Inequality in Urban Food Systems:

Assessing Grocery Store Distribution within the City of Los Angeles

Josh Beissinger

Occidental College

Urban & Environmental Policy Senior Comprehensive Research Project

Professor Rodnyansky

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ABSTRACT:

Food insecurity is a growing issue within cities. It is a crisis which disproportionately affects low income and people of color, as they have less access to fresh and nutritious foods, often leading to detrimental health consequences. This study explores these issues using the City of Los Angeles as a case study. Grocery stores within six neighborhoods varying in socioeconomic status and income levels were surveyed to determine price variation, quantity, and availability of fruits, vegetables, and dairy products. Shelf space devoted to fresh produce was measured at all sampled stores for store-to-store and store-to-neighborhood comparisons. Results from the statistical analysis showed that low income individuals had less access to stores with fresh produce. Additionally, individuals in lower income neighborhoods with low access to grocery stores had less square footage of fresh produce space at food stores nearby. The price analysis showed that lower income people were also burdened with higher prices at some stores. Lastly, neighborhoods with higher obesity rates had less shelf space devoted to fresh produce suggesting a correlation with a lack of access to fresh food. These results suggest that subsidies to encourage larger grocery stores to move into lower income neighborhoods with less fresh produce could help counter higher prices faced by these communities along with increasing access to healthier nutritious foods. Access to affordable fresh foods could potentially help reduce detrimental health outcomes faced by these communities as a result of having lower access to fresh food. However, more research is needed to determine the effects that larger grocery stores have on consumption patterns in these neighborhoods and the implications this may have on smaller privately-owned ethnic stores.

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INTRODUCTION:

Despite California being the state with the highest agricultural production in the United States (USDA 2022), the Los Angeles Food Bank recently reported that 1 out of every 3 Angelenos is food insecure (LA Regional Food Bank 2021). Food insecurity and equal access to healthy, fresh, and nutritious foods have issues that have plagued Los Angeles for decades. However, the burden is not shared equally among residents; at a national level the problem of food insecurity is greatest for people of color and low income communities. In addition to having less access to grocery stores overall, Black, Hispanic, and low income communities face inequitable access to fresh and nutritious foods nationally, often consuming high rates of processed foods leading to detrimental health outcomes (Powell et. al., 2007). A better understanding of the spatial patterns and relationships in fresh food availability across neighborhoods of different racial and socioeconomic characteristics is needed to develop more effective policy approaches to solve the issue of food insecurity and accessibility within Los Angeles. Additionally, more information about factors such as proximity to public transit, availability of a personal vehicle, or other modes of transportation are necessary for addressing this issue.

The question of *how accessibility to food stores differs across neighborhoods by socioeconomic status (SES) and race within Los Angeles City* is central to understanding patterns in the availability of fresh food in the region. This study used a two pronged approach to investigate the spatial distribution of food stores. First, all food stores were located and sorted by type (see below); second, stores were directly sampled within six distinct neighborhoods of different SES to determine how prices

differed between store type and region. To see how store type differed across neighborhoods, stores were classified into five distinct categories: grocery, convenience, specialty, ethnic, and big box stores. Sampling was conducted to determine the availability and price of fresh ‘market basket’ items which included eggs, milk, apples, and tomatoes, all items most commonly bought by an average American shopper (USDA 2022). Spatial analysis tools such as Google Earth Pro and ArcMap were used to overlay demographic data on top of food store type and locations citywide. STATA (StataCorp. 2021) and Microsoft Excel (Microsoft Corporation, 2018) were then used to determine if demographic and racial data were correlated with food store type and location.

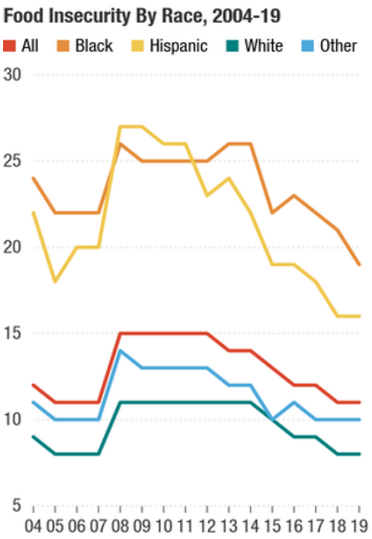
The ultimate goal of this research was to provide key data to help address food system inequalities and find solutions to prevent increased food insecurity in the most agriculturally rich state in the nation. This project explored patterns in fresh food access in diverse regions of Los Angeles to determine if relationships exist between store type, food price, location, and demographic variables. This information can be used to improve urban planning and support better public health outcomes for all residents, and particularly for Black, Hispanic, and low income communities.

LITERATURE REVIEW:

Food insecurity is a growing problem in urban areas of the United States (USDA 2022). Studies have linked regions of low access to fresh food with racial demographics and socioeconomic status, showing that food deserts are more common in poor, predominantly Black and Hispanic neighborhoods (Powell et al., 2007; Chung and Myers 1999). However, few studies have considered the full range of markets that provide fresh food, details of food categories available, prices, or the role of public transportation in access to fresh food. These factors together provide a more complete picture of access to fresh food in urban regions.

Food Security and Insecurity: The United States Department of Agriculture (USDA) defines food security as all members within a household having access to enough nutritious foods at all times in order to live a healthy and active lifestyle. Food security encompasses the ready availability of nutritionally safe foods as well as having assurance in the ability to purchase and acquire nutritionally adequate products without resorting to a reliance on emergency food supplies (USDA 2022). In contrast, food insecurity, as defined by the USDA, is “the limited or uncertain availability of nutritionally adequate and safe foods, or limited or uncertain ability to acquire acceptable foods in socially acceptable ways” (USDA 2022). It is important to note that food insecurity in the United States disproportionately affects communities based on race: Black households are nearly twice as likely to be food insecure compared to white families (Ney 2021). The lack of grocery stores, and other sources of affordable fresh produce is a result of decades of disinvestment in Hispanic and Black neighborhoods. Income is also a

dominant factor in determining access to sources of fresh food. Higher gross annual income is directly correlated with lower food insecurity rates (Ney 2021).



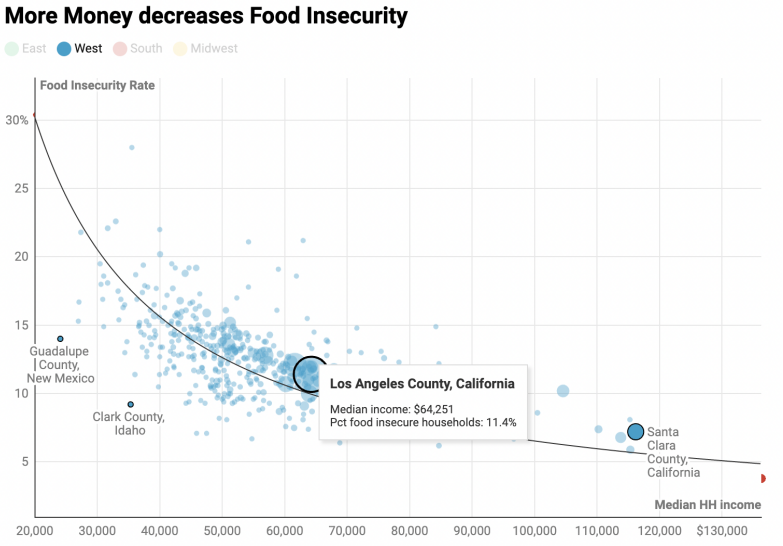


Figure 1: Patterns in food insecurity by racial groups in the United States from 2004-2019. From *Ney, Jeremy. "Food Deserts and Inequality." DataVisualizationLab, DataVisualizationLab, 30 Sept. 2021, https://www.socialpolicylab.org/*	**Figure 2:** Patterns in the rate of food insecurity with median household income in the Western United States. Los Angeles County is highlighted as 11.4% food insecurity at median household income of $64,251. From *Ney, Jeremy. "Food Deserts and Inequality." DataVisualizationLab, DataVisualizationLab, 30 Sept. 2021, https://www.socialpolicylab.org/*

Food insecurity rates have varied over a 15 year period in the U.S. (Figure 1; Ney 2021). Black and Hispanic people consistently experienced the highest rates of food insecurity compared to other racial groups. Despite food insecurity rates generally decreasing over a five to seven year period, a disparity among racial groups still exists. There has been a general trend of an exponential decline in food insecurity with increasing median household income in the Western United States (Figure 2). Los

Angeles County falls near the midpoint of the relationship with over 11% of the population experiencing food insecurity and a median household income of just over $64,000 per year (Ney 2021).

In Los Angeles City, one out of every three Angelenos is food insecure (Los Angeles Food Bank 2022). Food insecurity and equal access to healthy, fresh, and nutritious foods have been an issue that has plagued the Los Angeles region for decades (CDFA 2021). The South Central region of Los Angeles is considered a food desert; this region is characterized by a population that is 66.2% Hispanic, 27.6% Black, and 1.6% White (Data USA 2022). As described by Borrelli and Gunn (2020), these neighborhoods "lack access to fresh foods and a drought of grocery stores resulting in an influx of fast food restaurants, liquor stores, and small convenience stores." A report done in 2008 found that there were only seven grocery stores in the total South Central L.A. region (NBC Universal 2008).

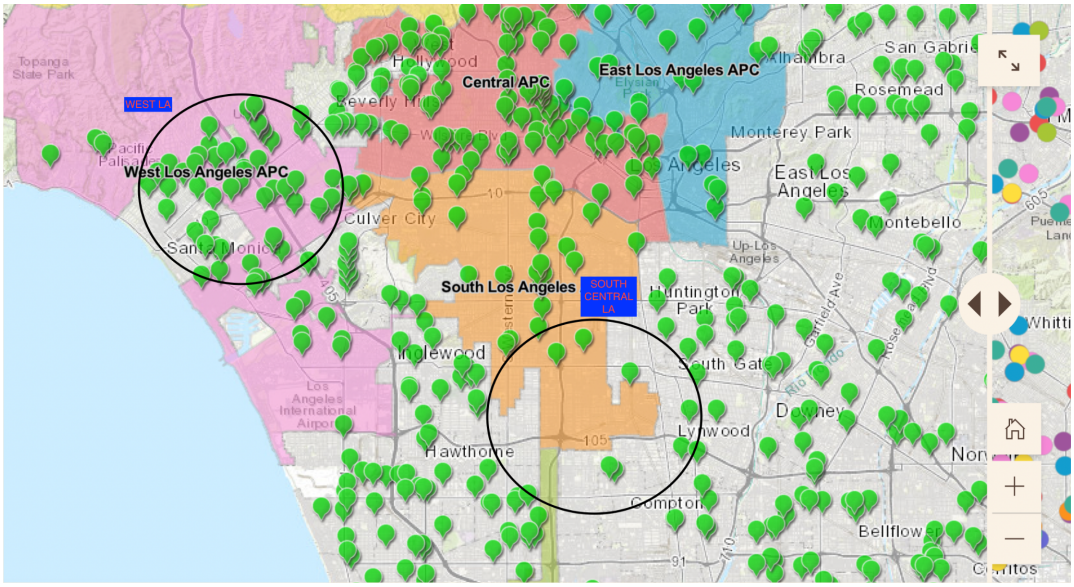


Figure 3. Map showing food store locations marked in green by city and neighborhood.[1]

[1] *Borelli and Gunn (2020)*

Borelli and Gunn (2020) showed the location of all fresh produce stores around L.A. County (Figure 3). The circle on the upper left shows the number of the grocery stores within West L.A. while the bottom circle shows a clear lack of grocery stores in and around the South Central region. While South Central L.A. has historically been deemed a 'food desert crisis' region, a more current reanalysis is needed to determine if improvements to grocery store availability and access to fresh food have occurred.

Food Stores by Type and Access: There are several categories of food stores that may exist within metropolitan regions. Identifying different types of food stores is important for understanding the spatial patterns of food access across a given geographic region or demographic. Han et al. (2012) classified food stores into three main categories: convenience, grocery, and specialty. While this classification method captures much of the variety of stores typical of urban areas, it lacks an important type of food store in the Los Angeles area. Being that Los Angeles is a very racially and ethnically diverse region, it is home to a number of ethnic food stores that are likely to play a particularly important role in food access in Los Angeles City.

There is contradictory data on food store access across socioeconomic groups. Some studies have found a lack of food stores in low income and minority neighborhoods (Widener 2016; Powell et al., 2007; McKenzie 2013). However, according to the USDA, grocery store access was greater in predominantly Hispanic and Asian neighborhoods than non-Hispanic and White neighborhoods (USDA 2009). The discrepancy in data on food store access may be reflective of cultural preferences for specific food types which may be more abundantly accessible at local ethnic stores

in ethnic neighborhoods such as Asian or Latino areas rather than larger name brand stores (Powell et al., 2007). Furthermore, existing studies on poor food environments may not accurately define ‘food deserts’ as they tend to solely focus on neighborhoods inundated with convenience stores and lacking full service grocery stores while failing to incorporate and predict how small ethnic stores alleviate food insecurity and affect health outcomes (Khojasteh and Raja 2016). The ethnic food retail sector is often crucial; these stores frequently stock and sell fresh fruits, vegetables, and dairy products within low resource communities (Khojasteh and Raja 2016). Ethnic stores are defined as stores that stock and sell fresh and dry imported foods and cater particularly to an ethnic clientele (Khojasteh and Raja 2016). Additionally, big box retail stores, or retail chains which are classified as physically large stores selling a large variety of products at discounted prices (Schuetz 2015), are likely to play an important role. Big box stores such as Walmart, Target, and Cosco often stock a variety of fresh produce and dairy products.

Access to full scale grocery stores largely differs depending on race, ethnicity, and income. Over the past two decades, studies have established that poorer neighborhoods are underserved by full scale grocery stores in several different metropolitan regions (McKenzie 2013). This disparity is not limited to income, as race is a significant determinant in accessibility to grocery store-based fresh food access, as well as disparities in the overall distribution of types of food stores available within a region. Studies conducted in multiple states within different metropolitan areas showed that predominantly Black neighborhoods tended to have fewer grocery stores available than predominantly White ones, while simultaneously having a higher number of

convenience stores. In urban areas, Black neighborhoods on average have 1.8 to 2.3 times as many non-chain food stores as White neighborhoods (Powell et al., 2007).

