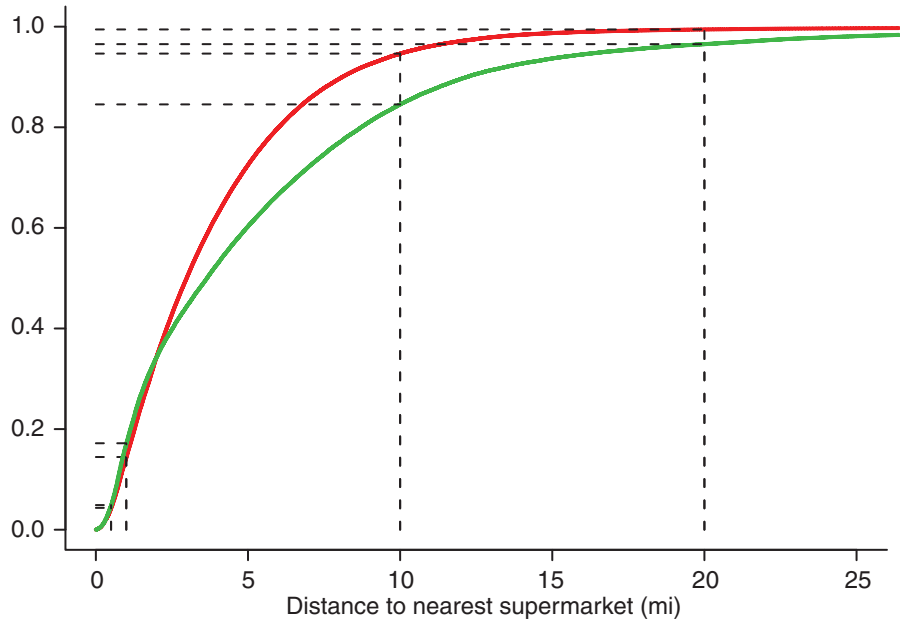
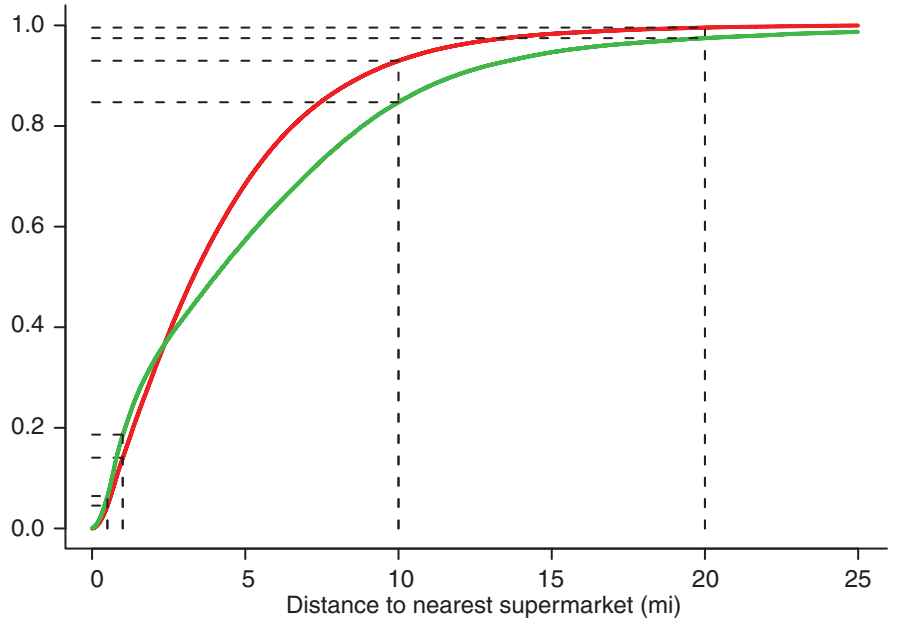


Figure C.6
Supermarket access for elderly households by low-income and non-low-income areas within rural areas

Cumulative share of people 65 and older



Methodology for Average Time Spent in Travel to Grocery Shopping

The estimates of average time spent in travel to grocery shopping were made using the pooled 2003-2007 American Time Use Survey (ATUS) data. The U.S. Bureau of Labor Statistics' ATUS is a continuous survey that began in 2003. One individual age 15 or older from each sampled household is interviewed about his or her use of time for the 24-hour period from 4 a.m. the day before the interview to 4 a.m. on the interview day. The time diary information includes where the respondent was and whom the respondent was with for each activity. The ATUS also collects information on the respondent's household, labor force participation, and demographic characteristics. (For more information on the ATUS, see www.bls.gov/tus).

