

MARKET WATCH

Availability And Prices Of Foods Across Stores And Neighborhoods: The Case Of New Haven, Connecticut

Although food prices do not differ much across neighborhoods, healthful foods are less available in low-income than in high-income neighborhoods.

by **Tatiana Andreyeva, Daniel M. Blumenthal, Marlene B. Schwartz, Michael W. Long, and Kelly D. Brownell**

ABSTRACT: Two studies compared food availability and prices in large and small stores across neighborhoods of varying income levels in New Haven, Connecticut. The findings suggest that supermarket access in lower-income neighborhoods has improved since 1971, and average food prices are comparable across income areas. Despite this progress, stores in lower-income neighborhoods (compared to those in higher-income neighborhoods) stock fewer healthier varieties of foods and have fresh produce of much lower quality. Policies are needed not only to improve access to supermarkets, but also to ensure that stores in lower-income neighborhoods provide high-quality produce and healthier versions of popular foods. [*Health Affairs* 27, no. 5 (2008): 1381–1388; 10.1377/hlthaff.27.5.1381]

MOST AMERICANS do not consume recommended levels of fruit, vegetables, whole grains, and other components of a healthy diet. Low-income populations are at particular risk of poor diet quality, which may exacerbate income-attributed disparities in health and mortality.¹ Economic factors such as food prices and wages may explain in part why low-income groups may be especially vulnerable to food insecurity, which in turn can increase risk for both malnutrition and obesity.² The impact of

availability and prices of healthful foods in low-income communities and the potential to address these factors through policy change have been discussed in both academic papers and public debate.

Disadvantaged populations often live in areas with limited access to healthful, unprocessed foods, which may affect their diet, weight, and health.³ There is some indication that poor Americans face higher food prices because of differences in the food retail landscape between low-income and wealthier

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Tatiana Andreyeva (tatiana.andreyeva@yale.edu) is a postdoctoral research associate in the Rudd Center for Food Policy and Obesity at Yale University, in New Haven, Connecticut. Daniel Blumenthal is a fellow at Harvard University in Cambridge, Massachusetts. Marlene Schwartz is deputy director at the Rudd Center. Michael Long is a research assistant there. Kelly Brownell is a professor of psychology, epidemiology, and public health at Yale University and director of the Rudd Center.

neighborhoods.⁴ Greater access to large grocery stores in suburban than in inner-city or rural areas explains some of the higher prices paid by the poor. Economies of scale, technological advancements, and increasing market competition drive down prices in supermarkets relative to those in smaller stores. Consumers lacking transportation to shopping outside their communities may pay higher prices and have a limited choice of food (especially healthy options) in their local small markets.⁵

This study examines access to healthful foods and food prices as a function of income and neighborhood. We start by estimating in Study 1 how the price differential between large grocery stores and small neighborhood markets has changed during the past thirty-five years by replicating a 1971 study of food price disparities in New Haven, Connecticut.⁶ Study 2 explores other attributes of the retail food landscape by comparing the availability, price, and nutritional quality of food in lower- and higher-income areas. The overall purpose is to evaluate the food retail environment across income areas and types of stores, to establish whether access to healthful foods and food prices are barriers to healthy eating in low-income communities.

Study 1: Data, Methods, And Results

■ **Data and methods.** We replicated the protocol from the 1971 Kunreuther research, collecting price data across stores in the same lower- and higher-income neighborhoods of New Haven for the same food items.⁷ Using Global Information Systems (GIS) computer software, we constructed a present-day map of census-block groups to correspond to each census tract studied in 1971. These groups define six New Haven neighborhoods (defined by historical neighborhood boundaries). We included supermarkets within a three-mile distance from the neighborhoods to increase the power of the store-size analyses and to account for the fact that many customers might travel to shop for food.

Each store was categorized as either (1) a

convenience store, mini-mart, or pharmacy/variety store; (2) a small grocery store; (3) a grocery chain; or (4) a large independent grocery store.⁸ Our sample included forty-eight stores (fourteen convenience, mini-marts, and pharmacy/variety stores; nineteen small grocery stores; thirteen chains; and two large independent grocery stores). Using data on availability, package size, and nonsale prices of the surveyed foods, we calculated unit prices for 622 food items and compared average prices by size of store (small markets, categories 1–2, versus large grocery stores, categories 3–4) and neighborhood (lower- versus higher-income areas). We examined how the price differential between smaller and bigger stores had changed since 1971.