There are many systemic drivers of the distribution of food stores and the development of food deserts. Market redlining retail practices date back to the end of World War II when White middle class families began to leave the city centers for quieter, more spacious, and segregated suburban neighborhoods (Eisenhauer 2001). The rapidly growing food retail industry was quick to follow the White flight. During the 1950s, newly constructed grocery stores grew in size from 10,000-15,000 square feet to 20,000-25,000 square feet allowing for the accommodation for more varieties of food and non food items and larger inventories overall. This made it harder for smaller independently owned stores to compete, evidently leading to the rapid decline of smaller stores (Eisenhauer 2001). The 1970s and ‘80s saw predatory pricing practices at large retail chain stores who fought for market dominance, some leading to leveraged buyouts. Stores that participated in leveraged buyouts during the late 1980s often had three different outcomes: less profitable stores were sold off, stores located in competitive markets saw the same or decreases in prices of goods, and profitable stores in less competitive markets saw a large increase in prices (Chevalier 1995). The third outcome, price increases in less competitive markets, encouraged other food stores in the same area to follow the trend of price gouging, leading to higher prices overall.

Price Inequity and Health Outcomes: Groceries sold within food deserts tend to be significantly more expensive compared to those sold within wealthier urban areas or

even suburban neighborhoods. In a recent study, the price of milk tended to be 5% higher and cereal prices were 25% higher in a food desert relative to locations with better food access (Silva 2020). It is notable that physical barriers often impede the construction of new large grocery stores within urban inner city areas, exacerbating the lack of access to fresh foods. Lack of infrastructure, easy access to a freeway or interstate system, space for loading docks, and a lack of distribution networks are all factors which play into this issue (Zhang & Debarchana 2016).

Similar to the factors that affect differential grocery store access, there are many inequalities when it comes to accessibility to fresh produce. Grocery store redlining has led to a decrease in the number of food stores within low income and minority communities and has also resulted in a lack of food stores selling fresh and nutritious foods resulting in large disparities across race, ethnicity, and income. Algert et al. (2006) noted that accessibility to fresh produce and other healthy nutritious foods within Los Angeles differed between poorer ethnic and wealthier White neighborhoods. Higher concentrations of poverty were correlated with fewer grocery stores in a region (Algert et al., 2006). Black communities are particularly burdened by this issue. Hilmers and Dave (2019) reported that within South Los Angeles, neighborhoods with larger numbers of Black residents tended to have the fewest healthy food options. Consequently, these neighborhoods also had higher numbers of fast food restaurants compared to West Los Angeles, an area of the city with a lower number of Black residents (Hilmers and Dave 2019). The limited access to full scale grocery stores, reliance on convenience stores and fast food chains, and higher prices for fresh and

nutritious foods continue to perpetuate health disparities with these neighborhoods (Hallum et al., 2020).

While foods at fast food restaurants and corner stores tend to be more affordable, there are many health consequences from consuming processed and non-nutritious foods (Cornell 2020). A chronic lack of nutrition starting at childhood can lead to high rates of diet related cancers, and in extreme cases, death. Life expectancy for residents living within food deserts is up to 15 years lower than the national average, when coupled with the addition of little exercise and external sources of pollution typical in some of these regions (Cornell 2020). People who consume lower quality, less nutritious foods tend to have higher rates of obesity, heart disease, and diabetes (Hallum et al., 2020). However, Kelli et al. (2019) notes that even after healthier options were made available within food deserts, consumers continued to purchase processed and non nutritious foods based on personal preference. The range of adverse health effects due to dietary choices within low income and minority communities is a topic which needs to be addressed and studied thoroughly before policies can effectively help to combat this issue.

Transit and Access to Fresh Food:

While recognizing that transit is an important component in fresh food access, this study's analysis was limited to vehicle ownership. Access to a vehicle or public transportation has been shown to help alleviate food insecurity within metropolitan regions. Zhang and Debarchana (2015) conducted a study in Hartford Connecticut revealing that residents who have access to a vehicle or resources to travel the 'extra

mile' to an alternative grocery store are evidently less vulnerable to the threat of food insecurity. The number of vehicles owned per capita lowers food insecurity rates for all households while the number of buses per household without vehicles also mitigates food insecurity rates for all households and households with children (Bonanno and Li 2014). However, these two coefficients were not statistically significant for low income households, meaning that while commuting via public transportation or personal vehicle may open up more opportunities to access cheaper stores or stores with fresh produce, it may be more of a burden for low income households. (Bonanno and Li, 2014).

Using spatial analysis tools such as a GIS can allow researchers to identify food deserts, their relationships to transit options and health outcomes, and measure how these change over time. Mapping can also help visualize disparities across variables such as race, ethnicity, and income in terms of food access and can allow scientists and researchers to study the root cause of these inequalities. Spatial analysis can expose important and often hidden trends which can provide context for further research and analysis (Freeman 2021).

Gaps in Knowledge: While studies have explored the definitions and drivers of food insecurity (USDA 2022) and the presence of food deserts in Los Angeles County, less information is available on the relationships among fresh food access at the neighborhood scale and the role of food store type, income level, and racial makeup in food access in the city. There is still a large gap in understanding of the role ethnic stores play in alleviating food insecurity within low access and low income communities. A significant body of literature within food studies solely focuses on larger scale food

stores (Khojasteh and Raja 2016) and fails to account for the gap that ethnic stores fill in providing communities with fresh and nutritious foods, and the relationships among regions with different food store types. While acknowledging that Los Angeles City may be unique in having a large ethnic store presence within these communities, this study helps fill this gap in knowledge by better understanding pricing, availability, and quantity of fresh produce within these stores in relation to other store types. Finally, data is lacking on the relationships among vehicle ownership and fresh food access across LA City neighborhoods, an important metric that may provide clues to additional outcomes such as health indices in the region.

METHODS:

Study Sites: This research was conducted within the City of Los Angeles, California. City boundaries were defined using GIS shapefiles from the Los Angeles GeoHub provided by Mayor Eric Garcetti's countywide database (Los Angeles Office of Finance 2022). Six neighborhoods were sampled including Koreatown, Highland Park/Eagle Rock, Silverlake, Boyle Heights, and Leimert Park. Highland Park and Eagle Rock were combined under the name 'NELA' (North East LA) as the neighborhoods were adjacent to each other. These neighborhoods represented a range of socio-economic conditions and varied in density, ethnic and racial makeup, as well as income level. Neighborhood boundaries and shapefiles for the five neighborhoods were provided by the LA Times Mapping Project (LA Times, 2022). Demographic data such as race, ethnicity, and income levels were sourced from the USC Neighborhood Project (USC Price 2022) and were joined spatially and overlaid with neighborhood shapefiles within GIS. In-person

sampling was conducted within these five regions to determine ground-truth data on store type, and census the availability of and price of the sampled items.[2]

Sampling within these five neighborhoods consisted of logging the prices of fresh food items in an average American weekly market basket (milk, eggs, apples, and tomatoes) which was determined by researching the most commonly purchased items at grocery stores that weren't soda, candy, or processed foods (https://www.ers.usda.gov/). Tomatoes and apples were chosen as they can be found in almost all grocery stores year round. Qualitative and quantitative information about the store itself was accounted for including number of cash registers, doors, distance to nearest transit stop, presence of bike rack(s), and food snap eligibility. These data are not used in the analysis but are available in Appendix 2 (Figure 1).

Approach: The first objective was to determine characteristics of food stores within both the wider LA City boundary and in my specific neighborhood study areas. To categorize store types, street addresses of food stores were pulled from the Mayor of Los Angeles's countywide database which lists all active businesses licenses registered with the Los Angeles Office of Finance. The countywide database is an open data portal with quantitative and qualitative information about Los Angeles County ranging from neighborhood crime statistics, COVID infection rates, transportation, and city infrastructure. Locating the address and coordinate points of each food store was done using the search query within the data portal to locate the spreadsheet of all active business listings. The data were sorted by the primary North American Industry Classification System (NAICS) description of 'Grocery Stores' (including 'supermarkets'

[2] *Eggs, milk, apples, tomatoes*

& convenience stores without gas) and by the NAICS code '445100' which filters the street addresses, business names, city, zip code, and coordinates for grocery stores and convenience stores only (fields listing mailing addresses, mailing city, mailing zip code, council district, location start and end date, and location account were excluded from the final data set).

Approximately 1,000 individual stores were identified and classified according to five specific categories (Table 1): Convenience, Grocery Store, Specialty, Ethnic, and Big Box Stores. Convenience stores are stores with no fresh meats and less than ten fruits and vegetables (if any) (Han et al., 2012). Grocery stores are classified as stores with a butcher, deli, or bakery, ten or more fruits and vegetables, contain aisles with fresh meat and milk, and have a produce section (Han et al., 2012). Specialty food stores are either bakeries, carnicerias/meat stores, or seafood/fish stores (Han et al., 2012).

Convenience: No fresh meat, 10 or fewer fruits and vegetables (if any), and 2 or fewer cash registers were classified as convenience stores.
Grocery Store: Stores with a butcher, deli, or bakery; sold fresh meat; and carried 10 or more fresh fruits and vegetables. [3]
Specialty: Bakeries, meat/butcher/carniceria, fish/seafood stores, fruit or vegetable stores.
Ethnic: Stores catering to the specific cultural and racial food preferences of a local ethnic population. [4]
Big Box: Retail chain stores characterized by physically large stores selling a wide range of consumer goods at discount prices.

[3] This definition was modified to be inclusive of smaller and larger stores under one category. Previous literature defines grocery stores and supermarkets as two distinct categories based on store size.

[4] Ethnic stores can be small and not full service - no fruits, vegetables, milk, - or can be larger and full scale servicing a community through selling imported foods which are not found in generic stores.

Table 1. Definitions of store category used in this study.

Ethnic stores are defined as those catering to the specific cultural and racial food preferences of a local ethnic population (Khojasteh and Raja 2016). Big Box stores are large stores selling a wide variety of products at discounted prices, ie. Walmart, Target, and Cosco. (Schuetz 2015). Categorizing by type allowed for further spatial analysis on how each store type was distributed throughout the city boundary and to see which neighborhoods had access to full scale stores versus purely convenience and liquor stores.

Each address from the Mayor's database was checked using Google Maps and Yelp to ensure that the name of the business and address were up to date. Addresses of businesses which were no longer open or were temporarily closed were removed from the analysis. If the availability of fresh produce was unclear from readily accessible information, store owners or managers were contacted via phone. If a phone number was not provided on Google, the business name was entered into Yelp which provided all contact information and photos of the store. After cleaning the data from the citywide database, all remaining addresses were geocoded (turning an address from a number into a physical point) to identify areas which had the highest concentrations of stores by type and locale. Shapefiles from the USC Neighborhood Project were respectively overlaid to identify patterns among race, ethnicity, and income (Appendix 1, Figures A2-5, A8). This facilitated an analysis of how stores were distributed throughout the city boundary and specifically within the study areas.

In-person data collection**:** All stores in each of the five intensive studies areas were identified. To compare across stores, a set of common food items including tomatoes, apples, milk, and eggs were chosen. To analyze the price of a subset of items for direct comparisons, a survey was used to capture qualitative and quantitative information including store hours and location, the price and quantity of fresh produce and dairy items within the store, food stamp acceptance, the total fresh produce floor space (square feet), proximity to the nearest transit stop, and if a bike rack(s) and bus shelter was available within 500 feet of the store. Total shelf space devoted to fresh produce was measured using a digital measuring tape (Tape Measure app for Mac) to determine how much space was devoted to fresh produce across all surveyed store types (Figure 4). This survey was used while sampling stores within the six distinct neighborhoods of different socioeconomic status, demographics, and transit availability to compare pricing of market basket items between store types by neighborhood. A total of 59 stores were sampled in person.

GROCERY NAME:
DATE:
ADDRESS:
GROCERY TYPE:
GROCERY STORE HOURS:

Placement: *(Mark where produce is located)*

Back

Front

Doors: *(Mark location on diagram)*

1.
2.
3.
4.
5.

Cash Registers:

1. 2. 3. 4. 5. 6. 7. 8.
9. Other:_____
→ Self Checkout: YES NO
→ Registers:_____

Food Stamps:

SNAP: YES NO
WIC: YES NO

Total Floor Space:

M^2:_____

Total Fresh Produce Floorspace:

M^2:_____

Price:

- White Bread _____
- Dozen Eggs _____
- Tomatoes (1lb) _____
- Gallon Milk _____
- Apples (1lb)_____

Variety: *(How many other types/varieties are available)*

- White Bread _____
- Dozen Eggs _____
- Tomatoes (1lb) _____
- Gallon Milk _____
- Apples (1lb)_____

Bus Stop/Train Station: *(Use Google Earth Pro)*

Bus stop/station within 500 ft. of the store? YES NO
→ If no, how far? _____ft.
→ Line #(s): _____
→ Shelter/bench available? YES NO

Bike rack? YES NO
Parking *(Total square footage):* _____
Notes:

Figure 4. Survey used to collect quantitative and qualitative data while sampling.

Data Analysis**:** The data were analyzed using the analysis of variance tool (ANOVA) in STATA 17.0 (StataCorp. 2021). One- and two-way ANOVA tests were used along with the Box Plot tool to graphically display trends. The analysis was structured by examining four models to account for the factors which could affect the distribution of price of produce: neighborhood, store type, neighborhood + store type, and neighborhood x store type interaction. The six neighborhoods (Highland Park/ Eagle Rock (NELA), Silver Lake, Korea Town, Boyle Heights, and Leimert Park) were analyzed as a factor. Store type was also analyzed as a factor. While the original classification called for 5 distinct store type categories (full scale, convenience, ethnic, specialty, and big box), big box stores were not found in all of the sampled neighborhoods and were collapsed into category 1 (full scale) for this analysis. The category was renamed to 'store combined' and had 3 classifications: (1) Full scale grocery, (2) convenience, and (3) ethnic. There were no specialty stores included in the sampled neighborhoods. Specialty and big box classifications were only used for citywide distribution as not every sampled neighborhood had a store within these two categories.