The pooled 2003-2007 ATUS microdata files contain 72,922 completed interviews. Of those, 11,726 observations are of respondents who grocery shopped on their diary day.

Measuring travel time can be difficult and complex. Individuals string together activities with travel in between ("trip chaining"), making it difficult to separate out travel specific for a single activity. For example, an individual may leave from home and travel some distance, stop to buy coffee, then continue traveling to the work location, work a full day, then travel to the dry cleaners, pick up dry cleaning, travel to the grocery store, grocery shop, travel to a restaurant, eat at the restaurant, and, finally, travel home. In this case, neither commuting to or from work or traveling to or from the grocery store is a single travel occurrence.

The ATUS time diary data contain extensive information about Americans' travel. The data specify travel as an activity, and record mode of transportation and whom the respondent was with when traveling. If the travel was by vehicle, the data include whether the respondent was the driver or passenger. Travel is defined as moving from one location (or address) to another.

To deal with the complexities of trip chaining, ATUS codes the travel activities as to their purpose, looking ahead to the next activity and location. For example, the time a respondent travels from home to work is coded as 180501, "Travel related to working." If the respondent went grocery shopping after work, the time spent traveling to the store is coded as 180701, "Travel related to grocery shopping." The exception to the "looking ahead" rule is when the respondent is traveling from one location to home, in which case the purpose of the travel is coded as a previous activity. As a result, calculating travel time to the grocery store is complicated by the fact that some diaries will have only one "side" of travel related to grocery shopping coded as travel related to grocery shopping and others will have both sides—the going and coming home—of the trip coded as travel related to grocery shopping.

To best deal with trip chaining and the ATUS coding, researchers decided to estimate average time to the grocery store as follows. For each time diary with grocery shopping as an activity in the respondent's time diary, researchers added all legs of travel from home to the grocery store and then

added all legs of travel from the grocery store to home. The total travel time home-to-shopping was compared with the total travel time shopping-to-home, and the shorter total time was chosen as the “time distance” to grocery shopping. In doing this, researchers did not have to consider the coded purpose of the travel, and they also did not have to consider the “dwell time,” that is, the time spent on an activity between two travel occurrences. All the characteristics of travel to grocery shopping, such as mode of transportation, were characteristics of the shorter travel side. In cases where the respondent did not start the day at home or did not end the day at home, researchers only had information for one side (home to grocery shopping or grocery shopping to home). In these cases, the total travel time for that side was used as the time distance to the grocery shopping.

For 6.4 percent of the grocery shoppers in the ATUS data, the shortest time distance is actually from work and not from home. It was decided that the work location is a relevant means of access to grocery shopping, so for these respondents the travel time is work-to-store or store-to-work. Consequently, the average times presented use two “anchors,” home and work.

Grocery shopping was defined as the ATUS activity 070101 with the location of grocery store, restaurant or bar, other store/mall, outdoors away from home, or other place. Grocery shopping with the locations home, work, church, and library were not included so as to exclude online grocery shopping. If the respondent was not at home for any activity in the 24-hour time diary, that observation was not included. If the mode of travel was by airplane, the observation was excluded as the grocery shopping was likely in an airport during out-of-town travel. Thirty-seven observations with grocery shopping were excluded for the following reasons: it was determined that the respondent was out of town when the grocery shopping took place; the time diary was not clear as to what the respondent did on the diary day, usually due to “can’t remember” or “none of your business” responses; or the respondent had a large number of errands or other activities on the diary day such that the total travel time to grocery shopping would likely be an overestimate of the time distance to the grocery store. The resulting dataset used to calculate the estimates contains 11,569 observations. A small number of extreme cases were included—respondents who had zero minutes travel to grocery shopping, which is possible if the store is in the same building as the respondent’s previous activity, and respondents who had 120 minutes or longer travel to grocery shopping. Additional details about variable coding and definitions are available on request.

The Bureau of Labor Statistics (BLS) and the Census Bureau calculated the estimates to ERS specifications to have estimates by whether or not the respondent was in a low-access area. Without BLS and Census cooperation, this analysis could not have been done as detailed geographical information is not publicly available in the ATUS data files.

