



The intersection of neighborhood racial segregation, poverty, and urbanicity and its impact on food store availability in the United States



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ABSTRACT

Background. Food store availability may determine the quality of food consumed by residents. Neighborhood racial residential segregation, poverty, and urbanicity independently affect food store availability, but the interactions among them have not been studied.

Purpose. To examine availability of supermarkets, grocery stores, and convenience stores in US census tracts according to neighborhood racial/ethnic composition, poverty, and urbanicity.

Methods. Data from 2000 US Census and 2001 InfoUSA food store data were combined and multivariate negative binomial regression models employed.

Results. As neighborhood poverty increased, supermarket availability decreased and grocery and convenience stores increased, regardless of race/ethnicity. At equal levels of poverty, Black census tracts had the fewest supermarkets, White tracts had the most, and integrated tracts were intermediate. Hispanic census tracts had the most grocery stores at all levels of poverty. In rural census tracts, neither racial composition nor level of poverty predicted supermarket availability.

Conclusions. Neighborhood racial composition and neighborhood poverty are independently associated with food store availability. Poor predominantly Black neighborhoods face a double jeopardy with the most limited access to quality food and should be prioritized for interventions. These associations are not seen in rural areas which suggest that interventions should not be universal but developed locally.

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Introduction

Significant racial and ethnic disparities in obesity exist in the United States (US). Age-adjusted prevalence of obesity is 32.4% in non-Hispanic whites, 38.7% among Mexican Americans, and 44.1% in non-Hispanic blacks (Flegal et al., 2010). Reasons for these disparities are uncertain, but one potential factor may be food store availability. Evidence suggests neighborhood racial segregation and poverty affects food store availability, but a search of the literature found only one previous study that has examined this in a nationwide sample (Powell et al., 2007). Additionally, the impact of urbanicity has not been well studied, and there is little data regarding the interaction of these factors affecting neighborhood food store availability.

Studies find positive associations between healthy food availability in neighborhoods and the intake of those foods by residents (Cheadle et al., 1991; Laraia et al., 2004; Larson et al., 2009; Morland and Evenson, 2009). Large supermarkets have been shown to stock more

healthy foods (Horowitz et al., 2004) at lower cost (Chung and Meyers, 1999; Cummins and Macintyre, 2002). Grocery and convenience stores are found to stock more energy dense, processed, high-fat, sugary, and salty foods (Walker et al., 2010). Residents of neighborhoods with better access to supermarkets eat healthier diets (Larson et al., 2009), but low-income and minority neighborhoods lack adequate access to large supermarkets (Black and Macinko, 2008; Millstein et al., 2009), a possible result of racial residential segregation.

Racial residential segregation may act indirectly through neighborhood concentrated poverty (Acevedo-Garcia, 2000; Williams, 1996). Studies find neighborhoods with more residents of low socioeconomic status (SES) have fewer high quality food stores and more low quality food stores (Landrine and Corral, 2009; Moore and Diez Roux, 2006; Morland et al., 2002; Powell et al., 2007). However, since racially segregated minority neighborhoods are more likely to be economically disadvantaged (Massey, 2001), it is difficult to disentangle the impact of segregation versus poverty. Zenk et al. (2005b) found no relationship between supermarkets and racial composition in low poverty areas, but in high poverty areas, neighborhoods with the highest percent of Black residents were further from a supermarket. This interaction between neighborhood racial composition and neighborhood SES poses a challenge in health disparities research.

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The relationship between neighborhood racial composition and food store availability has primarily been studied in urban areas and has consistently found neighborhoods with higher proportions of Black residents which have fewer supermarkets, longer distances to supermarkets, and more grocery stores (Baker et al., 2006; Bodor et al., 2010; Galvez et al., 2008; Landrine and Corral, 2009; Morland and Filomena, 2007; Zenk et al., 2005a, 2005b). One study of this relationship in a rural setting found the opposite association; residents of low income and minority communities were closer to all types of food stores compared to high income and White communities (Sharkey et al., 2010).

Our study examines availability of supermarkets, grocery stores, and convenience stores in US census tracts according to neighborhood racial/ethnic composition, poverty, and urbanicity. It expands on an existing nationwide study (Powell et al., 2007) by examining these relationships within census tracts instead of zip codes, examining the interaction between neighborhood racial/ethnic composition and neighborhood income, and including analysis of rural census tracts.

Methods

Data sources

Census bureau

Data were obtained from the 2000 US Census Population and Housing Summary Files 1 and 3. The nationwide sample includes 65,174 census tracts. The number of residents per census tract ranges from 1500 to 8000 and the spatial composition of census tracts varies widely depending on population density (US Census Bureau, 2012).

InfoUSA

Food store data from 2001 were obtained from InfoUSA, a nationwide commercial database of 12 million US businesses. Data are collected and updated monthly using telephone directories, annual reports, news outlets, government data, and the US Postal Service. Phone verification is conducted for new and large businesses (Brenna Smeall, personal communication, 9/9/10).