The dependent variable for all models was the price of the sampled food items (tomatoes, apples, milk) and fresh produce space (square feet). While price and quantity of eggs were collected, the volatility of the price due to avian flu complicated the analysis and thus eggs were excluded from the analyses here. Due to data being collected over a particularly economically volatile 8 month period from June 2022 to February 2023, prices for items sampled within the first four initial neighborhoods,

Highland Park/Eagle Rock, Koreatown, and Silver Lake, were adjusted for inflation using the Federal Reserve's Consumer Price Index (U.S. Bureau of Labor Statistics, 2023). To adjust for the prices of food specifically, the CPI index for food was used instead of the overall CPI for 2023. All samples taken from June and July 2022 were adjusted using the 2023 January CPI using the following equation:

$$\$\,January\ 2023 = \$\,June\ 2022 * \frac{(January\ 2023\ CPI)}{(June\ 2022\ CPI)}$$

The CPI for June 2022 was 296.31 while the CPI for July was 296.28. January 2023 CPI was 299.17. The CPI for February 2023 was not readily available by the time this analysis was done. Additionally, due to the avian flu outbreak in January 2023, the prices of eggs increased exponentially over a 1 month period potentially yielding inaccurate results for price comparisons across the five neighborhoods.

Akaike Information Criterion (AIC) was used to evaluate the fit of each of the four models to the data. AIC is a mathematical index used to compare models to determine the best-fit model, or model which explains the greatest amount of variation (Log-likelihood) relative to the number of parameters (*k*) in the model. AIC was calculated using the following equation:

$$AIC = -2 * log\ likelihood - 2k$$

The best model is the one with the lowest AIC value. The "*estat ic"* command in STATA was used to calculate the AIC value along with the log likelihood, and number of parameters. In addition, delta-AIC (ΔAIC), or the difference between the AIC value of the best model and the AIC value for each other model, and AIC weight (w_i) were calculated to rank the models. (w_i) is calculated using the following equation:

$$w_i = \ exp(-\frac{1}{2}\Delta_i) \ / \ (\Sigma^{R}_{r=1} \ exp(-\frac{1}{2}\Delta_i)$$

AIC weight is the proportion of the total amount of predictive power of a model compared to the other models in the full set. The values, which sum to 1, tell the relative importance of a model compared to other models in that set. (w_i) is the sum of all weights in the model with higher values representing the best approximation for that model. The ANOVA table was presented for the best model after running the AIC analysis. Delta-AIC and AIC weights were calculated in Excel (Microsoft Corporation, 2018).

To further understand the factors accounting for significant differences in fresh produce space among neighborhoods, demographic, accessibility, health, and wealth variables at the census tract level were also explored. The census tract data was sourced from USC's Neighborhood Data for Social Change portal (USC Price 2022). The covariates included in the analysis are defined below according to the U.S. Census and American Community Survey definitions (Table 2).

Asian, Black, Latino, White [5]	Percentage of the population in a census tract that identifies as either Asian, Black, Latino, or White
Diabetes	Percentage of adults who reported being diagnosed with diabetes by a medical professional
Obesity	Percentage of adults who report having a body mass index ≥30.0 kg/m² calculated from self-reported weight and height
Cancer	Percentage of adults who report ever being diagnosed with any type of cancer

[5] Native American & Pacific Islander populations were excluded from the analysis as population size per census tract was too small or 0%.

	(besides skin) by a medical professional
Median Household Income	The middle value for household income in an area, measured in dollars
Vehicle Ownership	Percentage of households who do *not* possess a working vehicle, excluding motorcycles or other recreational vehicles
Low Access Low Income	Percentage of low income individuals who do not live within ½ mile of a supermarket

Table 2: The U.S. Census & American Community Survey definitions used in this study.

Analysis of covariance (ANCOVA) models followed the same approach as pricing. Each census tract covariate in an additive model with store type was fitted to describe the amount of fresh produce space available at a store. Store type was designated as a categorical variable using the "i." delineation in STATA, while census tract covariates were designated as continuous using the "c." preface. Census tract data for race, wealth, and health covariates were transformed using the arcsin of the square root command in STATA to correct for skewness and kurtosis in order for the data to meet the normality assumption. Models were ranked by AIC value and AIC weights were used to evaluate the differences among models.

Limitations In Methodology: Data were collected over an 8 month period from June 2022 to February 2023. During this period prices for items sampled within the first three neighborhoods of Highland Park/Eagle Rock, Koreatown, and Silver Lake had to be adjusted for inflation using the Federal Reserve's inflation rate. Additionally, due to the avian flu outbreak in January 2023, the prices of eggs increased exponentially over a

1-month period potentially yielding inaccurate results for price comparisons across the five neighborhoods.

The location of all food stores within each of the 5 neighborhoods were identified, however, not all food stores within each neighborhood were sampled. Sampling had to be conducted during weekends, and some stores operated under reduced weekend hours or were closed for business. Smaller independent and family owned stores had the most store closures on weekends, but even larger chain stores such as Mother's Nutritional Center had limited hours and were closed on Sunday. In Boyle Heights, many smaller grocery and ethnic stores had limited hours on Saturday and were closed on Sunday due to church service or other religious observances. As such, not every store within Highland Park/Eagle Rock, Boyle Heights, and Koreatown were sampled (*see list of stores NOT sampled below.)* [6] For stores in Boyle Heights, a subset out of the 54 identified stores were selected for sampling due to the high number of small ethnic stores within the neighborhood. Out of the 54 food stores, 17 were identified to sell apples, tomatoes, milk, and eggs (with the exception of Urbashi Beer & Wine). The remaining 37 stores were either convenience, specialty, or merchandise stores and were excluded from sampling. Stores were called beforehand to determine availability of produce. If a store did not provide a phone number on Google or Yelp and the store owner/manager did not respond to the first two initial calls, the store was not sampled

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- Koreatown: Mothers Nutritional Center, La Latina Market, Montana Natural Meat, Don Cangrejo Market, Del Solar's Mini Market,
- Highland Park Eagle Rock: La Tropicana, Feli-Mex Market, Mothers Nutritional Center, Superior Grocers, Cookbook Market, 99 Cents Only
- Boyle Heights: Pico Gardens Market, Luna's Exotic Produce, Food4Less (E Olympic)
- Leimert Park: All stores sampled
- Silver Lake: All stores sampled

due to time constraints. Additionally, ethnic, specialty, and grocery stands/vendedoras within El Mercadito De Los Ángeles, a Mexican style indoor market, were not sampled.

RESULTS:

The results from the ANOVA statistical tests done in STATA and Excel revealed many relationships between product cost, neighborhood, store type, and the interaction between them. For each sampled item, the results of the AIC analysis are presented first in the table followed by an ANOVA test and figure showing the effects.

Milk Cost Analysis (Figures 5):

Model	K	Log-likelihood	AIC	Delta-AIC	AIC weight
Neighborhood	5	-107.92	225.84	4.27	0.097
Store type	**3**	**-107.79**	**221.58**	**0.00**	**0.815**
Neighborhood + Store	7	-106.09	226.18	4.60	0.082
Neighborhood x Store	12	-103.65	231.30	9.72	0.006

```
. anova milk_adj store_combined
```

Number of obs =	56	R-squared =	0.1124		
Root MSE =	1.70472	Adj R-squared =	0.0789		

Source	Partial SS	df	MS	F	Prob>F
Model	19.496048	2	9.7480242	3.35	0.0425
store_com~d	19.496048	2	9.7480242	3.35	0.0425
Residual	154.02131	53	2.9060625		
Total	173.51736	55	3.1548611		

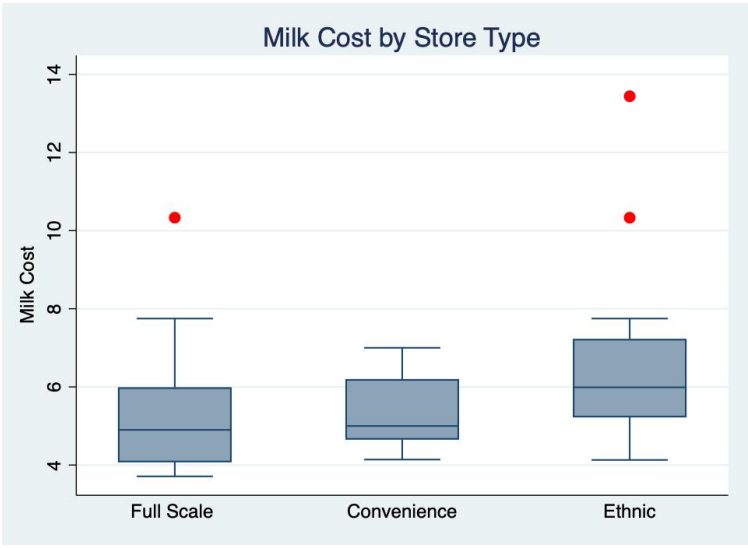

Figure 5. AIC table, regression analysis, box plot for milk cost by store type.

It is evident that store type 3, ethnic stores specifically, had higher prices for milk on average than both grocery and convenience stores (Figure 5). The analyses showed a significant relationship between milk cost and store type. Store type had the lowest AIC value and the model weight was 7 times more than the neighborhood ID effect. Store type alone described the differences in milk price compared to more complex two-way and interaction models. The ANOVA table also shows that these two variables are statistically significantly related ($p = 0.046$) at the 95% significance level.

Apple Cost Analysis (Figures 6):

Model	K	Log-likelihood	AIC	Delta-AIC	AIC weight
Neighborhood	**5**	**-76.72**	**163.44**	**0.00**	**0.759**
Store type	3	-81.75	169.49	6.05	0.037
Neighborhood + Store	7	-76.56	167.11	3.67	0.121
Neighborhood x Store	12	-71.92	167.85	4.41	0.084

```
. anova apples_adj neighborhood_id

                   Number of obs =         54    R-squared     =  0.2113
                   Root MSE      =    1.05168    Adj R-squared =  0.1469

          Source | Partial SS         df         MS        F     Prob>F
-----------------+----------------------------------------------------
           Model |  14.517021          4   3.6292553      3.28  0.0184
                 |
neighborh~d      |  14.517021          4   3.6292553      3.28  0.0184
                 |
        Residual |  54.195609         49   1.1060328
-----------------+----------------------------------------------------
           Total |  68.71263          53   1.2964647
```

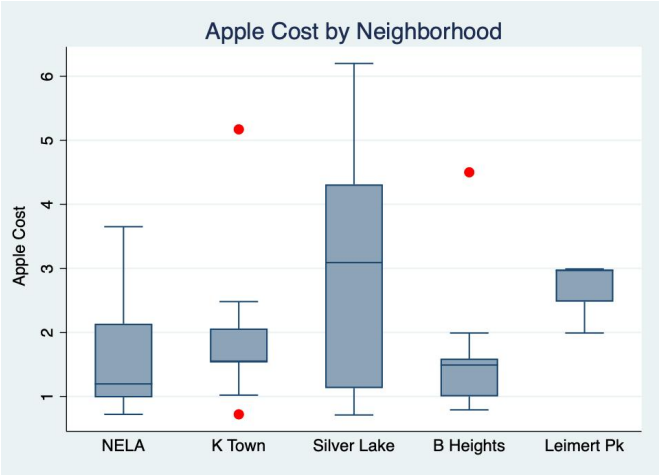

Figure 6. AIC table, regression analysis, box plot for apple cost by neighborhood.

The cost of apples was significantly related to the neighborhood where the store was located (i.e. neighborhood ID). The AIC table shows that neighborhood ID had the lowest AIC value with the highest AIC weight of 0.728 indicating the best fit model, approximately 6 times the AIC weight as the next best model. The ANOVA showed that these two variables were statistically significantly related at the 95% significance level with a p-value of 0.018. Displaying the relationship graphically revealed that Silver Lake and Koreatown have the highest cost for apples overall (Figure 6).

Tomato Cost Analysis (Figures 7):

Model	K	Log-likelihood	AIC	Delta-AIC	AIC weight
Neighborhood	5	-64.17	138.33	8.12	0.015
Store type	3	-64.57	135.14	4.93	0.075
Neighborhood + Store	7	-61.78	137.56	7.36	0.022
Neighborhood x Store	**11**	**-54.10**	**130.21**	**0.00**	**0.887**

```
. anova tomato_adj neighborhood_id##store_combined

                          Number of obs =         51    R-squared     =  0.3889
                          Root MSE      =    .789306    Adj R-squared =  0.2362

                   Source | Partial SS         df          MS        F     Prob>F
--------------------------+----------------------------------------------------
                    Model |  15.860805         10   1.5860805     2.55   0.0176
                          |
             neighborh~d |   4.964091          4   1.2410227     1.99   0.1143
             store_com~d |   4.6765401         2     2.33827     3.75   0.0321
neighborh~d#store_com~d |   8.7553749         4   2.1888437     3.51   0.0150
                          |
                 Residual |  24.920163         40   .62300407
--------------------------+----------------------------------------------------
                    Total |  40.780968         50   .81561937
```

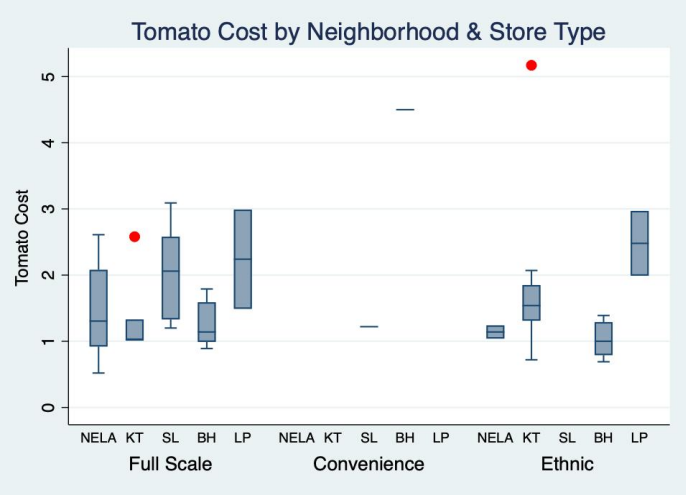

Figure 7. AIC table, regression analysis, box plot for tomato cost by neighborhood and store type.

Tomatoes followed a different pattern than that for apples. The tomato analysis was statistically significant for the interaction model with the interaction term being the most significant having the strongest p-value of 0.0098. The price was affected by both neighborhood, store type, and the interaction. Within Koreatown specifically, there were few stores which carried tomatoes. The interaction term revealed that store type had a bigger effect on some neighborhoods than others. The cost of tomatoes was highly variable between neighborhoods and across store types, leading to strong interaction observed.