The analysis used 90 percent confidence intervals to determine whether two average time estimates were statistically different.

Appendix D

Examples of Community Food Projects by Type of Project

Food Assessments

The Fresno Fresh Access Project was funded at \$200,000 for 2 years. The grantee organization was the Fresno Metropolitan Ministry, Fresno, California. The purpose of this community food assessment was to identify key factors in food availability, accessibility, affordability, and quality in Fresno County. The objectives were to assess a number of districts, involve local residents and community volunteers in the survey process, empower community members to make food policy recommendations to local officials, and create an action plan from data collected during the assessment.

The Fresno Metropolitan Ministry trained more than 80 local neighborhood leaders, conducted more than 850 survey-assessments of consumers, and surveyed 131 retail stores. Numerous activities and several different formats were used to collect data in an effort to assess area food needs. Activities included surveys, use of assessment software, GIS mapping, and local task forces. These methods provided different perspectives on food and nutrition needs in the county. Using software and GIS mapping tools, a base map of the food system in Fresno County was developed.

Some of the findings included the following (Jessup, 2005):

- Low-income people bought fresh produce at flea markets, but some lacked funds to buy fresh food;
- Healthy, culturally appropriate foods were not available in some neighborhoods;
- About one-third of weekly meals consisted of fast food;
- Food resources in the Fresno area that could contribute to both food access and economic development around food production and distribution were abundant; and
- Food acquisition habits varied by ethnicity.

Web site: www.fresnometroministry.org

The Community Tradition, Foods, and Future, an assessment project, was funded at \$13,895 for 1 year. The organization funded was Legacy Cultural Learning Center, Muskogee, OK. The food assessment planned by the Legacy Cultural Learning Center was guided by a publication produced through another CFPCGP grant with First Nations Development Institute (FNDI). FNDI was awarded a grant for training and technical assistance called the Food Sovereignty Assessment Tool (FSAT) (2004). The FSAT publication provides an introduction to the food security movement in Indian country and is a resource for thinking about food systems in Native communities and what can be done to regain control of Native food systems.

The FSAT has been widely used by Native American groups in assessing their food systems.

The Legacy Cultural Learning Center's project goal was to create the first organized collection of data focused on the food, diet, and traditional agriculture issues of the Muskoke People and their neighbors. The project assessed the food assets, strengths, needs, and deficiencies of rural, low-income communities in the Tribal Nation. They conducted meetings and surveys in 17 of the 23 Muskoke communities and in one neighboring Seminole Nation community to assess food system assets, strengths, needs, and deficiencies. There was good participation in discussions focused on diet-related health problems such as diabetes, heart trouble, and high blood pressure.

Data was collected from written surveys and also from more than 17 person-to-person interviews with tribal and community leaders, academics, and project collaborators. Through the surveys, the project learned that the Tribal Elderly Nutrition Service operates 10 fully equipped kitchens and dining facilities serving more than 18,000 meals monthly, including an extensive home delivery network. The surveys uncovered a heavy reliance on fast food, a preference for local food but limited access to it, and significant concerns about rising food costs. Approximately one-third of respondents have gardens. Surveys found a significant positive consumer response to the availability of locally produced foods available directly from farmers and farmers' markets. However, there are few local growers and small farmers do not have the ability to supply the quantities needed.

Following the surveys and interviews, project staff developed a draft plan of action to address the most urgent needs and concerns, including Elderly Nutrition Service purchases of local products, initiation of community gardens on donated land, purchase of a large RV to serve as a mobile resource center, and establishment of a Native Foods restaurant (The Legacy Learning Center, Muskogee, Oklahoma, 2006).

Web site: www.legacycultural.org/artwellness

Food Policy Councils

The project, **Food Access and Food Justice in New Orleans: Rising Above the Waterline**, was funded in 2006 for \$265,000 for 3 years. The organization funded was the New Orleans Food and Farm Network (NOFFN). It was designed to assist in the Hurricane Katrina recovery. The project supported the development of sustainable food projects and neighborhood capacity by facilitating innovative linkages at the neighborhood level. It brought together diverse groups including public health, social work, urban agriculture, and food security sectors via an active food system coalition.

