

Dynamic Urban Food Environments

A Temporal Analysis of Access to Healthy Foods

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Background: Low-income, urban populations' limited access to healthy foods is often pointed to as a key barrier to improving nutrition. Although much has been written on identifying urban "food deserts," little has been done to examine how the food environment changes over the course of 1 year.

Purpose: This study was designed to dynamically describe the urban food environment as a means to identify when at-risk neighborhoods are without access to healthy food.

Methods: Demographic and road data of Buffalo NY from the 2000 U.S. Census, a 2010 listing of city supermarkets, and 2011 government records of the time and location of urban farmers' markets are mapped. Road network distances from block groups to supermarkets and farmers' markets are calculated. A computer simulation, written in 2011, examines the market closest to each block group for 52 weeks.

Results: The average distance to markets with produce from block groups with poverty levels in the top 10th percentile is greater than that across all block groups during winter and spring months. However, during the farmers' market season, the same impoverished block groups are on average closer to markets when compared to all block groups.

Conclusions: Including the temporal dimension in an analysis of healthy food access generates a more complex picture of urban food-desert locations. The implications are that spatiotemporal factors should be used to inform appropriate interventions for creating an equitable food environment.

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Background

The inequities of the contemporary urban food environment have been well documented.¹ Low-income households are often faced with a confluence of economic, geographic, and social factors that constrain where and how they shop for food, resulting in less-nutritious diets.^{2–5} Maintaining such an unhealthy regimen has been linked to a number of chronic health problems, including obesity, diabetes, and cardiovascular disease.^{6–11} A first step toward improving the nutrition of this at-risk population, thereby reducing the related health consequences, is improving their "access" to healthy foods.

In a public health context, access to a preventive care or medical service is thought of as a complex combination of psychological, financial, and structural components that enable a person to receive necessary care.^{12,13} Related to both the previously mentioned economic and socio-structural

factors, spatial proximity to health services (e.g., a physician, hospital, food vendor, or pharmacy) is an important component of overall access to health care.^{14–18} The structural implications of being located near a service include the ability to easily transport himself or herself to that location and an increase in that person's knowledge of healthcare opportunities resulting from exposure.

Practitioners and policymakers designing interventions for reducing social disparities in access to healthy foods must know which urban populations are most in need of assistance to be effective. Quantitative methods have been used to derive maps that indicate which urban regions are without access to healthy foods.^{19–22} Although these studies provide a static snapshot of how accessible healthy foods are to various populations, they fail to capture the dynamic nature of the urban food environment.

One dynamic of relevance to variation in healthy food access is the opening and closing of farmers' markets throughout a given year. Although economic factors and dietary social norms still may impede low-income households' access to fruits and vegetables, farmers' markets have the potential to improve their spatial accessibility. However, the availability of farmers' markets is heavily dependent on seasonal conditions, especially in regions with a colder cli-

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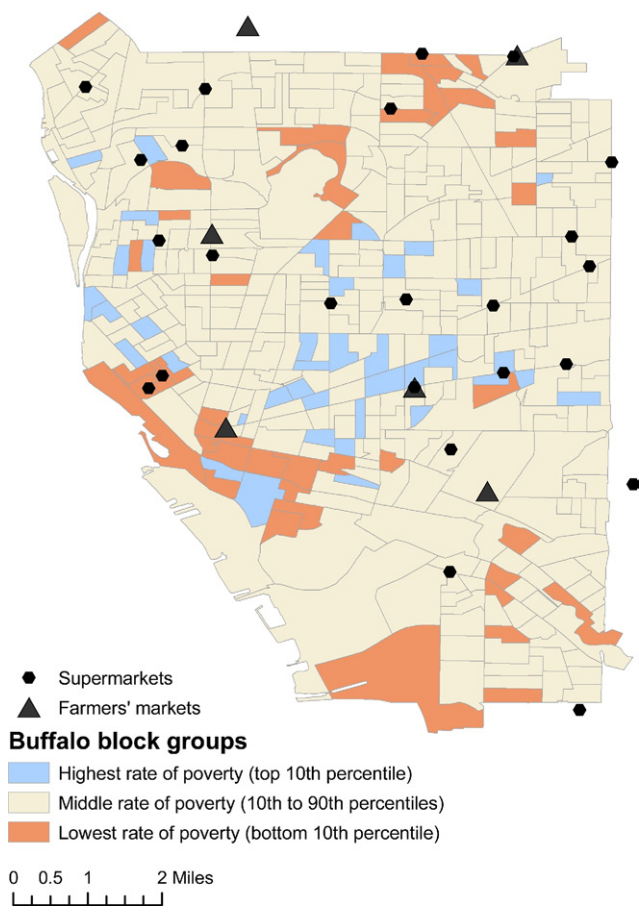


Figure 1. Locations of farmers' markets and supermarkets, with levels of household poverty in Buffalo NY

mate. For these reasons, a static conception of the food environment is insufficient and can misrepresent when and how nutrition interventions should be executed. Using the case of Buffalo NY, this paper explores how farmers' markets alter the urban food environment over the year in a cold-weather city with a high prevalence of poverty and evidence of food deserts.^{20,22–24} If an increase in spatial access manifests, outreach programs that occur during the farmers' market season could play a crucial role in improving the nutrition of at-risk populations.