Fresh Produce Space Analysis (Figures 8):

Model	K	Log-likelihood	AIC	Delta-AIC	AIC weight
Neighborhood	5	-409.48	828.96	11.23	0.003
Store type	3	-409.69	825.38	7.64	0.019
Neighborhood + Store	7	-402.84	819.67	1.93	0.337
Neighborhood x Store	**12**	**-396.87**	**817.74**	**0.00**	**0.887**

```
. anova fresh_produe_space neighborhood_id##store_combined

                   Number of obs =         58    R-squared     =  0.5026
                   Root MSE      =    254.557    Adj R-squared =  0.3837

                          Source | Partial SS         df         MS        F     Prob>F
-------------------------------+----------------------------------------------------
                           Model |  3012118.9         11   273828.99     4.23     0.0002
                                 |
                     neighborh~d |  1029063.5          4   257265.87     3.97     0.0075
                     store_com~d |  527121.87          2   263560.93     4.07     0.0236
neighborh~d#store_com~d |  680888.97          5   136177.79     2.10     0.0822
                                 |
                        Residual |  2980770.1         46    64799.35
-------------------------------+----------------------------------------------------
                           Total |  5992889           57    105138.4
```

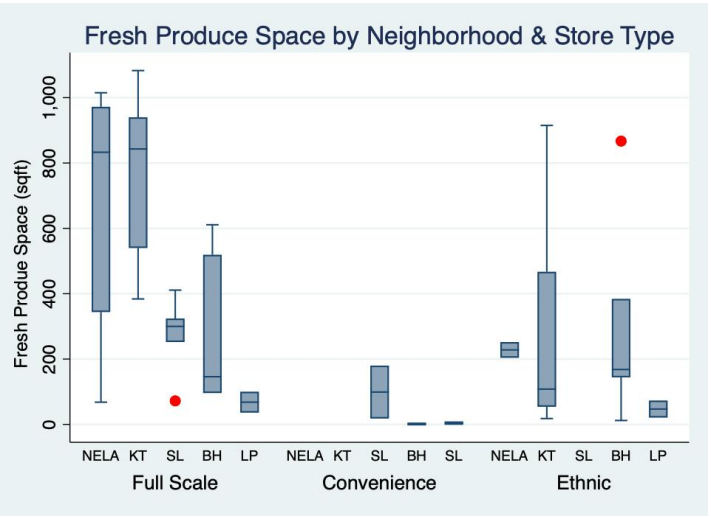

Figure 8. AIC table, regression analysis, box plot for fresh produce space by neighborhood and store type.

Fresh produce space was also highly statistically significant for the interaction model between neighborhood ID and store type at the 95% confidence level. While the interaction term was marginally significant (p-value of 0.082), the AIC model selection strongly supported the full model with the interaction. The graph shows large differences in the amount of produce space across both neighborhood and store type. Produce space was greatest in grocery stores (store type 1) and for NELA and Koreatown.

Demographic, Health, Wealth, and Access Analysis of Produce Space: To understand the significant relationships between produce space and neighborhood from the previous analysis, the data were analyzed at the census tract level. Census tracts are smaller than neighborhoods and differ in their racial composition, income, access, and health of residents, which is a more specific approach to measuring variables within a neighborhood. An analysis of covariance was used to analyze the statistical significance of demographic, health, wealth, and access variables as predictors of fresh produce space in conjunction with store type, as identified in the previous analysis.

The results from the AIC model selection table suggest that census tracts that have a higher proportion of individuals in low income neighborhoods and with low access to grocery stores had lower square footage of fresh produce space. Compared to models with demographic and health covariates, the low access low income variable had the lowest AIC value and carried a dramatically higher weight. The weight for this model was approximately 8 times greater than the second best model which included the proportion of Asian residents in the census tract.

Covariate type	Model	K	Log-likelihood	AIC	Delta-AIC	AIC weight
Store	Store type	3	-409.69	825.38	9.65	0.007
Race	Store type + Asian	4	-405.90	819.81	4.08	0.108
	Store type + Black	4	-409.48	826.95	11.23	0.003
	Store type + Latino	4	-409.15	826.30	10.58	0.004
	Store type + White	4	-409.69	827.38	11.65	0.002
Health	Store type + Diabetes	4	-409.46	826.91	11.19	0.003
	Store type + Obesity	4	-407.24	822.47	6.74	0.029
	Store type + Cancer	4	-409.01	826.15	10.42	0.005
Wealth/Access	Store type + Median income	4	-409.38	826.76	11.04	0.003
	Store type + No vehicles	4	-409.47	826.93	11.21	0.003
	Store type + Low access & income	**4**	**-403.86**	**815.73**	**0.00**	**0.833**
Null	Constant	1	-417.12	836.24	20.52	0.000

```
anova Fresh_Produe_Space i.Store_Combined c. LowAccessASC

                  Number of obs =         58    R-squared     =  0.3670
                  Root MSE      =    265.057    Adj R-squared =  0.3318

------------------------------------------------------------------------------
      Source | Partial SS         df         MS        F     Prob>F
-------------+----------------------------------------------------------------
       Model |  2199105.8          3   733035.25     10.43  0.0000
             |
Store_Com~d |  1172984.4          2   586492.22      8.35  0.0007
LowAccess~C |  844354.51          1   844354.51     12.02  0.0010
             |
    Residual |  3793783.2         54   70255.245
-------------+----------------------------------------------------------------
       Total |    5992889         57    105138.4
------------------------------------------------------------------------------
```

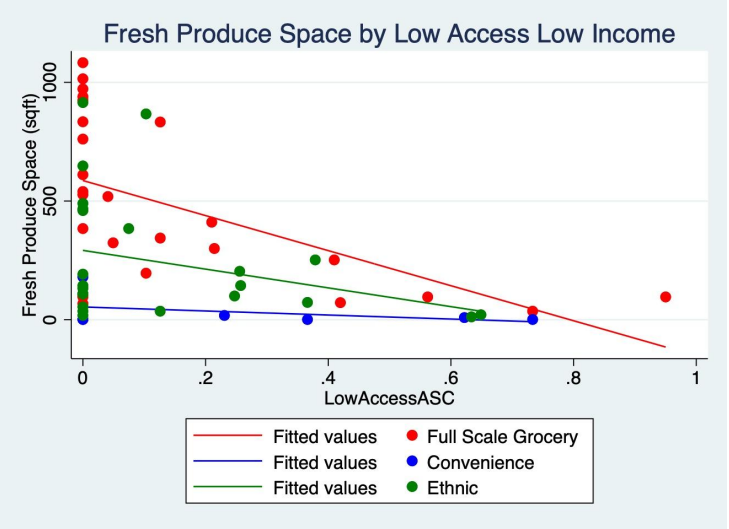

Figure 9. AIC table for all covariates, regression analysis and box plot for fresh produce space by low access low income

The analysis of covariance table suggests that the slopes for store types were strongly correlated with the low access low income variable and differed significantly among store types. Residents that live in neighborhoods with lower access and have lower wealth also have less fresh produce space available from which to choose healthy foods. The two other covariates which improved on store type alone were the proportion of the population which was Asian in a census tract, and the percentage of obese people of the total population. The correlation between Asian population and fresh produce space was positive indicating that an increase in Asian population is associated with greater fresh produce space in stores. The relationship with obesity showed that neighborhoods with a greater proportion of people who are obese had a smaller shelf area for fresh produce in all three store types. No other health indices emerged as key explanatory variables in the analyses. The lack of vehicle ownership also did not account for much of the variation in this analysis.

Summary of Results:

Several interesting trends emerged from this analysis. First, there was a significant relationship between milk cost and store type with higher milk prices at ethnic stores than at full scale or convenient stores. In contrast, the cost of apples was significantly related to neighborhood ID with Silver Lake and Koreatown having the highest cost for apples among the neighbors sampled. Both the tomatoes and fresh produce space were significant for the interaction model between neighborhood ID and store type at the 95% significance level. This indicates that the price of tomatoes differed among the store types, and that the difference varied by neighborhood. A similar pattern was found for produce space where grocery stores had the greatest space, and North East L.A. and Koreatown had more produce space on average than the other neighborhoods. The results from the AIC model selection table with the health, wealth, access, and demographic variables suggests that census tracts that have a higher proportion of individuals in low income neighborhoods and with low access to grocery stores have lower square footage of fresh produce space. Low income people have less access to stores with fresh produce, less shelf space devoted to fresh foods, and higher costs for some fresh foods. Lastly, neighborhoods with more obesity had less shelf space devoted to fresh produce potentially suggesting an important health outcome from the lack of access to fresh food in their local environment.

DISCUSSION:

This study aimed to explore measures of accessibility to food stores across neighborhoods of different socioeconomic status and race in Los Angeles City. Measures of accessibility included price, vehicle ownership, and availability of produce. The analysis yielded many relationships between pricing of common types of food, store type location, and demographic variables. The statistical analyses revealed that pricing for apples and milk were most notably higher at ethnic stores compared to any other store type, particularly full scale grocery stores. Cost of tomatoes was highly variable between store type and neighborhood, however, Leimert Park had the highest cost for tomatoes overall. Fresh produce space yielded a strong relationship with both store type and neighborhood ID. This signified a strong difference in the amount of space between these two variables. Overall, fresh produce space was greatest in full scale grocery stores and in both Highland Park / Eagle Rock (North East L.A.) and Koreatown.

There were a few notable limitations which impacted the results of this study. For sampling specifically, not all stores were sampled in each neighborhood due to sampling being conducted on weekends only. As mentioned previously, many stores, and ethnic stores in particular, were operating on reduced hours or were not open for business on weekends. This primarily affected stores sampled during winter 2022-23 and meant that some neighborhoods had fewer stores included in the data analysis. Additionally, sampling was conducted over an eight month period meaning prices of items increased due to inflation. While the rising price of goods was corrected for using the 2022 - 2023 CPI index, the unexpected exponential increase in the price of eggs

due to the avian flu outbreak could not be corrected for and was left out of the analysis altogether.

This study showed that distribution of full scale grocery and food stores are not evenly distributed across demographics and neighborhoods, a similar result to that of Algert et al. (2006). Hilmers and Dave (2019) noted that neighborhoods with a large African American population tended to have the fewest healthy food options. This was true specifically for Leimert Park, the neighborhood with the highest number of black containing the least amount of stores, and full scale grocery stores out of all six sampled neighborhoods. Additionally, prices between store types varied greatly, with higher prices at ethnic stores and lower prices at full scale grocery stores yielding the same result found by Silva (2020) in a similar study. Future research should focus on ways to reduce the cost of food items in predominantly black and brown lower-income neighborhoods that have less access to full scale grocery stores.

The results from this study were inline with what previous literature and studies have shown: lower income communities are burdened with lower access to fresh produce and faced with overall less shelf space at stores devoted to fresh produce. Another significant finding which went hand in hand with a similar study done on pricing in the mid 1990s (Chevalier 1995) showed that low access low income communities are confronted with higher prices for produce and dairy items at certain stores. Additionally, this study showed a strong correlation between less access to fresh produce and obesity, suggesting an important health outcome for those who are living in low access communities. Finally, this study highlighted the importance of ethnic stores within low

income low access communities as these stores often served as the primary source of food, specifically to those without access to a vehicle.

POLICY RECOMMENDATIONS:

The results from this study suggest 3 main areas for policy change and reform: 1; fresh food accessibility, 2; food pricing by store type, and 3; accessibility to full scale grocery stores. This section will discuss the policy proposals and rationales stemming from this study.

The evidence from the statistical analysis suggests that food costs at ethnic stores were higher than prices at full service grocery stores. Additionally, the ethnic stores identified in this study were primarily located within neighborhoods of lower income and may cater to a demographic which may traditionally be lower income. While almost every store sampled accepted food stamps, higher prices only add an additional burden to those suffering from poverty, and food stamps were unlikely to make up the difference in costs, especially with the rapidly increasing costs occurring in 2023. Subsidizing large grocery stores to move into neighborhoods that lack full scale grocery stores may help lower food costs within low income neighborhoods. In general, large grocery stores have lower prices and wider food availability than smaller store types. Because grocery stores had more produce space available, incentivizing grocery stores to establish in lower income neighborhoods could significantly increase availability. The analysis showed that Asian neighborhoods had more fresh produce space available, thus the initial focus of policy interventions should concentrate on Black and Latino neighborhoods. One potential problem with subsidizing larger grocery stores is that this

could force smaller family owned ethnic stores to go out of business. One solution could be to provide similar incentives to smaller stores, perhaps via a one-time grant program to provide more healthy and affordable food options.

Nutrition counseling in food deserts and low income neighborhoods could help to reduce obesity and possibly even cancer rates within these communities. Results suggest that targeting neighborhoods with less shelf space for nutrition counseling and health care related to obesity are necessary. Encouraging farmers markets and urban gardens could also help alleviate the issue. While this analysis did not specifically address fresh produce distribution through non-traditional storefronts, the health outcomes suggest that benefits could be gained by increasing availability of fresh produce through these non-traditional sources. Incentive programs for farmers markets or community gardens could include small grants or facilitating partnerships with nonprofits working in this area.

CONCLUSION:

This study revealed important discrepancies in access to fresh food stores across neighborhoods of different socioeconomic status and demographics. As noted by literature reviewed above, access to fresh and nutritious foods is vastly unequal in the U.S., with Hispanic, Black, and low income people facing disproportionately larger burdens compared to their White and wealthier counterparts. The same is true in Los Angeles City. In addition to the unequal access to food stores containing fresh produce, prices of items found within ethnic stores common in low income communities tended to be higher than those at full scale grocery stores and even convenience stores. As such,

policy recommendations are rooted in encouraging larger full scale grocery stores to establish locations within low income communities through subsidies which would aid in increasing access to more affordable fresh food options, and a wider variety of healthier foods. This could ultimately help reduce detrimental health effects in these communities such as obesity, diabetes, and cancer that occur as a result of consuming high amounts of processed foods. These data should be useful for policy recommendations to help alleviate food insecurity city- and countywide, and hopefully serve as a model for cities at a national level. Future work should include social science research on food choices across demographic and socioeconomic groups, education, and public health programs to encourage healthy diet choices.

