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Urban foodscape trends: Disparities in healthy food access in Chicago, 2007–2014

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ABSTRACT

We investigated changes in supermarket access in Chicago between 2007 and 2014, spanning The Great Recession, which we hypothesized worsened local food inequity. We mapped the average street network distance to the nearest supermarket across census tracts in 2007, 2011, and 2014, and identified spatial clusters of persistently low, high or changing access over time. Although the total number of supermarkets increased citywide, extremely low food access areas in segregated, low income regions did not benefit. Among black and socioeconomically disadvantaged residents of Chicago, access to healthy food is persistently poor and worsened in some areas following recent economic shocks.

1. Introduction

In an era of explosive biomedical innovation that is generating major therapeutic advances against a wide array of diseases, intractable health disparities continue to undermine public health in the United States. Socioeconomic, racial and ethnic disparities in diabetes, hypertension, cancer, and cardiovascular and kidney diseases are just a few examples of the most striking disparities (Davis et al., 1995; Deaton and Lubotsky, 2003; Vart et al., 2015; CDC, 2005). The complex underlying mechanisms of health disparities involve differences in education, employment, health literacy, health insurance, financial status, and access to high-quality medical care, and the medical consequences of stress, bias, and racism (Pickett and Wilkinson, 2015; Adler and Rehkopf, 2008; Phelan et al., 2010).

Systematic differences in the built environment that affect urban neighborhoods' access to healthy foods may also perpetuate health disparities (Lake and Townshend, 2006; Moore and Diez Roux, 2006; Walker et al., 2010; Ball et al., 2009). In neighborhoods with severely restricted access to healthy foods, residents may preferentially consume processed foods that often contain large amounts of refined sugars, polyunsaturated fats, and sodium- and phosphate-based food additives that are associated with increased risks of adverse clinical outcomes due to diabetes, hypertension, atherosclerosis, and kidney disease (Gordon-Larsen et al., 2006; Wrigley et al., 2003; Gutierrez, 2015). Heightened awareness of these "food deserts" stimulated local, state, and national programs to incentivize grocery retail development in underserved communities, including the City of Chicago's *A Recipe for Healthy Places* and the Illinois Fresh Food Fund (Karpyn et al., 2010; CDHED, 2013). However, few studies examined longitudinal geographical changes in healthy food access in response to these initiatives or other social and economic events that alter the "foodscape."

The Great Recession of 2008 exacerbated income inequality across the United States (Fisher et al., 2015; Pfeffer et al., 2013) and exposed the underlying effects of systemic racism, segregation, and concentration of poverty to undermine development of healthy neighborhoods (see discussions in Bower et al., 2014 and Landrine and Corral, 2009).

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We hypothesize that the Recession also magnified unequal access to healthy food by disproportionately reshaping the retail business landscape in vulnerable neighborhoods. With an estimated population of 2.7 million, Chicago is the third largest city in the United States, and one of its most racially and socioeconomically segregated (Moore and Diez Roux, 2006; Whitman et al., 2012). Previous cross-sectional studies reported disparate neighborhood access to healthy food across Chicago and elsewhere (Austin et al., 2005; Suarez-Balcazar et al., 2006; Zenk et al., 2011; Block and Kouba, 2006; Grigsby-Toussaint et al., 2010; Kwate and Loh, 2016; Powell et al., 2007; Bower et al., 2014), but none investigated the impact of major historical events like the Great Recession on change in healthy food access over time. In addition, Safeway abruptly closed all of its 14 Dominick's supermarkets in Chicago in 2013, further threatening healthy food access in neighborhoods served by the chain (Channick, 2013). The purpose of the current study was to describe longitudinal trends in healthy food access in Chicago in 2007, 2011, and 2014 using advanced spatial analyses. We focused on supermarkets as a proxy of healthy food access, as has been done in previous in population-based studies, because supermarkets offer a greater number of healthy food items than other establishments; healthy food availability increases with store size for nearly all food categories; and individuals who shop at supermarkets consume more fruits and vegetables than those who do not (Hendrickson et al., 2006; Horowitz et al., 2004; Laska et al., 2010; Block and Kouba, 2006; Zenk et al., 2005; Rose and Richards, 2004). We tested the hypotheses that healthy food access was disproportionately low and diminished further between 2007 and 2014 in low-income, predominantly minority-populated neighborhoods in response to the changing social landscape induced by the Great Recession and the Dominick's closure.