Variables

Neighborhoods were measured as census tracts. The dependent variable of interest was a count of (1) supermarkets (2) grocery stores, and (3) convenience stores. InfoUSA provided Standard Industrial Classification (SIC) codes for each food store. SIC codes are used by the US Department of Labor for industry identification business monitoring. SIC codes 541102 and 541103 identify convenience stores and 541101, 541104–541108 identify supermarkets and grocery stores. Supermarkets were distinguished from grocery stores by classification as a franchise or if the number of store employees was greater than 50. ArcGIS 9.3 software was used to map the latitude/longitude of each food store to its census tract. Each food store type was summed for each census tract to create a count variable for supermarkets, grocery stores, and convenience stores.

The independent variable of interest combined racial/ethnic composition and level of poverty for each census tract. A racial/ethnic composition variable was created categorizing each tract as predominantly non-Hispanic white, non-Hispanic black, or Hispanic if greater than or equal to 60% of the population was of that race/ethnicity, similar to measures used by Moore et al. (2008). Remaining tracts were classified as integrated, including those categorized as predominantly Asian or predominantly other. A census tract was defined as low poverty if 10% of the households reported an income below the federal poverty level (FPL), medium poverty if 10% to 19.9% of households reported an income below the FPL, and high poverty if greater than or equal to 20% of households reported an income below the FPL. Using the racial/ethnic composition and poverty variables, a combined 12-category predominant neighborhood race/ethnicity and neighborhood poverty variable was created. Census tracts were defined as urban if they fell within a Metropolitan Statistical Area (MSA) and rural if not. The geographic region of each tract was determined by whether it was located in a state in the Census defined Northeast, Midwest, South, or West. Population density was a count of people per square mile of the census tract per 1000 population.

Analysis

Multivariate count regression models were used to explore associations between food store count and the interaction between racial/ethnic composition and poverty level while controlling for region, population density, and urbanicity. Separate models were run for nationwide, urban, and rural samples. In the rural sample, the number of low and medium poverty tracts that were predominantly Black and Hispanic was small (range 2 to 29) so low and medium poverty census tracts were combined.

While Poisson models are typically used with dependent count variables, food store counts were overdispersed; therefore, negative binomial regression models were used (Long, 1997). Separate models were run for each type of food store to estimate incidence rate ratios (IRR). A cluster command was used in all models to account for clustering of census tracts at the county level. Using the IRRs, an estimated count of food stores was generated for all levels of combined neighborhood race/ethnicity and poverty. All analyses were conducted using STATA version 11.0.

Results

Descriptive summary statistics

Table 1 presents characteristics of census tracts by neighborhood racial composition. Predominantly White tracts are most frequently low poverty, urban, and in the South. Predominantly Black tracts are most frequently high poverty, urban, and in the South. Hispanic tracts are most often high poverty, urban, and in the West. Integrated tracts are most commonly high poverty, urban, and in the West. While 50.1% of White census tracts are low poverty, less than 10% of Black or Hispanic tracts are low poverty. Most Black and Hispanic census tracts are high poverty, 70.7% and 71.5%, respectively.

On average, there are 1.37 convenience stores, 1.17 grocery stores, and 0.23 supermarkets per tract (Table 2). Urban census tracts have fewer convenience ($p < 0.001$) and grocery stores ($p < 0.001$) and more supermarkets ($p < 0.001$) than rural tracts. As neighborhood poverty increases, there are more grocery stores ($p < 0.001$) and fewer supermarkets per tract ($p < 0.001$).

Regression results

Nationwide sample

Results from multivariate count regression models (Table 3 and Fig. 1) demonstrate that for all neighborhood racial/ethnic groups, the number of supermarkets per census tract decreases in stepwise progression as level of poverty increases. Comparing high poverty tracts, White tracts have the most supermarkets. Compared to predominantly White low poverty tracts, there are fewer ($p < 0.001$) supermarkets in high poverty White (IRR = 0.83, 95% CI: 0.76–0.91) followed by integrated (IRR = 0.63, 95% CI: 0.57–0.69), Hispanic (IRR = 0.60, 95% CI: 0.53–0.69), and Black (IRR = 0.30, 95% CI: 0.26–0.34) tracts. Compared to other racial/ethnic tracts, predominantly Black tracts have the fewest supermarkets at all levels of poverty. The number of supermarkets in predominantly Hispanic low and medium poverty census tracts is lower than in White low poverty tracts, but not statistically significant.

For all neighborhood racial/ethnic groups, the number of grocery stores increases in stepwise progression as the level of neighborhood poverty increases. In high poverty White, Black, Hispanic, and integrated tracts, there were 1.77 (95% CI: 1.67–1.88), 2.34 (95% CI: 2.14–2.57), 3.13 (95% CI: 2.73–3.57), and 2.35 (95% CI: 2.18–2.25) times as many grocery stores, respectively, as compared to predominantly White low poverty tracts. For all levels of poverty, predominantly Hispanic tracts have the most grocery stores. However, in low poverty tracts the difference between Hispanic tracts and all other racial/ethnic groups is not statistically different when compared to White low poverty tracts.

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