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Appendix 1: Maps showing the Distribution of Variables Used in this Study

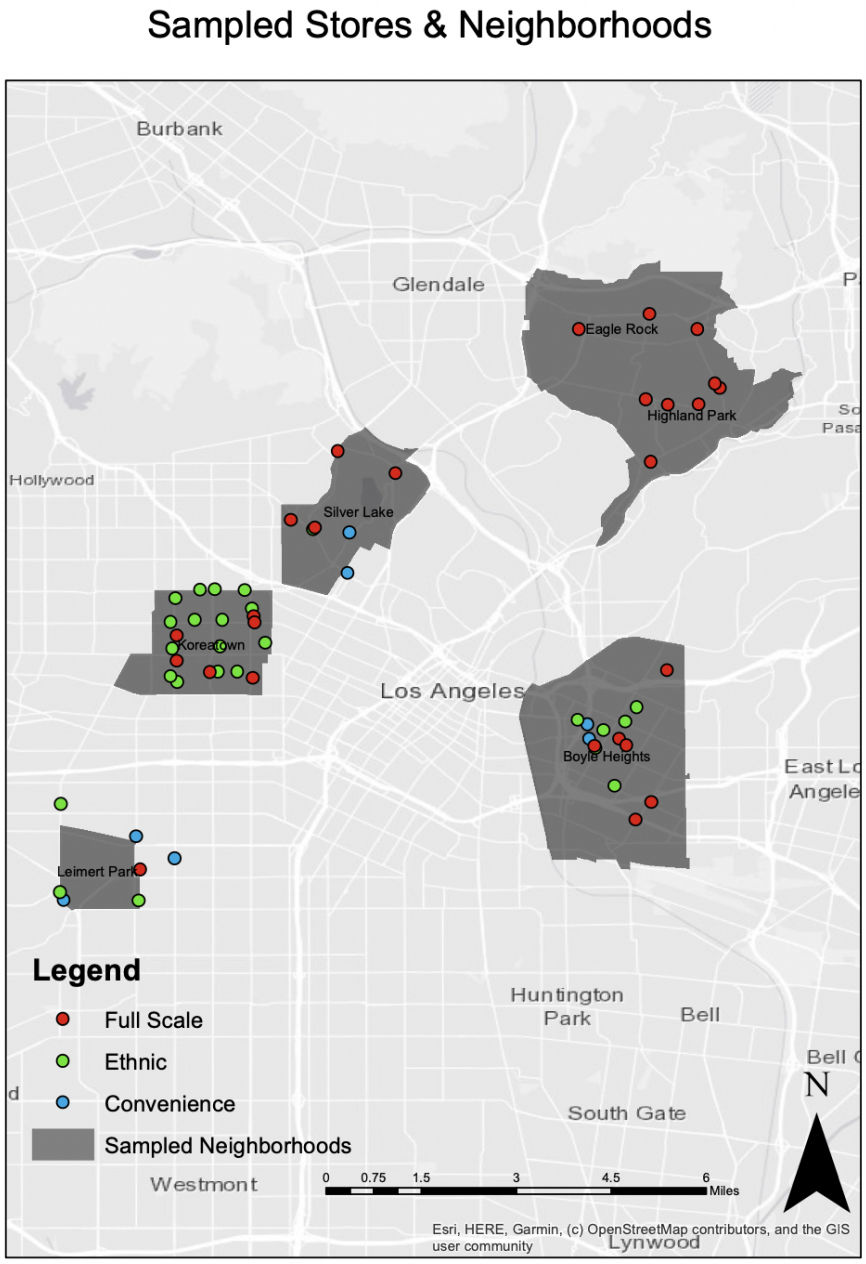

Figure A1: Sampled stores within sampled neighborhoods. [7]

[7] Exact definitions of Leimert Park varied, neighborhood shapefile used above excluded tracts along Western Avenue while other definitions included Western Avenue as a part of the neighborhood which is why some stores are outside of the boundary on the Eastern end.

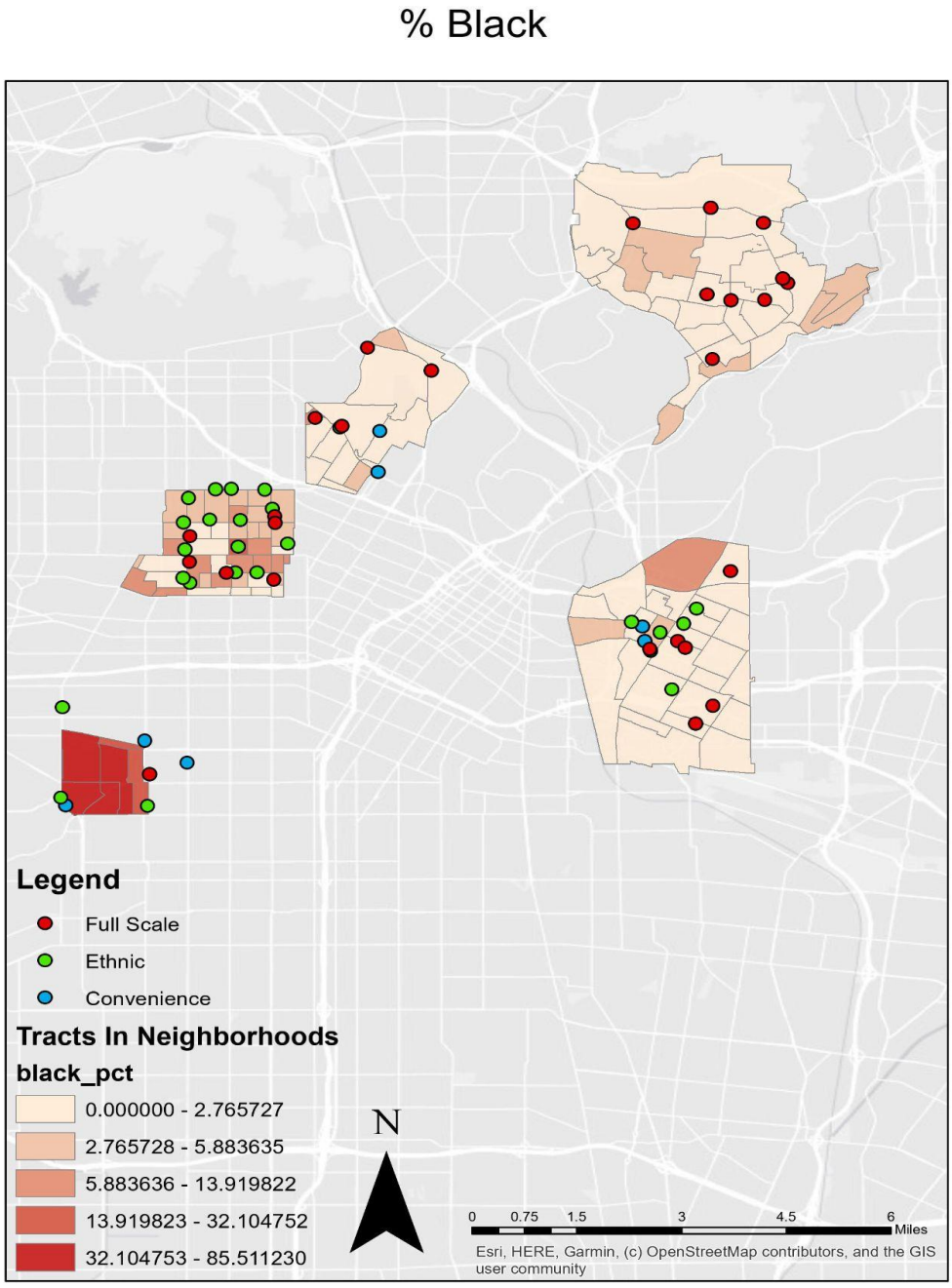

Figure A2: Percentage of people identified as Black by census tract by Neighborhood overlaid with sampled stores.

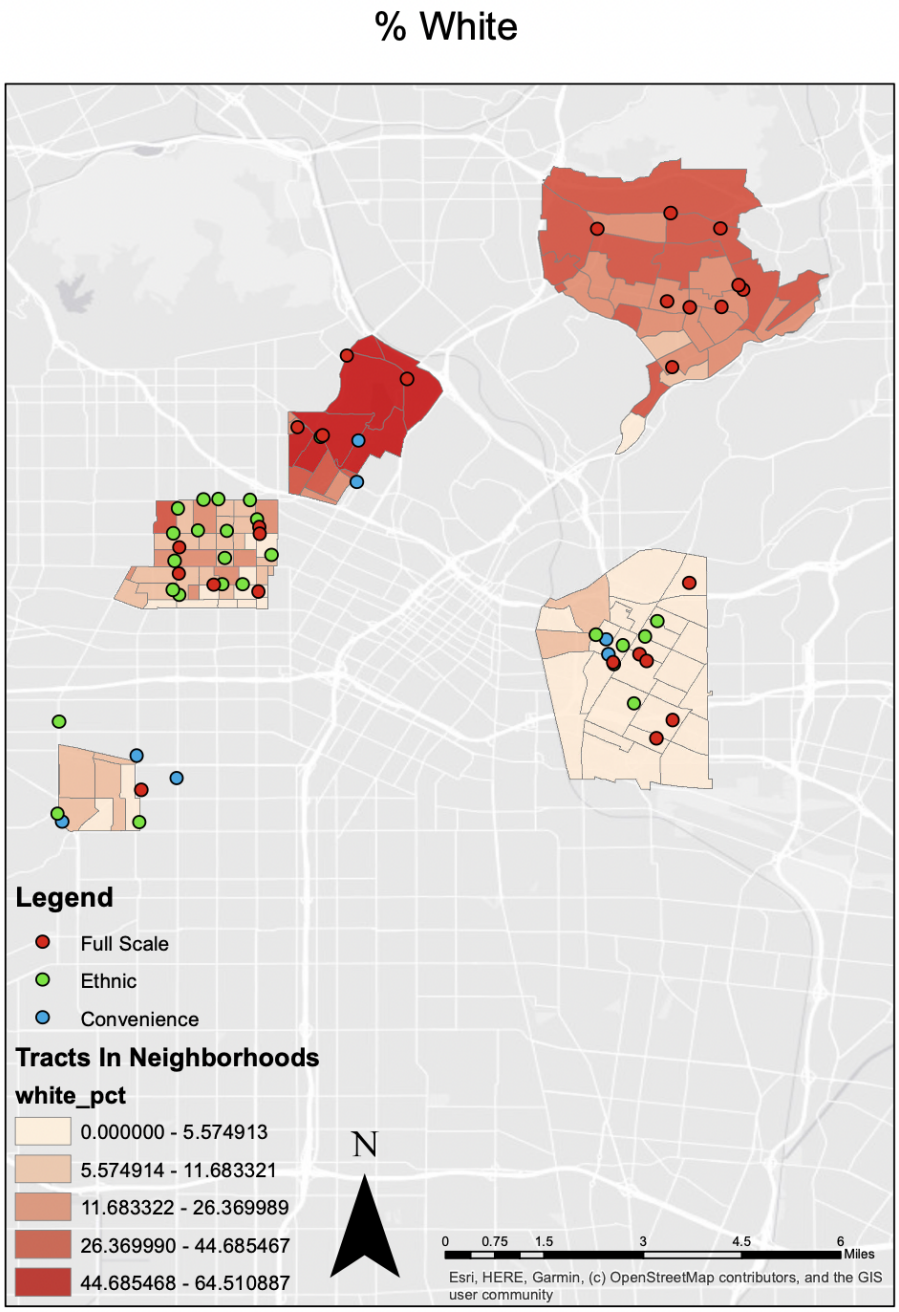

Figure A3: Percentage of people identified as White by Neighborhood overlaid with sampled stores.

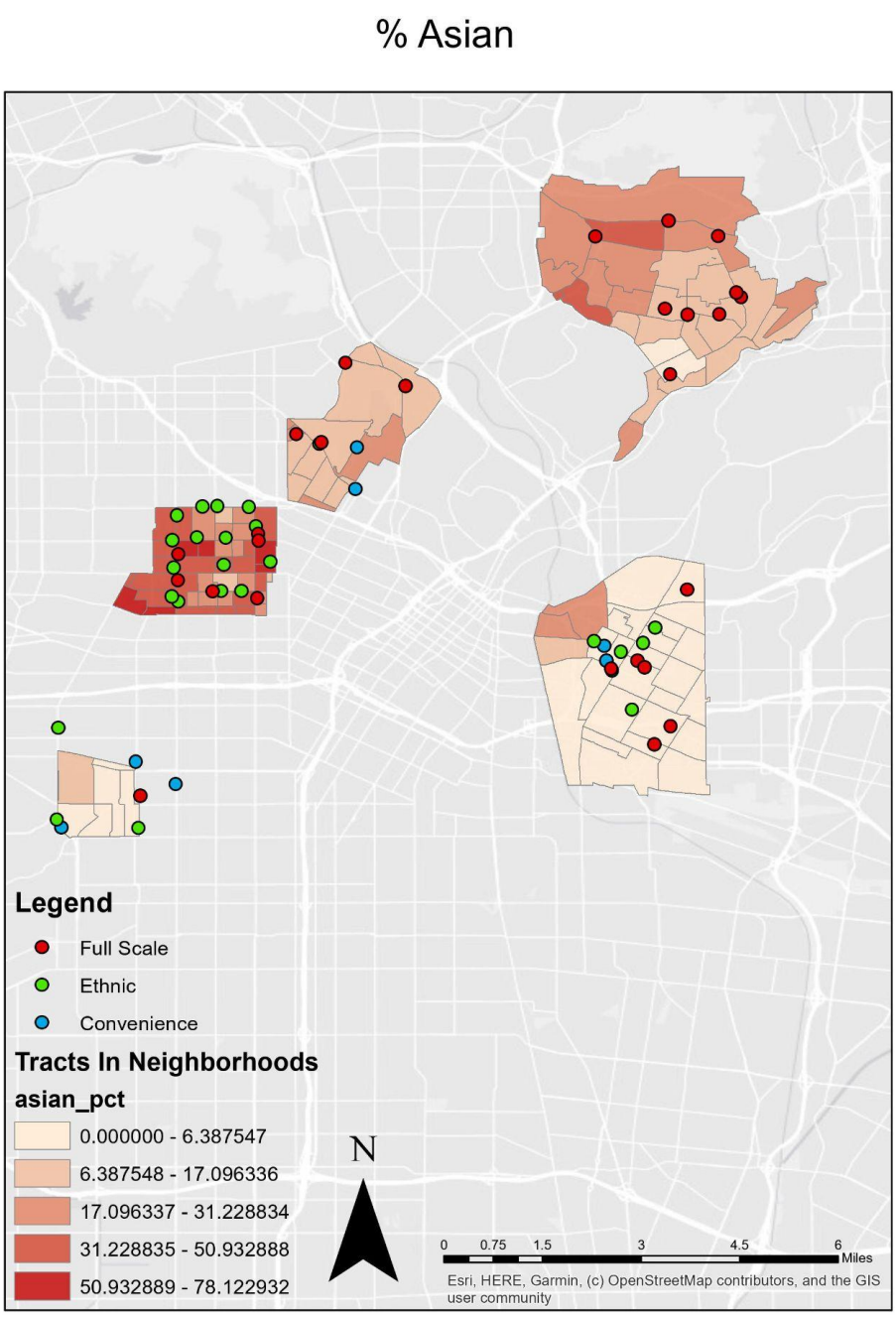

Figure A4: Percentage of people identified as Asian by Neighborhood overlaid with sampled stores.