Methods

Data for markets in Buffalo NY with a "supermarket" designation (stores with produce departments) are compiled from Hoover's Company Records,²⁵ cross-checked with 2010 directory listings found on Google Maps and the Yellow Pages (as some data were out of date), and geocoded into a GIS. The locations of farmers' markets similarly are geocoded into the GIS, using addresses provided in a 2011 directory on the New York State government's website.²⁶ Each farmers' market's start and end dates are recorded. Demographic data from the 2000 U.S. Census of households below the poverty line are represented at the block group level (Figure 1).

Next, the shortest road-network distance from the centroid of every block group to every supermarket and farmers' market is

calculated in the GIS and stored. A computer program is written that iterates through 52 weeks, and for each week assigns every block group its nearest supermarket or open farmers' market. The weekly temporal scale is chosen to approximate the frequency of household grocery purchases. If the government records indicate a particular farmers' market is closed that week, no block group will have access to it. A record is kept of every block group's shortest distance to a market for every week, for later analysis. It is also worth noting that farmers' markets are in general open for only a few hours a week, making them less flexible venues than supermarkets. However, it is assumed that a household can make their weekly grocery purchases during this restricted time period in order to demonstrate the potential of farmers' markets.

Results

The chart presented in Figure 2 shows the average distances from block groups with a poverty level in the top and bottom 10th percentile to the nearest supermarket or open farmers' market. During the winter months, block groups with both the lowest and highest prevalence of impoverished households have higher average distances to the nearest supermarket or farmers' market. However, both drop below the average distance to the nearest market during the farmers' market season. Wealthier block groups have greater spatial access than the poorer block groups during the initial portion of the farmers' market season, until around Week 30 (July). It is interesting that wealthier block groups have, on average, a smaller average distance during the farmers' market season than the average distance from all block groups combined, and then a larger distance to their nearest market during the rest of the year.

One explanation for the temporal discrepancy of access for wealthier places is that block groups with wealthier households have more economic resources and therefore attract farmers who perceive these regions as being areas with more demand. Conversely, it is also the case that block

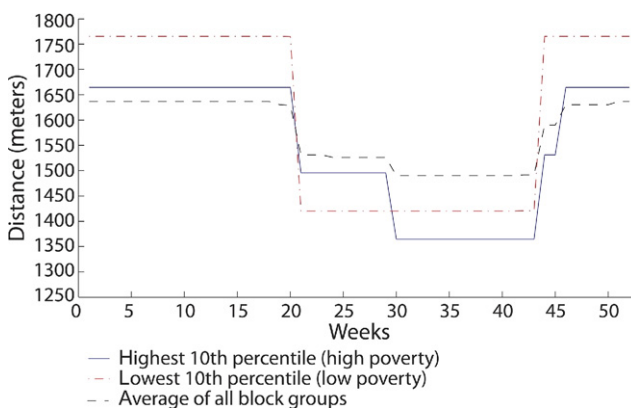


Figure 2. Average distance to the nearest market based on poverty levels

Note: The lowest and uppermost 10th percentiles are used as cutoff points. Weeks 1–17 ≈ January–April; Weeks 18–47 ≈ May–November; Weeks 48–52 ≈ December

groups with the highest levels of poverty have the lowest average distance to markets during the farmers' market season. During the farmers' market season, lower-income neighborhoods have relatively good spatial access to fresh fruits and vegetables. Additionally, areas with a higher prevalence of poverty have a higher average distance to markets than all block groups combined during the winter weeks. This could have profound implications on how food outreach programs are conducted, as the proximity of farmers' markets to poorer neighborhoods could be used as a leverage point during the summer weeks whereas other strategies are employed during the winter period.

Conclusion

This report has shown that taking into account the dynamic presence of farmers' markets reveals new properties of the metrics that previously have been used to characterize regions of cities as being a part of, or not a part of, food deserts. As described in this analysis of Buffalo, there are populations within the city that lack physical access to healthy foods for substantial portions of the year. These populations' spatial access can change from week to week, complicating the notion of a static food desert.

Health professionals, researchers, and policymakers should consider urban food environments as dynamic entities, where social and economic processes result in nonlinear increases and decreases in spatial access over time. Doing so could enhance greatly the ability of health programs to make cost-effective improvements in diets within low-income neighborhoods. Buffalo has taken a first step by having farmers' markets accept purchases through the Women, Infants, and Children (WIC) and Seniors Farmers' Market Nutrition programs. Similar economic and educational initiatives could further encourage healthy eating among at-risk urban residents.

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