■ **Results.** The availability of supermarkets in lower-income neighborhoods in New Haven has improved over the past several decades. In 1971, only small markets were available in lower-income areas. Today, a quarter of the stores in New Haven's lower-income neighborhoods are supermarkets. Almost half of these grocery stores are independent markets that did not operate in higher-income areas.

For the surveyed seven foods, average prices were not significantly different between lower- and higher-income neighborhoods. Prices were 51 percent higher, on average, in small neighborhood stores than in supermarkets. In 1971 this price differential in New Haven was 20 percent. The multifold increase in the price gap by store size has been primarily the result of faster growth of prices in small neighborhood stores compared to large grocery stores (by 33 percent).

Study 2: Data, Methods, And Results

The purpose of the second study was to further examine the availability and prices of healthful and regular food options across neighborhoods and types of stores.

■ **Data and methods.** We used the Nutrition Environment Measures Survey in Stores (NEMS-S) protocol to collect data across stores in higher- and lower-income areas of

Hew Haven.⁹ The NEMS-S tool evaluates nutrition environments in retail stores across a spectrum of measures such as availability and prices of healthful and regular food options and the quality of produce. The NEMS-S tool has good reliability and high validity. The items assessed by the NEMS-S included fruit and vegetables and categories of food with regular and healthful options (such as lower fat, lower calorie, or whole grain).

After completing training on the NEMS-S use for rating retail nutrition environments, we pretested the tool in several New Haven stores and adapted it for our study.¹⁰ We excluded several categories of food present in the NEMS-S (baked goods, hot dogs, and frozen dinners) to add categories and food items that are important in a healthy low-cost diet (for example, canned and frozen vegetables).¹¹ We also changed brands of selected items to represent brands commonly found in New Haven stores. We modified the binary measure of produce quality to provide more refined (three) categories of quality.

The revised NEMS-S tool included twelve food categories: milk, cheese, fruit, vegetables, frozen and canned vegetables, meat, meat alternatives, bread, grains, cereal, potato chips, and beverages. The healthful options in these categories were low-fat/skim milk, reduced-fat cheese, ten kinds of fresh fruit, ten kinds of fresh vegetables, frozen vegetables (peas, broccoli, green beans), canned vegetables (corn, green beans), lean beef/chicken, canned tuna/beans, 100 percent whole-wheat/whole-grain bread, brown rice/whole-grain pasta, plain cereal/unflavored oatmeal, baked potato chips, diet soda, 100 percent fruit juice, and bottled water.¹² The regular options were whole milk, regular cheese, regular beef/chicken, canned refried beans, white bread, white rice, regular pasta, high-sugar cereal, regular potato chips, regular soda, and juice drinks. We used standardized product comparison and procedures with reference brands for all items (except produce).

Neighborhoods' relative income assessments. We assessed four New Haven neighborhoods to represent relative income diversity within ar-

reas. Our sample included all stores within the boundaries of the neighborhood and stores within close proximity to the neighborhood. We defined this proximity by a half-mile buffer around the lower-income neighborhoods and a one-mile buffer around higher-income areas. The larger buffer in higher-income neighborhoods reflects a relatively lower density of stores and better means of transportation to those stores.¹³

Classification and mapping of stores. We used multiple sources to identify, map, and classify retail food stores. We obtained a list of retail food stores in Connecticut from InfoUSA Inc., a commercial database provider.¹⁴ We geocoded store locations and identified stores within neighborhood buffers using ArcGIS 9.2 and Environmental Systems Research Institute (ESRI) Census 2000 TIGER/Line data for street and census-block-group locations.¹⁵ We verified and extended geocoded InfoUSA store locations by checking stores' Web sites and through observations during field work. We included all types of publicly available retail food outlets, classified into two categories: convenience stores (including drug stores and food marts) and grocery stores (supermarkets and small stores with fewer than three cash registers).