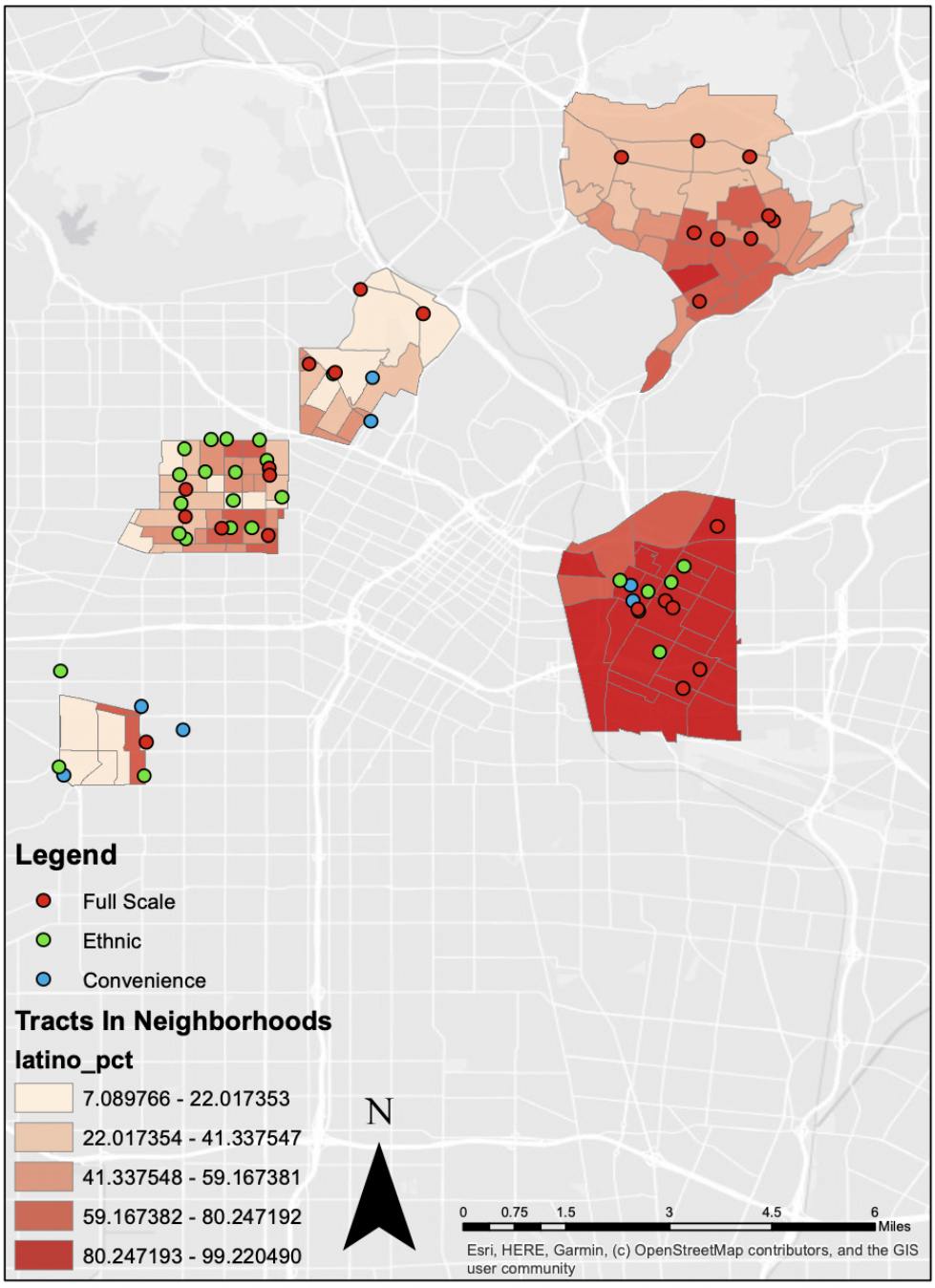

Figure A5: Percentage of people identified as Latino by Neighborhood overlaid with sampled stores.

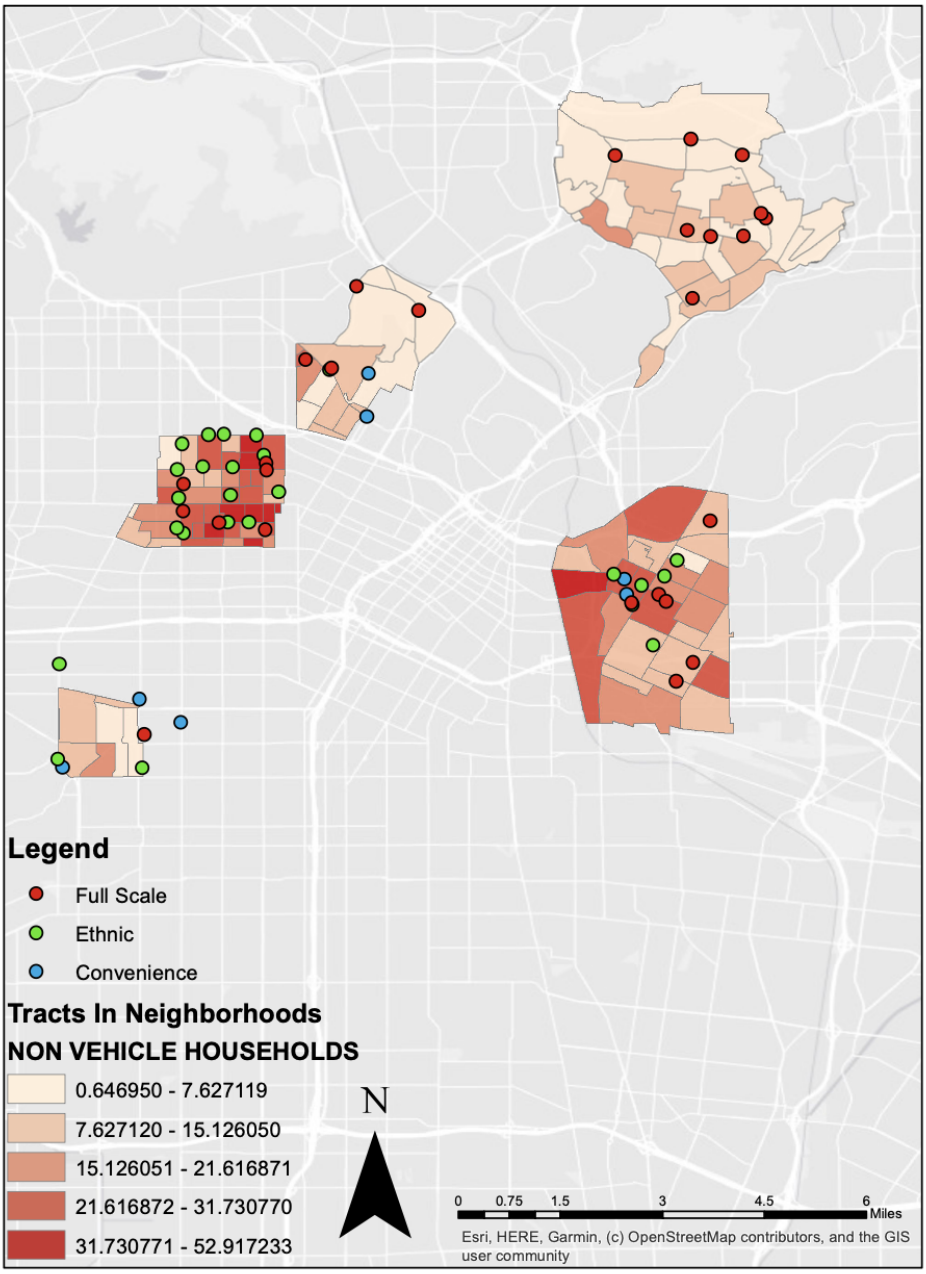

Figure A6: Households without vehicles overlaid with sampled neighborhoods and stores.

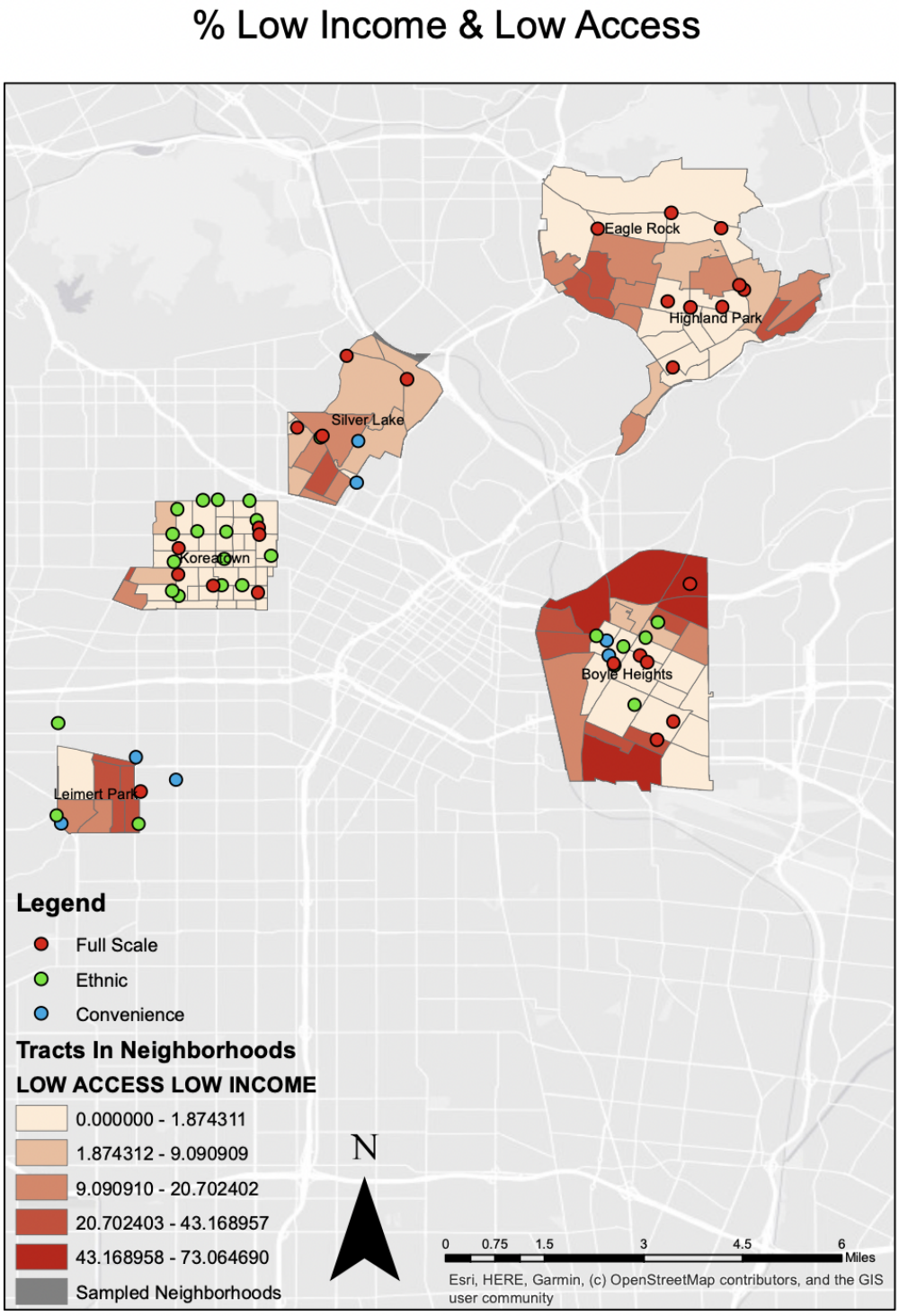

Figure A7: Percentage of people who are low income and have low access to food stores.