2. Methods

2.1. Data sources and definitions

2.1.1. Population and spatial scale

Using 2010 United States Census designations, we investigated 791 resident-populated census tracts in the City of Chicago that incorporated a total population of 2.7 million people. While we calculated food access measures at a 10-foot scale along the street network, we used census tracts as the spatial unit of observation for food access index calculation because much food access research and policy utilizes the census tract as a standard, and following changes to the 2010 Decennial Census, the tract is the finest spatial resolution available for non-decadal socioeconomic data.

2.1.2. Census variables

We obtained data on demographic, social, and economic characteristics of the population within the individual census tracts from the 2012 American Community Survey (ACS) 5-year estimate. We used this data as a baseline rather than tying each time period to corresponding ACS 5-year data, as changes between time periods at such a short interval can be obscured by large margins of error at the tract level (Spielman et al., 2014; Folch et al., 2016). We used the following demographic and socioeconomic variables: race-ethnicity demographics including White, Black, Asian, Other race, and Hispanic ethnicity; education variables including percent population with no high school education, with high school diploma, and college graduates; and additional socioeconomic variables that include median annual income, unemployment percentage, and percentage of families in poverty and children in poverty.

2.1.3. Supermarket classification

We defined supermarkets as full-service stores that: (1) carry a diverse line of groceries including fresh produce, fresh meats, and a deli, in addition to packaged and dry goods; and (2) contain five or more checkout lanes. The supermarket classification methodology and initial data collection we used was based on the results of Block and Kouba (2006), that systematically surveyed all available food stores in Chicagoland communities, including supermarkets, groceries and convenience stores; and Block, Chavez, and Birgen (2008), that expanded data collection for the year of 2007. These studies provided an operating definition of "supermarkets" and the initial validated data upon which we based the longitudinal supermarket dataset for the current study. We used the following definitions from those studies:

- *Diverse line of groceries.* The original food census study by Block and Kouba (2006) used a market basket list for data collection. The United States Department of Agriculture (USDA) Community Food Assessment Handbook, which is built from its "Thrifty Food Plan" recipes, served as the basis for the food list. Block and Kouba (2006) added a few items to this list that were culturally important within the neighborhoods of study (e.g. sweet potatoes, greens, and baby formula) but did not remove any items to allow for replicability. Surveys were then performed by eight research teams over a two-month period and during similar times of day; each team included one student and one community member. Teams were assigned stores of various types in dispersed locations to minimize potential effects on data collection by different teams. Teams went through a six-hour training prior to data collection, including an interactive class and supermarket practice session. Food availability, cost, and quality were surveyed for the following main items: fresh fruits and vegetables, canned fruits and vegetables, frozen fruits and vegetables, bread and grain, dairy, meats and protein, fats and oils, baby food and formula, sugars and sweets, spices, and baking supplies. Compared to all other stores (independent groceries, drug stores, convenience stores, liquor stores, gas stations, dollar stores, specialty stores), chain and independent supermarkets had the highest availability of food items across all categories (Block and Kouba, 2006).
- *Checkout lanes.* During the data collection period for the 2006 study, the research field teams recorded the number of checkout lanes at each store they visited. Chain supermarkets consistently had more than five checkout lanes in the original Block and Kouba (2006) analysis. Based on this research and industry standards (Food Marketing Institute, 2004), we used five or more checkout lanes as an indicator to classify a particular store as a supermarket.
- *Chain versus Independent Stores.* We defined chain supermarkets as supermarkets that were part of national or regional chains. In 2007, these included Jewel-Osco, the largest local chain (now owned by Albertson's), Dominick's (then owned by Safeway), and Food 4 Less (a division of Kroger). Whole Foods and Trader Joe's were included as a chain specialty supermarket. Wal-Mart Supercenters and Super-Target were included as "superstores," i.e. large big box stores that also sold a wide variety of groceries. Based on earlier research (Block and Kouba, 2006) and industry standards (Food Marketing Institute, 2004), we classified all of these chain stores as supermarkets. We defined independent stores as stores that were not part of a larger chain and which appeared on the cross-referenced list of purchased and public supermarket data, even if it had multiple locations. For local chains, Block and Kouba (2006) conducted a web search for independent stores in their original study. In their data collection for the 2006 study, Block's research team surveyed 117 independent stores, 65 of which met their criteria to be classified as a supermarket. For comparison, there were 68 chain full-service or specialty supermarkets in Chicago at that time. More details can be found in Block and Kouba (2006) and Block, Chavez and Birgen (2008).

2.1.4. Supermarket data

We curated a dataset that detailed the locations of all chain and independent supermarkets in the Chicago area in 2007, 2011, and 2014