Store type and neighborhood. Our data analysis was based on store and neighborhood comparisons using t-tests and z-tests for the group means and proportions. Two dimensions of the food retail landscape were considered: store type (convenience versus grocery stores) and neighborhood (lower- versus higher-income areas). We did not have statistical power to compare store types by income area. Comparisons by store type and income area were done for availability and prices of healthful and regular food options and quality of produce.

Availability comparisons. Availability comparisons were conducted as percentages of stores that had the product available. We compared availability of food categories, items, and all healthful versus regular food options. The analyses of prices were completed using data for all stores in which the products were avail-

able. Prices of fruit and vegetables were standardized by converting estimates to the dollar price per pound using the conversion-factor data from the U.S. Department of Agriculture (USDA).¹⁶ Prices of other food were standardized by converting data into standard units for each food category (for example, twenty ounces for bread). Quality of fruit (or vegetables) was evaluated based on the average quality of all available fruit (or vegetables) rated individually using a categorical 1–3 scale of quality from “fair” to “good” to “excellent.” The raters followed a protocol with specific definitions of quality ratings to ensure data comparability.

Price comparisons. Price comparisons were for average absolute prices of food by income area and type of store, and for relative prices of healthful and regular food options within stores and neighborhoods. To compare overall prices of food, we constructed a representative basket of food items available in both types of stores and neighborhoods. This excluded food items unavailable in some types of stores, limiting the variety of food items in the basket but at the same time ensuring the basket comparability across stores and income areas. Price comparisons for a representative food basket included average pricing of the basket of all healthful and regular food options, and all food items by store type and income area.

■ **Results for Study 2.** We identified seventy-nine retail food outlets in operation during our study. Four stores refused to participate, leaving us with a completion rate of 94.9 percent. Our final sample included seventy-five stores (nineteen small and large grocery stores and fifty-six convenience stores), of which forty-seven were in lower-income neighborhoods and twenty-eight were in higher-income neighborhoods. Among convenience stores, relatively more food marts and drug stores were located in higher-income areas. Supermarkets accounted for the same 8 percent share of stores in both areas, although

their density per 10,000 residents was higher in low-income neighborhoods.¹⁷ Relatively fewer full-variety stores in wealthier areas of New Haven may reflect residents’ greater capability to shop in supermarkets outside their neighborhoods.

Availability of healthful food. Availability of healthful food between convenience and grocery stores varied by product but was significantly better in grocery stores (Exhibit 1). Customers were significantly less likely to find

“We found significantly worse average produce quality in lower-versus higher-income neighborhoods.”

produce, brown rice, lean meat, whole-wheat bread, and whole-grain pasta in convenience stores than in grocery stores. Of all healthful options, only canned vegetables, baked potato chips, and healthier versions of beverages (bottled water, 100 percent fruit juice, and diet soda)

had similar availability across stores. Of note, when convenience stores did carry items in a given food category, they often stocked only regular options. For example, reduced-fat cheese was sold in 4 percent of convenience stores, but 45 percent had regular cheese. Similar differences in relative availability of healthier and regular items were found for bread, grains, and, to a lesser extent, for milk and cereal.

We hypothesized that there would be significantly lower rates of availability of healthful food in lower-income versus wealthier areas. For two categories this appeared to be the case: milk and chips (see Exhibit 1). Regular potato chips could be purchased almost in every store in both areas, but baked potato chips were half as likely to be available in lower-income neighborhoods. For many items, however, there was no significant difference in availability. Further, for fruit and vegetables we found a higher rate of availability in lower-income areas. This may reflect the high prevalence of food marts and drug stores (usually not selling produce) in higher-income neighborhoods, which might have obscured our estimates.

Food prices. Prices of most healthful food op-

EXHIBIT 1
Availability Of Healthful Food Options, By Store Type And Neighborhood
Socioeconomic Status, 2007

Type of food	Type of store (%)		Neighborhood (%)	
	Convenience store	Grocery store	Low-income area	High-income area
Any fruit	34	95***	62	29***
Any vegetables	21	89***	47	25*
Any frozen vegetables	14	53***	25	21
Any canned vegetables	80	89	85	79
Baked potato chips	27	26	19	39*
Lean beef/chicken	2	47***	13	14
Plain cereal	70	84	77	68
Skim/low-fat milk	71	89*	70	86*
Whole-wheat/whole-grain bread	14	47***	17	32
Whole-grain pasta	2	42***	11	14
All surveyed healthful food options	46	70***	53	50
All surveyed regular food options	70	81**	76	67*

SOURCE: Authors' analysis.

