"Foodscapes, Inequality, and Disease: Interrelationships between Food Environment and Public Health in Charlottesville, VA"

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Abstract

Relative to white and higher socioeconomic status groups, minority and low socioeconomic status groups experience disproportionate mortality and morbidity from diet-related diseases such as diabetes, heart disease, and obesity. Recent research has focused on the concept of "food deserts," areas lacking ready access to healthful and affordable food, as a potential mechanism driving the relationship between race, class, and health. One of the major challenges in studying food deserts has been effectively classifying or characterizing the local food environment, leading to a lack of consensus among researchers on the interrelationships among race and class, food environment, and health outcomes. Focusing on the Charlottesville, Virginia metropolitan statistical area, we use local data to address two main questions: 1) Do neighborhood socio-demographic characteristics, such as race and class, predict characteristics of the local food environment? 2) Are lower quality local food environments associated with poorer public health outcomes?

Introduction

Diet is a significant risk factor for many of the leading health problems in the United States: heart disease, hypertension, stroke, obesity, diabetes and certain cancers. Relative to white and higher socioeconomic status (SES) groups, minority and low SES groups experience disproportionate mortality and morbidity from diet-related diseases such as diabetes, heart disease, and obesity (Kumanyika 2006; Satia 2009; Williams and Collins 1995). Recent research has focused on the concept of "food deserts," areas lacking ready access to healthful and affordable food, and other aspects of the local "foodscape" as potential mechanisms driving the relationship between race, class, and health (Raja, Ma, and Yadav 2008; Zenk et al. 2005). One of the major challenges in studying food deserts has been effectively classifying or characterizing the local food environment (Moore et al. 2008; Odoms-Young, Zenk, and Mason 2009), leading to a lack of consensus among researchers on the interrelationships among race and class, the local food environment, and health outcomes. Focusing on the Charlottesville, Virginia metropolitan statistical area (MSA), we use detailed local data to address two main questions:

1) Do neighborhood socio-demographic characteristics, such as race and class, predict characteristics of the local food environment?
2) Are lower quality local food environments associated with poorer public health outcomes?

Background

A diet predominantly comprised of healthy foods, such as fruits, vegetables, whole grains, lean meats, and low-fat dairy, with low intake of nutrient-dense (high caloric) foods containing refined sugars and trans fats, is associated with lower risk of chronic disease (Ver Ploeg et al. 2009). While many factors play a role in determining diet—from lack of knowledge or time to individual preferences—the local food environment circumscribes dietary choices. Through a process of cumulative disadvantage, already disadvantaged neighborhoods (be it on indicators such as education, poverty, or minority status), are proposed to have reduced access to healthy foods, which exacerbates disparities in health outcomes.

Much research emphasis has been given to the presence, or absence, of large grocery stores or supermarkets in neighborhoods. The size of these stores and the variety of products within them guarantees access to healthy foods; more importantly, their size creates economies of scale that contribute to the affordability of healthy food (cf. Chung and Myers 2005 for a discussion of higher prices in convenience stores). Analysis finds that, compared to higher income and predominately white areas, low-income and minority neighborhoods have reduced access to supermarkets (Morton and Blanchard 2007; Shaffer 2002; Zenk et al. 2005) and greater access to convenience stores (Wang et al. 2007). Moreover, where qualitative comparisons of the store offerings were made, low income and minority communities were less likely to have healthy foods offered in stores (Sloane et al. 2003) and, when it was available, the quality of the produce offered in these stores was lower (Zenk et al. 2006).

Examination of other aspects of the local food environment, such as restaurant type and menu offerings, finds that fast food restaurants are more densely clustered in low income areas (Block, Scribner, and DeSalvo 2004; Simon et al. 2008) while heavily minority communities have reduced access to restaurants offering healthy menu options (Baker et al. 2006; Lewis et al. 2005).

Data and Measures

Prior research suggests that the relationship between socio-demographic characteristics and food environment varies across locations (Smith et al. 2009). This study is restricted to the Charlottesville, Virginia MSA, which includes Charlottesville City, Albemarle County, Greene County, Fluvanna County, and Nelson County. The Charlottesville area has sufficient diversity, particularly with respect to racial composition and socioeconomic conditions (see Table 1), to create substantial variation at the tract level.