The first component of NOFFN's project was to increase food justice awareness in New Orleans through expanding the membership and representation of "Grow New Orleans," the local food system coalition. Grow New Orleans mobilized and connected food system stakeholders

and community members, and created a formalized food policy network to inform public policy and private development.

The project helped to rebuild the food system by developing a food access and food justice action plan and by creating neighborhood food access maps. These inform both the general public and those involved in rebuilding efforts. To further include and mobilize the public, NOFFN involved communities and leaders to conduct neighborhood-based participatory food assessments. They plan to create sustainable community food projects based on neighborhood appraisals and regional assets, which contribute to local food security. NOFFN plans to facilitate three to five targeted community food projects, which will lead to a sustainable and just food system (World Hunger Year, 2009; Food Security Learning Center).

Web site: www.noffn.org

Educating State Legislative Leaders and CFP Grantees About Policy Options That Support Community Food Systems was a project funded in 2005 for 2 years at \$200,000. The organization funded was the National Conference of State Legislatures (NCSL). The goal of this training and technical assistance project was to broaden the CFP program's impact on State and local policy by sponsoring site visits and forums for legislators, legislative staff, and community representatives, and by hosting a national training session for CFP grantees to learn about legislative processes, to build capacity of CFP grantees to implement policy initiatives as part of their projects. Policy training on such topics as food policy councils, direct marketing, and procurement policy were offered. In recognition of the role legislators have in crafting policy, NCSL educated them and their staff about the legislative and programmatic components of creating a sustainable community food system and enhancing access to fresh produce. This component had the added benefit of building relationships between legislators and CFP grantees.

The project consisted of two components: site visits and training. Three 2-day site visits provided a forum for participants to discuss problems and progress in implementing community food systems with agriculture, transportation, land-use, nutrition, food service, food security, and education experts. Participants, including legislators, legislative staff, CFP grantees and local stakeholders, visited sites ranging from small farms, distribution centers, schools, or other State institutions that purchase local produce, or farmers' markets. Preference for selection of programs for the site visits were given to past or current CFP grantees. The second component was a 1-day pre-conference training at the 2006 Community Food Security Coalition (CFSC) annual conference to educate CFP grantees about the legislative process and about how to incorporate policy into current or future programs. NCSL partnered with the CFSC throughout this entire project (World Hunger Year, 2009).

Web site: <http://www.ncsl.org>

Youth Programs

Healthy Harvests Initiative: Building Boston’s Food Security from the Ground Up was funded in 2000 for 2 years at \$150,000. The organization funded was The Food Project in Lincoln, MA. The Food Project made substantial progress in demonstrating the economic viability of a sustainable metropolitan food system by linking food production with youth and community-based enterprise. It opened and equipped a 1,500-square foot urban center that included a commercial kitchen and involved youth in business startup and management by working with them to research, design, and test a value-added food enterprise: farm-fresh salsa. It also tripled the membership in its Community Supported Agriculture program and increased both its urban and rural farmland.

The kitchen has become an integral part of The Food Project’s work. Youth use the kitchen to process and prepare produce for value-added products, a catering business, and weekly food deliveries. All of the programs incorporate culinary and nutrition training, expanding the scope of the involvement of youth in the creation of a local food system. Children from local elementary and middle schools have classes in the kitchen, which is also available to local growers for canning food grown in their gardens.

Healthy food production and consumption skills were further modeled in the community through land remediation, education, and outreach. Under the grant, an additional urban lot was cleared, cleaned, and put into production growing herbs and vegetables. Youth further began a series of regular community lunches and now prepare 11 lunches annually serving over 800 people. The Food Project has also established an education center with a library of cookbooks and resources on food enterprise development. The project also runs two farmers markets a week for the entire local community where youth are employed in marketing and selling the produce they grow (World Hunger Year, 2009).

Web site: <http://www.thefoodproject.org>

“Food for Life” was funded in 2001 at \$180,000 for 3 years. The organization funded is the Youth Farm and Market Project (YFMP) in Minneapolis, MN. A central objective of the grant to the YFMP was to help youth both understand and strengthen the local food system (i.e., to learn to grow food, to plan and prepare nutritious meals, and to increase community awareness, health, and diversity). To that end, YFMP collected recipes that emphasized nutritional content, as well as other cooking class materials. They created and implemented a comprehensive, cultural nutrition curriculum, which called for the participation of parents and local chefs. YFMP has grown a variety of cultural foods, specifically Asian and Latin American, for summer lunches. Meal plans emphasizing the importance of balance were also designed.