NOTES: For a list of the surveyed healthful and regular food options, see text. Statistical significance denotes difference between types of stores or between neighborhoods.

* $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$

tions were usually higher relative to the cost of regular alternatives. There were three exceptions: high-sugar and plain breakfast cereal, reduced-fat and regular cheese, and skim/low-fat and whole milk. The highest price margin for healthier products was found for baked chips, lean meat, and whole-grain pasta (20–60 percent above the cost of regular options). Healthier whole-grain versions of bread and rice were about 10–30 percent more expensive than white products. With some deviation in the size of relative price differences, overall patterns for healthful and regular food options were similar across income areas.

Comparisons of absolute food prices across income areas suggest that prices in all types of stores are on average about 4 percent higher in wealthier neighborhoods (Exhibit 2). The average cost of a representative food basket with items available in all types of stores and neighborhoods is \$46.7 in lower-income areas versus \$48.5 in higher-income areas (\$26.1 versus \$27.2 for healthful food options). These estimates are unadjusted for differences in quality

of produce, which varies by neighborhood. Once we exclude produce from the calculation, differences in the average prices between areas fall by almost half (to about \$1 or 2 percent). The difference in the average prices of food in convenience versus grocery stores is also about 4 percent (and about 5 percent for healthier options). This estimate cannot be compared to our data on price differences between small and large stores in Study 1. The group of grocery stores in Study 2 included small grocery stores (usually with higher prices), which were part of the small-markets group in Study 1.¹⁸

Quality of fresh produce. Using the three-point produce quality scale, we found significantly worse average produce quality in lower- versus higher-income neighborhoods (2.0 versus 2.4, $p < 0.05$). Fruit had more pronounced differences in quality by income area (2.0 versus 2.5, $p < 0.01$) than vegetables (2.0 versus 2.2). Although this was based on a small sample of supermarkets, we observed notably lower quality of produce in supermarkets located in

EXHIBIT 2
Prices Of Healthful And Regular Food Baskets, By Store Type And Neighborhood
Socioeconomic Status, 2007

Type of food	Type of store		Neighborhood	
	Convenience store	Grocery store	Low-income area	High-income area
Basket of healthful food options	\$26.8	\$25.6	\$26.1	\$27.2**
Basket of regular food options	20.9	20.4	20.6	21.3
All-foods basket	47.8	45.9	46.7	48.5**

SOURCE: Authors' analysis.

NOTES: For a list of the surveyed healthful and regular food options, see text.

** $p < .05$

lower-income neighborhoods than in wealthier neighborhoods (2.2 versus 2.9). Grocery stores had significantly better-quality produce than convenience stores.

Discussion

■ **Availability is key differential.** Based on data from different neighborhoods in New Haven, we found that the availability of many healthful food items and produce quality are worse in lower-income areas, but food prices are not higher. Although residents of lower-income communities have better access to supermarkets than they did thirty-five years ago, many still shop in small neighborhood stores without healthful food options. Given that price differences between such stores and supermarkets have increased since 1971, lack of access to grocery stores has become an even more important driver of disparities in diet quality.

Although residents of lower-income areas are in particular need of improving their diet and health, their moving away from regular to healthier options may be difficult to achieve, given the available choices of food in local stores. Whereas disproportionate supply may reflect demand of the clientele for less healthful alternatives, dominance of these options may limit choices for people who would be willing to try healthier products.

■ **Prices are about the same.** Overall, residents of lower-income areas in New Haven are not paying higher prices for food, including

healthful food when available. Our findings of 4 percent lower average food prices in lower-income neighborhoods, however, are unlikely to suggest major differences in the buying power of the residents. Given the low share of expenditures on food consumed at home in personal disposable income (10.5 percent for the lowest-quintile income group in 2006), the difference of 4 percent in food prices for someone with below-median income (such as \$20,000 per year) implies about a 0.4 percent change in real income.¹⁹

The finding that prices were not higher in lower-income neighborhoods of New Haven is puzzling at first glance and contrary to what has been published earlier. This might be explained in different ways. First, a large number of higher-cost buying opportunities (for example, drug and convenience stores) now exists in all neighborhoods. This may give the appearance of higher prices in wealthier areas and mask the fact that the poor may have these as main options, while people with greater means may use these only for impulse buying. In our study, in fact, prices from supermarkets in lower-income areas were higher than those from comparable markets in wealthier areas (by 6–7 percent), although this cannot be considered a definitive finding because of the small number of such markets in our sample.