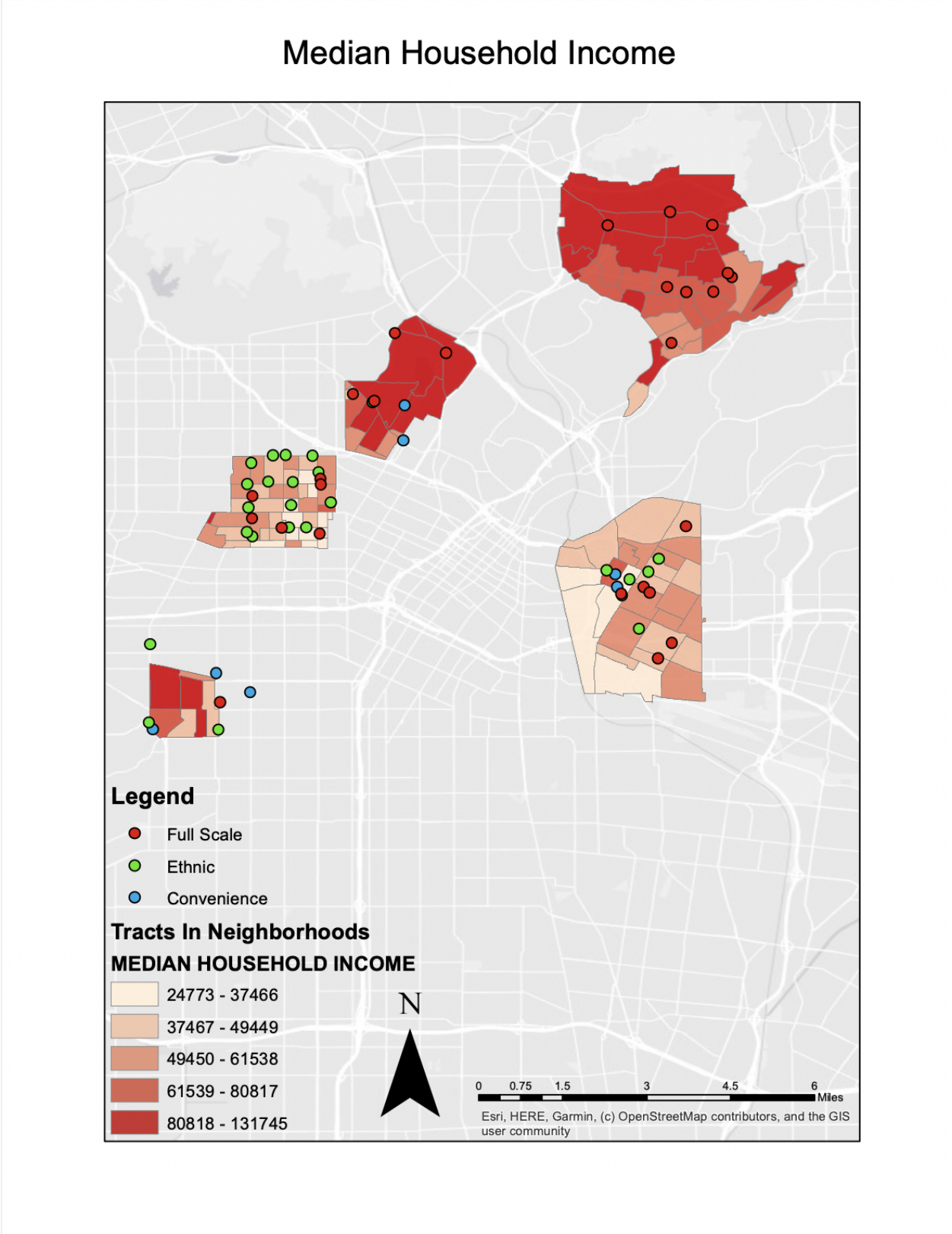

Figure A8: Median household income across sampled neighborhoods.

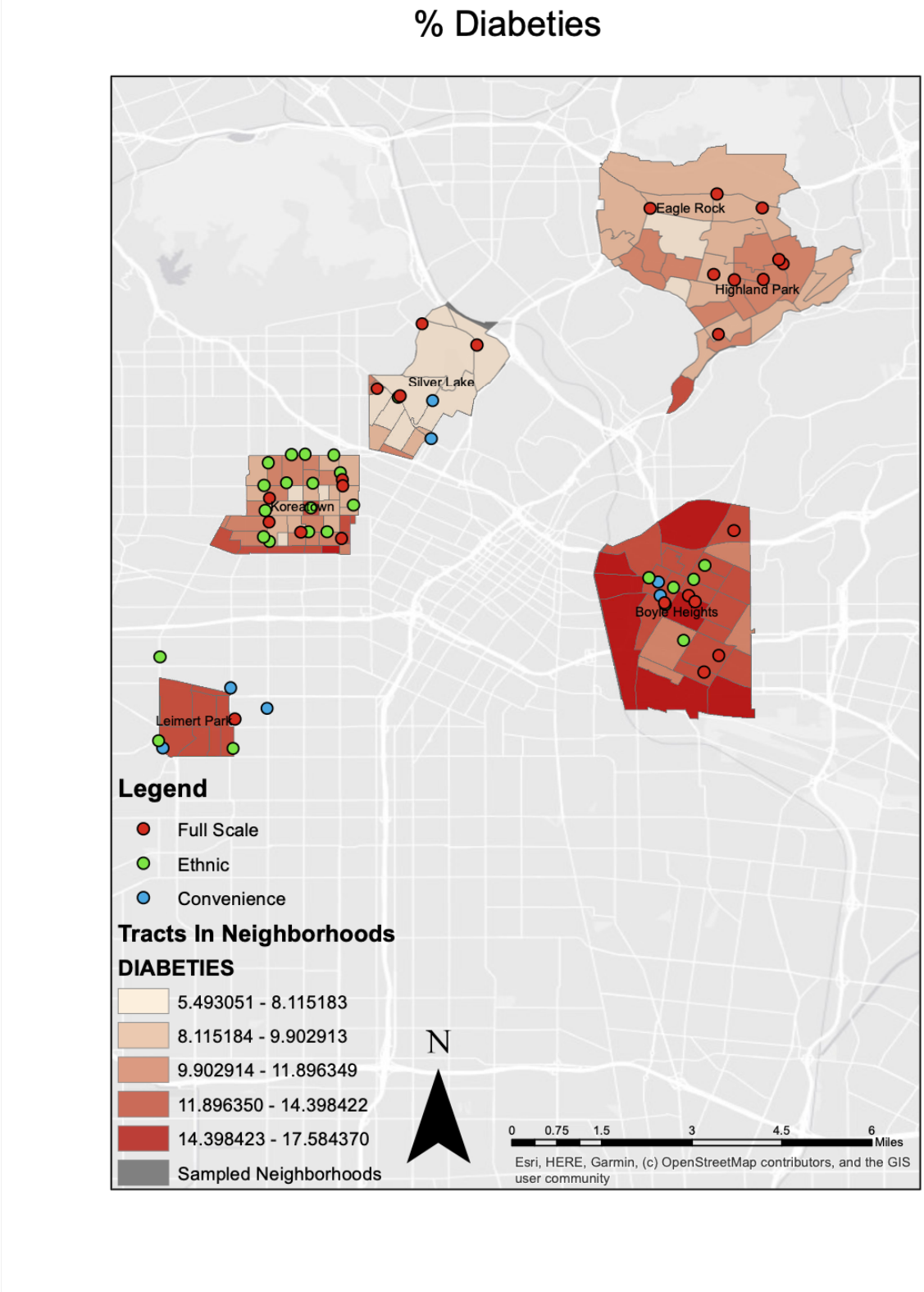

Figure A9: Percentage of people who reported to have diabetes.

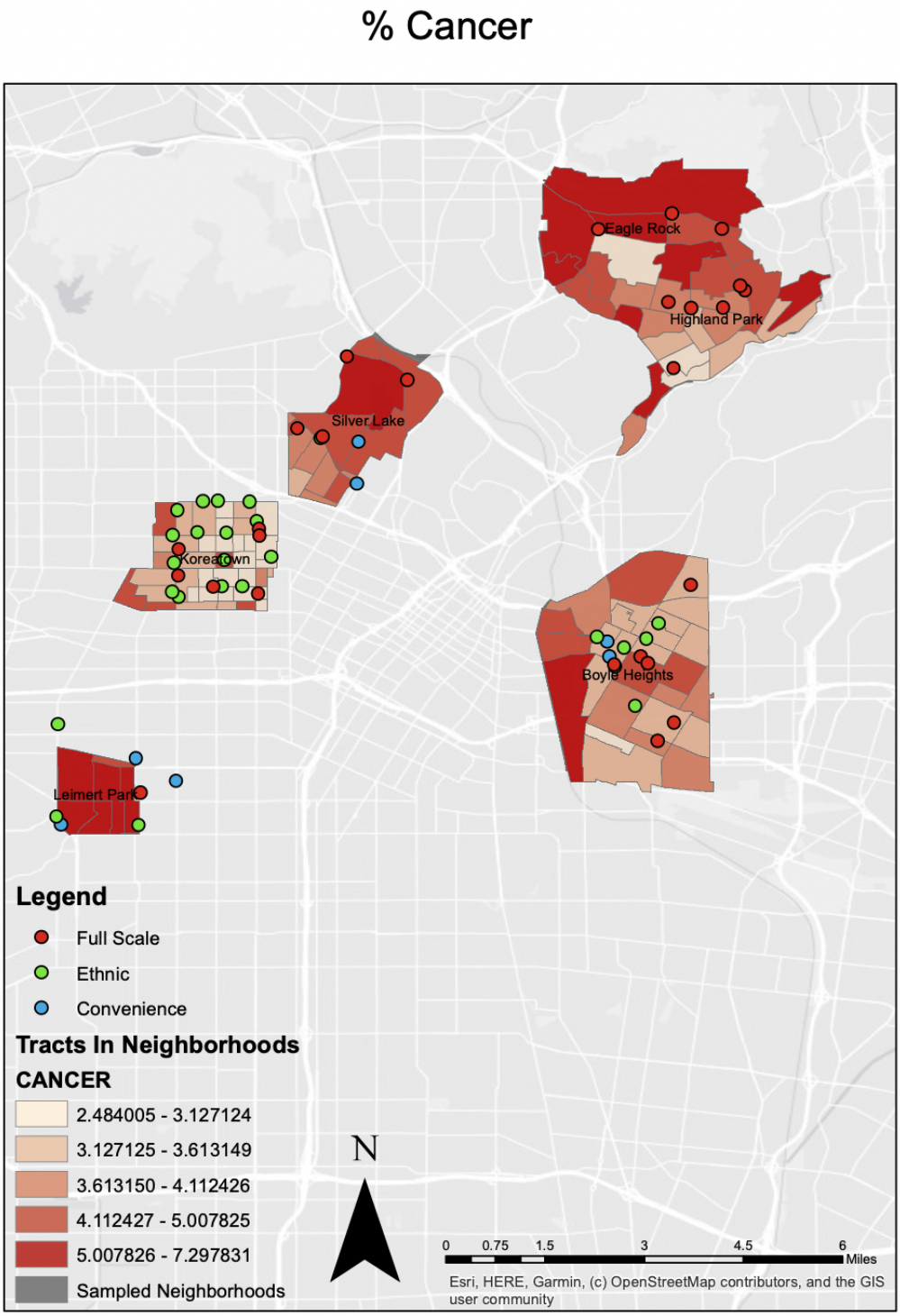

Figure A10: Percentage of people who had cancer (other than skin cancer) by census tract.

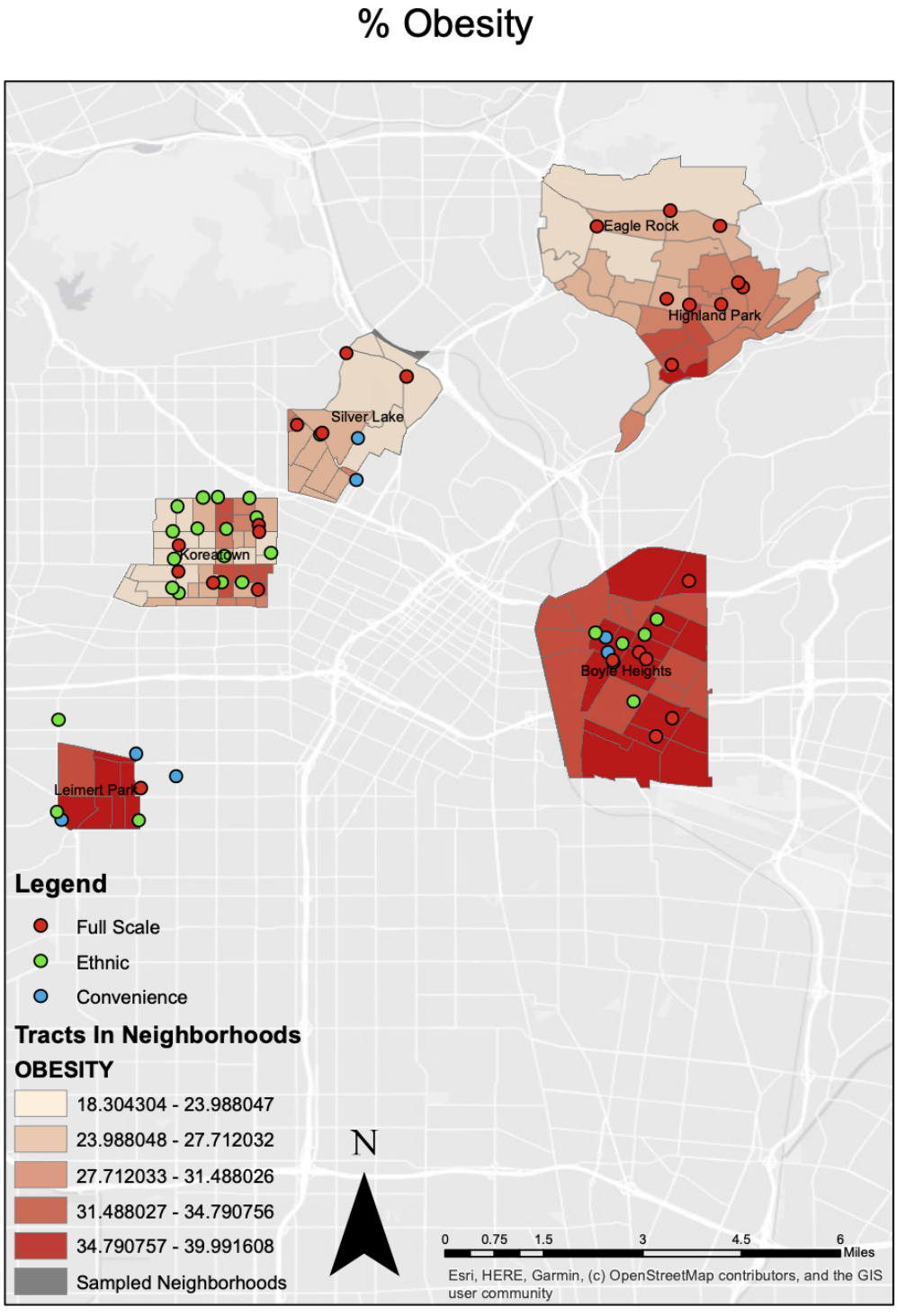

Figure A11: Percentage of people who were reported obese by census tract.