YFMP worked with ethnic farmers of the Twin Cities area to plan purchases and distribution in low-income housing developments. YFMP staff also met with school officials to discuss securing more local, organic produce for school meals. They worked to sell produce to several local businesses and

restaurants and to secure culturally appropriate foods that would supplement project-grown foods for summer lunches. Program participants had at least three opportunities to prepare a meal alongside local chefs. Youth-led harvest festivals provided recognition, community meals, and awards for project participants.

Another objective of the grant was to make a wider variety of foods available to low-income consumers via public housing markets. They assisted immigrant growers who were able to sell a variety of vegetables and prepared foods to the project. They also worked with a number of schools on gardens and on getting local foods into school meals. They ran a youth farmstand at a senior public housing high rise, which was very popular with senior residents (World Hunger Year, 2009).

Web site: <http://www.youthfarm.net>

Entrepreneurial Food and Agriculture Activities

Appalachian Center for Economic Networks is an organization in Athens, OH, that has been funded for two separate projects, both involving entrepreneurial training: “Appalachian FoodNet Project” in 2003 and “Rural Food Centers Project” in 2005. The total amount funded was \$200,000.

These projects enhanced the food system in a three-county area of southeastern Ohio by developing linkages between low-income residents, food businesses, consumers, and nonprofit and faith-based organizations. The project developed a gleaning and food processing program, provided training and assistance to food-related businesses started by low-income people, expanded a regional branding program, and convened a local food congress. These projects responded to the goals of the Appalachian Food Congress by establishing three new food centers in isolated rural communities to help meet long-term food and economic needs, provide food processing and gardening training, and expand markets for local products and low-income entrepreneurs.

The project provided direct technical assistance in bringing the kitchen up to commercial codes, developing strategic uses for the kitchens, and providing basic equipment needed for the planned uses. Once operational, these kitchens were able to offer food processing and training to low-income residents hoping to start small food businesses to supplement family income. The kitchens will also be able to process gleaned crops from neighboring fields to assist local food pantries that are housed in their facilities. The commercial kitchens can also be utilized for hosting summer feeding programs for low-income children during the summer months (World Hunger Year, 2009).

Web site: <http://www.acenetworks.org>

Building an Integrated Sustainable Food System was funded in 2005 for \$210,000 for 3 years. The organization funded was the Appalachian Sustainable Development, Abington, Virginia.

This project promoted a “field to table” strategy in southern Virginia and eastern Tennessee to stimulate the development of food and farm-based economic opportunities for limited resource farmers and entrepreneurs, to increase access to local foods for low-income households, to enhance the value-added infrastructure, and to educate the public about a sustainable food system.

The main needs this project addressed were poor or inadequate nutrition; the decline in farm incomes and family farming; lack of access to larger, better paying markets for local farm products; the lack of infrastructure needed to add value to local farm products; the lack of affordable, locally raised organic and sustainable farm products; and inadequate research, education, and technical assistance available to farmers attempting new enterprises and/or production practices. The overall purpose of this project is to help create a more just and sustainable food system in southwestern Virginia and northeast Tennessee, one that can serve as a model for other rural regions around the Nation (World Hunger Year, 2009; Food Security Learning Center, Community Food Projects Database).

Web site: <http://www.appsusdev.org>

Urban Agriculture

Integrated Development Through Urban Agriculture was funded in 2002 and 2005 for a total of \$184,000. The organization funded was Nuestras Raices in Holyoke, Massachusetts. The grantee built an urban agriculture center with classrooms and a community gathering space, as well as a bakery and restaurant that were later spun off to private entrepreneurs. The grantee conducted market research and promotion of Puerto Rican specialty produce, assisted experienced community gardeners in establishing commercial gardens, and aided youth in establishing a market garden.

A second CFP grant in 2002 allowed Nuestras Raices to build on and expand its agriculture-based community development work. The organization took a leadership role in the development of the Holyoke Food Policy Council, a partnership of 30 members from various sectors of the food system. The council conducted a visioning/mapping exercise and interviewed stakeholders to complete a study of the local food system. Nuestras Raices established two new community gardens at public housing projects with plots for 6 families and 40 youth. An existing 17-plot community garden was transformed into a market garden where adults and youth have begun farming commercially. The organization also conducts a Spanish-language promotion program for two farmers’ markets, supports a youth-managed stand at one of the markets, provides technical assistance and shared tools to residents growing Puerto Rican specialty crops not available elsewhere, and is developing seed sources for those crops to sell at farmers markets.