Another possibility is that New Haven has somehow made lower-cost food more accessible to the poor. Several full-service chain su-

permarkets and other large independent markets exist in lower-income areas of the city, giving New Haven a higher density of large markets compared to cities such as Detroit.²⁰ A history of New Haven suggests that market forces, not city planning or regulation, are responsible.²¹ Developers searching for areas that were “understored” found that New Haven had relatively few stores in areas where disposable income per acre was high enough to invest and where stores were feasible to build and operate. Low income in these areas is offset by high population density, and retail food development occurs.

■ **Policy correctives.** It is possible that the food retail industry will see other opportunities in low-income areas and that market forces will offer some help in correcting food-price disparities. The well-known lack of low-cost access to healthful food in low-income communities is, however, a major problem that may suggest the need for government intervention. At the local level, tax incentives, zoning changes, and enterprise development areas might be mechanisms to produce change. In addition, cities can consider whether transportation can be arranged so that people from a broader radius can get easy access to large markets.

Federal action might also be a possibility. Through massive spending programs such as the Farm Bill and its components such as the Women, Infants, and Children (WIC) and Food Stamps programs, there might be opportunities to address both access and price. These are at the heart of food insecurity, which is linked to both under- and overnutrition.

■ **Study limitations.** There are several limitations of this study. Our analysis of trends in price differences between small and large food stores was limited by the number of items used in the 1971 comparison study. Also, as consumption trends shift, relative prices change, which may affect the price spread. We may see a larger relative price change for items less popular and important today than in 1971. We tested this hypothesis by excluding certain food items from the estimation (for example, coffee), which did not qualitatively change

the results. Second, our study is based on data from one city, and additional research is needed to determine whether the results can be generalized to other locations. Third, our sample was not large enough to enable the analysis of differences in availability and prices by type of store and neighborhood. Based on our indicative results for food prices in supermarkets in lower- versus higher-income areas, this analysis seems an important subject for further research.

ACCCESS TO HEALTHFUL food is a critical domain of securing high-quality nutrition. New Haven might set a good example of recent developments in the city that led to the opening of several supermarkets in low-income communities, thereby improving the availability of healthful food choices and eliminating food-price disparities.

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NOTES

1. S. Bleich et al., “Why Is the Developed World Obese?” NBER Working Paper no. 12954 (Cambridge, Mass.: National Bureau of Economic Research, 2007); S.Y. Chou, M. Grossman, and H. Saffer, “An Economic Analysis of Adult Obesity: Results from the Behavioral Risk Factor Surveillance System,” *Journal of Health Economics* 23, no. 3 (2004): 565–587; and D.M. Cutler, E.L. Glaeser, and J.M. Shapiro, “Why Have Americans Become More Obese?” *Journal of Economic Perspectives* 17, no. 3 (2003): 93–118.
2. World Health Organization, *Obesity: Preventing and Managing the Global Epidemic*, WHO Technical Series no. 894 (Geneva: WHO, 2000); A. Drewnowski and S.E. Specter, “Poverty and Obesity: The Role of Energy Density and Energy Costs,” *American Journal of Clinical Nutrition* 79, no. 1 (2004): 6–16; J. Cawley, “An Instrumental Variables Approach to Measuring the Effect of Body Weight on Employment Disability,” *Health Services Research* 35, no. 5, Part 2 (2000): 1159–1179; and J. Cawley, “The Impact of Obesity on Wages,” *Journal of Human Resources* 39, no. 2 (2004): 451–474.