Appendix 2: Data Not included in Analysis

DBA Name	Store Type	Date	Address	Coordinates		Doors	Cash Registers	Self Checkout	Registers	Food Stamps	Fresh Produe Space	Bus Stop	Shelter or Bench	Bike Rack	White Bread $	Quant	Dozen Eggs	Quant	Tomatoes 1lb	Quant	Milk 1Gal	Quant	Apples 1lb	Quant
Super A	1	61922	5250 York Blvd, Highland Park, CA 90042	34.11997,	-118.2013	2	6	0	0	1	527	1	1	0	4.49	8	3.69	7	1.99	3	5.29	3	1.59	6
El Super	1	61922	5610 York Blvd, Los Angeles, CA 90042	34.11860,	-118.19620	2	9	0	0	1	834	1	1	0	4.19	8	4.49	4	0.5	1	3.98	3	0.89	6
The York Stop Market	1	61922	5941 York Blvd, Los Angeles, CA 90042	34.11875,	-118.18925	1	1	0	0	1	68	1	1	0	NA	NA	5	3	NA	NA	5	2	NA	NA
Calimax Family Market	3	61922	6604 N Figueroa St, Los Angeles, CA 90042	34.12351,	-118.18443	1	1	0	0	1	204	0	1	0	NA	NA	4.69	2	1.19	3	4.99	2	0.99	5
Uno Liquor Produce Market	2	62022	6655 N Figueroa St, Los Angeles, CA 90042	34.12355,	-118.18552	1	3	0	0	1	252	1	1	0	NA	NA	4.99	1	0.99	1	4.99	2	0.99	5
Food 4 Less	1	62022	5100 N Figueroa St, Los Angeles, CA 90042	34.10553,	-118.20012	2	12	0	0	1	1015	0	0	0	4	17	3.19	1	0.99	3	3.89	1	1.29	8
Vons	1	62122	7311 N Figueroa St, Los Angeles, CA 90041	34.13599,	-118.18954	2	6	1	4	1	838	1	1	0	5.99	16	4.79	5	2.49	6	4.99	5	2.49	4
Sprouts	1	62222	2245 Yosemite Dr, Los Angeles, CA 90041	34.13592,	-118.21657	2	5	1	4	1	972	1	1	1	3.29	10	2.99	6	0.88	7	4.29	5	2.49	7
Trader Joes	1	62222	1566 Colorado Blvd, Eagle Rock, CA 90041	34.13940,	-118.20049	1	8	0	0	1	344	1	1	1	2.99	3	3.99	2	1.5	2	3.59	1	0.69	5
H Mart (Madang Plaza)	3	71722	621 S Western Ave, Los Angeles, CA 90005	34.06293,	-118.30947	2	5	0	0	1	467	1	1	0	NA	NA	5.99	5	1.99	4	12.99	1	1.69	7
California Marketplace	1	71722	450 S Western Ave, Los Angeles, CA 90020	34.06589,	-118.30843	1	8	0	0	1	940	1	1	1	4.79	3	5.99	4	0.99	7	7.49	2	1.49	7
Ralphs	1	71722	670 S Western Ave, Los Angeles, CA 90005	34.06012,	-118.30851	2	14	1	6	1	761	1	1	1	3.49	9	3.49	7	0.99	3	3.99	5	1.49	7
H Mart (Ktown Plaza)	3	71722	928 S Western Ave, Los Angeles, CA 90006	34.05537,	-118.3084	2	6	0	0	1	490	1	1	1	NA	NA	5.29	6	1.49	3	7.49	2	1.99	4
H K Market	3	71722	124 N Western Ave, Los Angeles, CA 90004	34.07443,	-118.30875	2	6	0	0	1	915	1	1	0	NA	NA	4.99	5	1.49	3	6.49	2	1.99	7
Jons	1	72022	2224 W 8TH STREET, Los Angeles, CA 90005	34.0576,	-118.3000	1	5	0	0	1	384	1	1	0	2.99	7	4.29	4	1.29	2	3.59	2	1.49	5
El Changarro Oaxaqueno	3	72022	3113 W 8TH STREET, Los Angeles, CA 90005	34.0577,	-118.2946	1	1	0	0	1	132	1	1	1	NA	NA	4.99	2	2	1	6.99	2	2	3
Mi Oaxaca Market	3	72122	3824 BEVERLY BLVD, Los Angeles, CA 90004	34.0764,	-118.2929	1	1	0	0	1	54	1	1	0	NA	NA	4.99	1	0.99	2	5.89	2	1.79	3
El Latino Market	2	72122	4157 BEVERLY BLVD, Los Angeles, CA 90004	34.0765,	-118.2998	1	1	0	0	1	36	1	1	0	NA	NA	NA	NA	0.99	2	5.55	2	1.29	3
Mercado Benito Juarez	3	72122	3260 W 8TH STREET, Los Angeles, CA 90005	34.0577,	-118.299	2	1	0	0	1	108	1	1	0	NA	NA	5.59	2	1.27	2	5.59	2	1.49	3
Mercado El Oaxaqueno	3	72122	263 S Alexandria Ave, Los Angeles, CA 90004	34.0695,	-118.298	1	1	0	0	1	108	1	0	0	NA	NA	4.99	2	1.79	1	3.99	2	1.49	1
El Portillo Market	3	72122	4151 W 3rd St D, Los Angeles, CA 90020	34.069525152538404,	-118.3043362	1	2	0	0	1	108	1	0	0	3.49	1	8.99	2	1.39	2	6.99	2	1.69	2
Selecta Supermarket	3	72122	4368 W 3rd St, Los Angeles, CA 90020	34.06901525350129,	-118.3098380	1	1	0	0	1	100	1	1	0	NA	NA	4.49	1	1.49	2	5.99	2	0.99	1
Zunigas Market	3	72322	3033 W 6th St, Los Angeles, CA 90020	34.064212526261024,	-118.2882146	1	1	0	0	1	18	1	1	0	NA	NA	4.89	2	NA	NA	4	1	2.4	1
Zion Market	1	72322	888 S Vermont Ave, Los Angeles, CA 90005	34.05639411293984,	-118.2910708	1	10	0	0	1	1088	1	1	1	NA	NA	4.99	5	0.99	3	3.99	2	1.49	7
Farm Fresh	2	72322	849 S Western Ave, Los Angeles, CA 90005	34.056595388257655,	-118.309852	1	1	0	0	0	36	1	1	0	NA	NA	10	2	5	2	NA	NA	5	1
H Mart (City Center)	3	72322	3500 W 6th St Suite #100, Los Angeles, CA 90020	34.06350431579408,	-118.2985097	1	5	0	0	0	648	0	1	0	2.49	1	4.99	5	1.29	3	7.49	3	1.99	9
Vons	1	72322	3461 W 3rd St, Los Angeles, CA 90020	34.07038155229162,	-118.2908743	2	8	1	4	1	540	1	1	1	3.99	12	2.99	9	2.49	5	4.99	5	1.99	6
Ralphs	1	72322	3410 W 3rd St, Los Angeles, CA 90020	34.068925164587895,	-118.2907199	2	8	1	6	1	925	1	1	1	4.99	13	3.49	5	0.99	4	4.29	3	1.49	8
Seafood City Supermarket	3	72322	134-140 S Vermont Ave, Los Angeles, CA 90004	34.0720236090614,	-118.291313	1	5	0	0	1	460	1	1	0	4.29	1	7.59	2	1.69	2	5.99	2	1.19	2
Los Primos Mini Market	3	72322	4322 Beverly Blvd, Los Angeles, CA 90004	34.07699587868412,	-118.3031313	1	1	0	0	1	110	0	1	0	3.99	2	5.99	1	0.7	1	9.99	2	0.7	3
Trader Joes	1	72422	2738 Hyperion Ave, Los Angeles, CA 90027	34.10803792911217,	-118.271631	2	13	0	0	1	300	1	1	1	3.99	3	2.69	1	1.16	5	3.59	1	0.69	6
Whole Foods	1	72422	2520 Glendale Blvd, Los Angeles, CA 90039	34.10207330180275,	-118.2584434	2	7	1	6	1	411	1	1	0	3.69	8	3.99	6	1.99	4	4.49	5	2.99	5
7-Eleven	2	72422	1647 Silver Lake Blvd, Los Angeles, CA 90026	34.089427641205134,	-118.2690146	1	2	0	0	1	18	0	1	0	NA	NA	NA	NA	NA	NA	4	1	3	2
Circle H Markets	2	72422	2511 Sunset Blvd, Los Angeles, CA 90026	34.0801642084833,	-118.2694074	1	1	0	0	1	180	1	1	0	NA	NA	4.89	2	1.18	2	5.99	2	1.09	3
99 Cents Only	5	72422	3600 Sunset Blvd, Los Angeles, CA 90026	34.09016768389189,	-118.27736	1	4	0	0	1	252	1	0	1	2.99	1	4.49	1	1.29	2	3.88	2	2.99	4
Erewhon	1	72422	4121 Santa Monica Blvd, Los Angeles, CA 90029	34.092275479466714,	-118.2824281	1	6	0	0	1	324	1	1	0	8.99	3	11.99	7	2.49	4	9.99	8	5.99	4
Yummy.com	1	72422	3907 Sunset Blvd, Los Angeles, CA 90026	34.09052872368643,	-118.2769334	1	2	0	0	1	72	1	1	1	6.99	7	5.89	3	2.99	3	5.99	3	4.17	3
Loras Market	2	20423	700 N Pickett St, Los Angeles, CA 90033	34.04959075024718,	-118.2034026	1	1	0	0	1	12	1	1	0	NA	NA	7	2	1	1	5.75	2	1.5	1
La Princesita	3	20423	2514 E Cesar E Chavez Ave, Los Angeles, CA 90033	34.04628011831943,	-118.2060311	1	1	0	0	1	144	1	1	0	4.39	2	9.52	1	1.29	1	5.29	2	1.29	1
Marketia Mazatlan	3	20423	2900 1st St, Los Angeles, CA 90033	34.044341129958674,	-118.2109506	1	1	0	0	1	192	1	1	0	NA	NA	NA	NA	1	1	5	2	1	4
Urbachi Beer And Wine	2	20423	2007 1st St, Los Angeles, CA 90033	34.045653116368835, -	118.2146451	1	1	0	0	1	1	1	0	0	NA	NA	NA	NA	NA	NA	5.5	2	1.5	1
Corona Market	2	20423	1913 1st St, Los Angeles, CA 90033	34.04668885833505,	-118.2168647	1	2	0	0	1	144	1	0	0	NA	NA	7.99	2	1.39	2	5.39	5	1.89	3
Smart And Final	1	20423	2308 East 4th St, Los Angeles, CA 90033	34.04059087669781,	-118.2130451	2	4	0	0	1	196	1	1	0	2.99	16	5.99	6	1.29	2	5.19	6	1.49	5
Northgate Market	3	20423	425 S Soto St, Los Angeles, CA 90033	34.04023860531988,	-118.2128821	2	7	0	0	1	867	1	1	1	2.79	10	6.49	3	0.79	2	4.99	10	1.99	9
Calimax Market	2	20423	2901 Whittier Blvd # K, Los Angeles, CA 90023	34.03157689812215,	-118.2084627	1	2	0	0	1	384	1	1	0	2.99	3	8.99	3	0.69	1	5.99	5	0.99	3
Vallarta Supermarket	1	20423	3425 Whittier Blvd, Los Angeles, CA 90023	34.02794154268634,	-118.2000279	1	4	1	4	1	519	1	1	0	2.49	10	5.99	5	0.99	1	5.99	11	0.79	5
Big Bear Liquor And Market	1	20423	2600 1st St, Los Angeles, CA 90033	34.04240506447123,	-118.2073684	1	2	0	0	1	96	1	0	0	3.49	2	8.99	2	0.89	1	5.99	1	0.99	1
Nicos Market	1	20523	2707 Lancaster Ave, Los Angeles, CA 90033	34.05803485132267,	-118.1964322	1	1	0	0	1	96	0	0	0	4.59	2	7.99	2	1.59	2	6.75	5	1.59	2
Food 4 Less	1	20523	2750 1st St, Los Angeles, CA 90033	34.04093417752436,	-118.2057264	1	13	0	0	1	611	1	1	0	2.99	9	5.79	2	0.99	8	3.89	8	1.29	5
Guadalajara Market	1	20523	1103 S Lorena St, Los Angeles, CA 90023	34.023903137492795,	-118.2036353	1	1	0	0	1	96	1	0	0	4.59	2	9	2	1.79	2	6.5	1	1.49	1
Sun Market	2	20523	2200 East 4th St, Los Angeles, CA 90033	34.04241356007997,	-118.2141791	1	1	0	0	1	1.5	1	1	0	3.49	1	9	1	4.5	1	5	3	4.5	1
Right Choice Caribbeam Market	3	21123	4233 S Crenshaw Blvd, Los Angeles, CA 90008	34.007366695339265,	-118.3351873	1	1	0	0	1	73	1	1	0	7.25	3	NA	NA	1.99	2	NA	NA	NA	NA
7-Eleven	2	21123	4299 S Crenshaw Blvd, Los Angeles, CA 90008	34.005574031969054,	-118.3342155	1	2	0	0	1	1	1	1	0	2.79	1	NA	NA	NA	NA	4.79	1	2.97	2
Super Uno Market	3	21123	4375 S Van Ness Ave, Los Angeles, CA 90062	34.00545378060359,	-118.3172095	1	2	0	0	1	21	1	0	1	4.49	1	8.99	3	2.97	1	5.99	2	2.97	2
G & J Market	1	21123	2045 W Martin Luther King Jr Blvd, Los Angeles, CA 90062	34.01257825154303,	-118.3167797	1	2	0	0	1	36	1	0	0	4.29	3	6.99	2	1.49	2	5.99	2	1.99	2
La Promesa Mini Market	2	21123	3935 S Western Ave, Los Angeles, CA 90062	34.0151148068618,	-118.3090015	1	1	0	0	1	1	0	0	1	NA	NA	8.5	2	NA	NA	4.65	2	NA	NA
Arlington Community Market	2	21123	3798 Arlington Ave, Los Angeles, CA 90018	34.0201422008959,	-118.3177691	1	1	0	0	1	9	0	0	0	4.25	2	8	1	NA	NA	7	3	NA	NA
99 Cents Only	5	21123	3060 Crenshaw Blvd, Los Angeles, CA 90016	34.027555792548654,	-118.3349226	1	5	0	0	1	100	1	1	0	2.99	4	6.99	3	2.99	2	3.99	4	2.99	3

Figure 1: All data collected while sampling.