To increase the agricultural space in the community, CFP grant funding allowed Nuestras Raices to look for farmland for purchase. Two plots were identified and in late 2004, with State and foundation funding, the organization was able to buy a 4-acre stretch of land on the Connecticut River near downtown Holyoke. The land, called the Tierra de Oportunidades,

now includes six new market farms, nature trails, an outdoor stage, tropical flowers and crops, and a farmstand. There are plans for a youth center and an office on the land as well, in part to reflect the substantial involvement of community youth in the efforts to purchase the land and to draft a business plan for the farm operation (World Hunger Year, 2009; Food Security Learning Center, Community Food Projects Database).

Web site: <http://www.nuestras-raices.org>

Neighborhood Urban Agricultural Coalition was funded in 2002 for 3 years at \$200,000. Greensgrow in Philadelphia, Pennsylvania, was funded for this project. The project provided a comprehensive, practical approach to improving access to fresh food in low-income communities through the establishment of small, locally owned urban farms that use vacant land and “brownfields,” sponsored and developed by community-based organizations and community development corporations. The effort developed neighborhood cooperatives (CSA shares) to be supplied by both urban producers and rural farmers.

The grant helped Greensgrow to establish the Neighborhood Urban Agriculture Coalition to increase access to healthy food in the surrounding neighborhood. The farm has started a twice-weekly farmstand on its property that sells its own produce along with products from other nearby farms and producers. Over 20 farms are part of the project, including Amish farms and some from nearby New Jersey. All food is labeled with place of origin and any special growing practices. The stand accepts food stamps and WIC and Senior Farmers’ Market Nutrition Program coupons, and operates a satellite stand at the nearby Senior Center. Development of the Greensgrow nursery and CSA were also facilitated by CFP funding. Greensgrow is established as a group of producers and farmers who make value-added product and sell them at both the Greensgrow farmstand and to the Reading Terminal Market, a major public market in Philadelphia. The farm has been able to expand into two additional small lots, now used for heirloom tomatoes and bee colonies. Farm staff teach low-income urban consumers about the complexity of community food issues. The staff also brings concerns of consumers to the producer group. Greensgrow also is working with local high schools and Temple University, whose students are learning about the Greensgrow model for urban agriculture.

Greensgrow aims to encourage other similar brownfield land redevelopment in Philadelphia. It is involved in local zoning issues and has developed a preliminary site selection protocol for other groups to use (World Hunger Year, 2009).

Web site: <http://www.greengrow.org>

Rural Producers

The Tribal Fish Market Connection Project was funded in 2003 for \$125,000 for 3 years. The organization funded was Ecotrust, Portland, OR. The project works with the Columbia River Inter-Tribal Fish Commission (CRITFC) on wild salmon marketing and helps provide more diverse sources

of revenue and employment to the 400 tribal fisher families on the Columbia River. The project helped build a business plan and product development capacity for the four Columbia River treaty fishing tribes represented by CRITFC—the Confederated Tribes of the Umatilla Indian Reservation, the Confederated Tribes of the Warm Springs Reservation, the Yakama Nation, and the Nez Perce Tribe. The tribes are brought together by the struggle to save the salmon and by shared spiritual traditions. Fishers involved in the project are selling their “treaty right tribal caught fish” at Portland Farmers’ Market, with a devoted fan base and the capacity to increase their income fourfold. With Ecotrust spreading the word, consumers are quickly learning that there are plenty of high-quality regional foods that not only taste great but can help maintain a way of life closely tied to the identity and spirit of tribal nations (World Hunger Year, 2009).

Web site: <http://www.ecotrust.org>

Patchwork Family Farms: Value-Added Processing for Community Food Security was a project funded for \$183,898 through the Missouri Rural Crisis Center, Columbia, Missouri. The project built the capacity of two ongoing programs, “Patchwork Family Farms” and the “Food Cooperative,” to become self-sufficient through value-added processing activities. The project increased processing capacity by 20 percent, increasing profitability per hog by finding uses for less popular cuts of meat. The project successfully produced and marketed additional value-added products. Expanding on a food cooperative system already in place, the project increased the diversity and volume of local products available to cooperative members in 23 rural counties in the middle of the State.