Table 1. Demographic Characteristics of Charlottesville MSA and Select Counties

	Charlottesville MSA	Charlottesville City	Albemarle County	Fluvanna County
Median Age	35.9	29.5	36.2	38.0
Age 65+ (%)	13.2	13.5	12.5	13.6
Minority (%)	21.3	30.6	19.8	21.0
No High School Diploma (%)	13.1	16.1	9.3	10.8
In Labor Force (%)	64.0	60.8	65.1	63.6
Individuals below poverty level (%)	12.0	26.5	8.1	7.0
Households Receiving Food Stamps (%)	5.3	9.9	3.4	3.4
Homes that are owner-occupied (%)	65.1	46.3	63.8	83.6

Source: 2006-2008 American Community Survey (Data for Greene and Nelson are currently unavailable)

We will utilize three main data sources to identify relationships that may exist between socio-demographic characteristics, food access, and health outcomes: 1) business information – to obtain the location of all food sources in the area, 2) demographic data – to understand the population characteristics and how they relate to food access and food quality, and 3) heath indicators.

Business Information

We draw on information from InfoUSA, a database of all publicly listed businesses, to obtain the address of all food merchants in the Charlottesville, VA MSA. Each business will be geocoded to its

specific location. Drawing on NAICS code and specific local knowledge (direct evaluation, if necessary), businesses will be classified in two ways:

1) Type of establishment. Food stores (where food is primarily purchased to consume at home), fast food/takeaway restaurants, and "sit-down" restaurants, and
2) "Healthy" or "unhealthy" food merchants. Healthy food merchants are those that offer a variety of fruits, vegetables, whole grains, lean meats, or low-fat dairy. Unhealthy food merchants are those that offer little or no fruits, vegetables, whole grains, lean meats, or low-fat dairy.

Preliminary analysis of the Charlottesville business information shows 261 "Food Store" establishments including grocery stores, convenience stores, meat and fish markets, and fruit and vegetable markets; 531 "Eating Places" including carry out foods, restaurants, pizza, and ice cream parlors; and 36 retail "Liquor Stores."

Demographic Data

We will aggregate data from the forthcoming 2005-2009 American Community Survey 5-year estimates at the Census tract level. Key variables of interest include *race*, measured as either percentage black or percentage minority; *poverty*, the proportion of the population falling below the federal poverty line; *food stamp recipiency*, the proportion of households receiving food stamps; and *vehicle ownership*, the proportion households with access to an automobile. Additional relevant tract characteristics include owner-occupied housing, educational attainment, labor force status, and population density.

Health Indicators

We will draw upon individual health records from the Virginia Department of Health to evaluate *mortality* rates by race and cause of death. These records include the address information necessary for geocoding records to the appropriate tract. Additionally, Prevention Quality Indicators (PQIs) from the Agency for Healthcare Research and Quality (www.ahrq.gov) may be used to estimate *morbidity* from diet-related disease. PQIs provide detailed information on local rates of hospital admission, including the reason for admission. Of interest in this dataset are diet-related health condition admissions, such as admissions due to short-term or long-term complications from diabetes, uncontrolled diabetes, coronary heart disease, and hypertension.

Analysis

Multiple measures will be used to capture the characteristics of the local food environment:

- *Distance* - captures the distance from consumers to retailers. Distance will be measured from tract centroid to tract centroid in ArcGIS software.
- *Density* - the ratio of food merchants in a given tract to population size, e.g., supermarkets per 1,000 people.

- *Food imbalance* – the ratio of healthy to unhealthy food merchants in or near a given tract. Food imbalance occurs in food desert areas where major grocers are distant but unhealthy food vendors are readily available, while communities with food balance have roughly equal access to both grocery stores/supermarkets and unhealthy food merchants.

A combination of these measures will be used to identify the nature of the local food environment for each tract. The use of latent clustering techniques with Latent Gold 4.5 to identify distinct types of local food environments will also be explored. We will then use regression analysis to determine whether the type of local food environment for a tract can be predicted using tract-level socio-demographic characteristics from the American Community Survey. Based on previous research, we expect to see a significant correlation between lower quality food environments and low-income, high minority areas.

Additionally, we will use regression analysis to determine whether there is a significant relationship between the type of local food environment and the rates of mortality and morbidity due to diet-related diseases. Discussion of results will address the implications for community-level public health interventions.

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