3. C.R. Horowitz et al., "Barriers to Buying Healthy Foods for People with Diabetes: Evidence of Environmental Disparities," *American Journal of Public Health* 94, no. 9 (2004): 1549-1554; D.C. Sloane et al., "Improving the Nutritional Resource Environment for Healthy Living through Community-Based Participatory Research," *Journal of General Internal Medicine* 18, no. 7 (2003): 568-575; K. Morland et al., "Neighborhood Characteristics Associated with the Location of Food Stores and Food Service Places," *American Journal of Preventive Medicine* 22, no. 1 (2002): 23-29; and S. Inagami et al., "You Are Where You Shop: Grocery Store Locations, Weight, and Neighborhoods," *American Journal of Preventive Medicine* 31, no. 1 (2006): 10-17.
4. H. Kunreuther, "Why the Poor May Pay More for Food: Theoretical and Empirical Evidence," *Journal of Business* 46, no. 3 (1973): 368-383; P. Kaufman et al., *Do the Poor Pay More for Food? Item Selection and Price Differences Affect Low-Income Household Food Cost*, Agricultural Economics Report no. 759 (Washington: U.S. Department of Agriculture, 1997); and C. Chung and S.L. Myers, "Do the Poor Pay More for Food? An Analysis of Grocery Store Availability and Food Price Disparities," *Journal of Consumer Affairs* 33, no. 2 (1999): 276-296.
5. Sloane et al., "Improving the Nutritional Resource Environment"; and Morland et al., "Neighborhood Characteristics."
6. Kunreuther, "Why the Poor May Pay More for Food."
7. A higher-income (lower-income) neighborhood is defined as a neighborhood with median household income above (below) the national median household income, which is also the median in the New Haven sample (\$42,000 based on the 2000 U.S. census). The status of lower- and higher-income areas did not change between 1971 and 2006.
8. An appendix with detailed definitions of store types is available from the authors upon request.
9. K. Glanz et al., "Nutrition Environment Measures Survey in Stores (NEMS-S): Development and Evaluation," *American Journal of Preventive Medicine* 32, no. 4 (2007): 282-289.
10. A representative of our research team completed the NEMS-S training provided by Emory University researchers and received a certified NEMS trainer credit. All raters were trained by the certified trainer.
11. K. Morland and S. Filomena, "Disparities in the Availability of Fruits and Vegetables between Racially Segregated Urban Neighbourhoods," *Public Health Nutrition* 10, no. 12 (2007): 1481-1489; and J.N. Bodor et al., "Neighbourhood Fruit and Vegetable Availability and Consumption: The Role of Small Food Stores in an Urban Environment," *Public Health Nutrition* 11, no. 4 (2008): 413-420.
12. The ten types of fresh fruit were bananas, apples, oranges, grapes, cantaloupe, peaches, strawberries, honeydew melon, watermelon, and pears. The ten types of fresh vegetables were carrots, tomatoes, sweet peppers, broccoli, lettuce, green beans, celery, cucumbers, cabbage, and cauliflower.
13. Based on the 2000 U.S. census, 47 percent of households in the lower-income neighborhoods in our study did not have access to a vehicle at home, compared to 7 percent of households in the higher-income neighborhoods.
14. InfoUSA, *Database of U.S. Businesses*, vol. 2006 (Omaha, Neb.: InfoUSA, 2006).
15. Environmental Systems Research Institute, "Census 2000 TIGER/Line Data," http://www.esri.com/data/download/census2000_tigerline/index.html (accessed 16 June 2008).
16. USDA, "National Nutrient Database for Standard Reference," Release 20, September 2007, <http://www.ars.usda.gov/ba/bhnrc/nndl> (accessed 18 June 2008).
17. As reported in the 2000 U.S. census and 2002 economic census, the density of stores per 10,000 population in New Haven is 2.4 times higher for convenience stores and 4.7 times higher for grocery stores in lower- versus higher-income neighborhoods.
18. We did not have a sample size of large stores in Study 2 to replicate Study 1 price comparisons.
19. U.S. Department of Labor, Bureau of Labor Statistics, "Consumer Expenditure Survey, 2006," <http://www.bls.gov/cex> (accessed 16 June 2008).
20. Mari Gallagher Research and Consulting Group, "Examining the Impact of Food Deserts on Public Health in Detroit," 2007, <http://www.wyaleruddcenter.org/what/policy/pdfs/DetroitFoodDesertReport.pdf> (accessed 14 July 2008).
21. D.W. Rae, *City: Urbanism and Its End* (New Haven, Conn.: Yale University Press, 2003).