Patchwork Family Farms is composed of 15 independent family hog farmers. When consumers purchase a Patchwork product, the money directly supports Missouri farm families. Patchwork Family Farms has been recognized by USDA, the Environmental Protection Agency, and Oxfam America for their efforts to help the environment and sustain the traditions of rural communities. Meat was cooperatively sold to African-American churches in St. Louis and Kansas City at reasonable prices.

During 1999, when hog prices for Missouri farmers averaged 28 cents per pound, Patchwork producers received 43 cents per pound. With the grant, Patchwork Family Farms was able to double their product line, test value-added marketing, and provide a “best sellers” product list. To achieve the goal of expanding the food cooperative system, this project grew the capacity for marketing and distribution of locally raised produce, meat, and other local products to low- and moderate-income families in Mid-Missouri. This expanded marketing capacity allows for local growers and producers to supply the enlarging cooperative system. Also, the project worked to increase the number of farmers and grantee chapter members who are growing for themselves and for sale through the coop program.

To grow the coop system, through increased demand, the Missouri Rural Crisis Center will develop an outreach campaign targeting rural Missourians that explains the economic, environmental, social, and public health benefits of community-based food systems. To further the public’s appreciation of

local foods and increase or continue interest in coops and local products, they will also provide education and resources pertaining to the preparation and processing of locally raised food and related products (World Hunger Year, 2009; Food Security Learning Center, Community Food Projects Database).

Web site: <http://www.inmotionmagazine.com/rural.html>

Community Gardens

Urban Detroit Agriculture and Education Project received funding of \$150,000 in 2003 for 2 years. The organization funded was Capuchin Soup Kitchen, Detroit, Michigan. The project provides a haven for low-income people to socialize with their neighbors, gives access to affordable produce, and educates people about nutrition and the origins of their food. The project has evolved to focus on four objectives: launching a Garden Resource Program, organizing educational opportunities for community and backyard gardeners, developing the Romanowski Farm Park (a public park centered on a 5-acre farm in Detroit), and increasing access to nutritious food for all Detroiters. The project works with 80 community gardens connected to many grassroots organizations that are critical to the success of the program. This Detroit project is an example of the extraordinary types of collaborations that make community food projects work. The project works with the following collaborators: The Greening of Detroit, Detroit Agriculture Network, Michigan State University Extension, O.W. Holmes Elementary School, American Indian Health and Family Services, City of Detroit Recreation Department, Michigan Association of Community Gardeners, Michigan Department of Agriculture, Gleaners Food Bank, Michigan Department of Community Health, Catherine Ferguson Academy, Detroit 4H Center, Foundation for Agriculture Resources in Michigan and Michigan State University.

The Garden Resource Program encourages communication and collaboration among gardeners working in the same areas (called clusters) of the city. In the program's first year (2004), it offered several incentives to facilitate the efforts of the 300 households working in 33 community gardens and 47 family gardens. The program tilled or plowed gardens; tested soil for nutrients and heavy metals; delivered compost and woodchips to gardeners; distributed coffee bags for use as a weed barrier; provided tools; distributed containers of vegetable, herb, and flower seedlings ready for planting; and organized hundreds of volunteers. At meetings in each of the four participating city clusters, gardeners have chosen a neighborhood leader and a location for a neighborhood resource center. In addition, the Garden Resource Program will use the Soup Kitchen's Earth Works Garden program as a model for future market expansion for its own participants. Last year, Earth Works program gardeners sold produce, honey, black raspberry-currant, and gooseberry jams at four low-income health clinics. They marketed their products at a local farmers' market in the spring and planned to harvest vegetables from the farm in the summer. Through all its efforts, the program improves communication, services, and resources for participants and ultimately increases access to affordable, nutritious food.

The Capuchin Soup Kitchen and its partners have increased food security throughout Detroit by increasing the number of urban gardeners citywide and by seeking new partners. The Urban Detroit Agriculture and Education project grant allowed project partners to form the Detroit Agriculture Network, which will become its own nonprofit organization focused on food security (World Hunger Year, 2009).

Web site: <http://www.cskdetroit.org/>