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Fruit and vegetable accessibility as a risk factor for hypertension in blacks living in DeKalb & Fulton County, GA: A comparative case study.

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Executive Master of Public Health

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Fruit and vegetable accessibility as a risk factor for hypertension in blacks living in DeKalb & Fulton County, GA: A comparative case study.

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An abstract of
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Abstract

Fruit and vegetable accessibility as a risk factor for hypertension in blacks living in DeKalb & Fulton County, GA: A comparative case study.

By

Natasha Monts Mann

Hypertension is a risk factor for coronary heart disease, stroke, and a vast number of other related cardiovascular diseases (CVD). Coronary heart disease (CHD) and stroke rates alone are disproportionally higher for Blacks. A healthy diet has been proven to lower blood pressure and hypertension (HTN) rates in all people regardless of race or socio-economic status. Blacks are a vulnerable population to HTN due to the fact that they develop high blood pressure earlier in life and tend to have higher mortality rates than any other race. Access to healthy and fresh food has been shown to have an effect on eating behaviors. The impact of location of food stores and its influence diet and hypertension health status still remains unclear. The purpose of the study is to evaluate the correlation between food accessibility and its affect in hypertension rates in the Black community living in DeKalb and Fulton counties. Data was obtained using the U.S. Census Bureau database to gather data for population demographics. A list of businesses where people can buy food in DeKalb and Fulton County was compiled using the SNAP Retail Locator. The final list of stores was plotted on a map via GIS technology. The relative risk was calculated to determine the probability of developing hypertension or a cardiovascular disease for those living in a "low" or "no" accessibility area compared to the probability of the event happening in the population that lives in a "moderate" or "high" accessibility area. The results show there were slight associations between hypertension prevalence and food accessibility for DeKalb county (RR= 1.004). The opposite was found for DeKalb County's cardiovascular morbidity relative risk factor (RR = 0.5367). There was no significance between fruit and vegetable accessibility and hypertension rates in Fulton County. However, there was an association between cardiovascular related deaths and food accessibility (RR = 1.0002) for Fulton County. The results also confirm that there are fewer major grocery retailers located in predominately Black neighborhoods in DeKalb and Fulton County.

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Chapter I: Introduction

One in three deaths in the United States are due to cardiovascular related diseases. In 2011, The Million Hearts organization estimated $320 billion dollars are spent in health care costs and lost productivity due to heart disease and stroke (Million Hearts, 2016). In addition, about 1 out of every 6 healthcare dollars is spent on heart related diseases. Hypertension is a risk factor for coronary heart disease, stroke, and a vast number of other related cardiovascular diseases. Coronary heart disease and stroke rates alone are disproportionally higher for Blacks (Mozaffarian D, 2016).

In metro Atlanta, from 2008 to 2012, the second leading cause of hospitalizations for DeKalb County residents were cardiovascular related diseases and it was the leading cause of death for those ages 35 and older (DeKalb County Board of Health, 2015). More specifically, the population under investigation (i.e. adult Black male or females residing in DeKalb and Fulton Counties) had even higher rates. During that same time frame, Blacks had the highest morbidity rates for cardiovascular diseases including: high blood pressure, hypertensive heart disease, obstructive heart disease and stroke (Georgia Department of Public Health, 2014). One study in particular noted that when compared with whites, Blacks were shown to develop high blood pressure earlier in life and their blood pressure scores were significantly higher (Chan, Stamler, & Elliot, 2015). The higher blood pressure levels for Blacks were associated with an increased risk of heart disease and stroke. The question remains, how do we practically prevent or even reduce the high levels of blood pressure in the Black communities?

Public health researchers have shifted their focus to how to go about preventing high blood pressure and other cardiovascular related diseases. A few studies have shown the potential benefits of fruit and vegetable intake has on preventing hypertension and cardiovascular diseases (Joshipura, 2001), (He F, 2006), (Liu, JE, Lee, Hennekens, Willett, & Buring, 2000), (Reusser, 2006). Several other studies noted that many of the nutrients in fruits and vegetables, such as dietary fiber, potassium, and antioxidants, have been associated with reduced risk for cardiovascular disease (Joshipura, 2001), (Hung, Joshipura, Jiang, & al, 2004), (The DASH Collaborative Research Group, 1997), (Chan, Stamler, & Elliot, 2015). Daily fresh food intake and consumption requires some level of availability and accessibility. Several neighborhoods in Georgia's DeKalb & Fulton counties do not have access to fresh quality fruit and vegetables. In areas shown to have little or no accessibility to fresh fruits and vegetables, it has been proven that these areas have higher rates of chronic diseases and unfortunately, these areas are more likely to be comprised of a mixture of low-income Blacks, Hispanics, and immigrants (Staples, 2016). The areas with little to no accessibility to fresh produce are known to be food deserts. The U.S. Department of Agriculture defines food deserts as low-income communities that are located more than one mile from a reliable source of fresh produce and other healthy whole foods. Households living in food desert areas are also prone to food insecurity. Food insecurity exists when people do not have adequate physical, social or economic access to food as defined above. Residents of food deserts who lack a reliable source of transportation are often forced to shop at convenience stores where prices are higher than full-service supermarkets and selection is typically limited to processed foods high in fat, salt and sugar (Bonds, 2016).

Numerous studies have shown that neighborhood accessibility to food stores has an effect on fruit and vegetable intake and the overall health of the neighboring areas; however, the impact of location of food stores and its influence diet and hypertension health status still remains unclear. The few studies that have addressed the locality of food stores have not investigated the correlation between the population density of a specific county, the number of available food stores, and the corresponding hypertension rates. Increasing accessibility to fruits and vegetables in all neighborhoods can perhaps reduce rates of hypertension and other chronic cardiovascular diseases. Thus, there is a need to understand the correlation between food inaccessibility and the affect it has on the morbidity of hypertension and other cardiovascular diseases in the African- American population living in prime food desert areas. The purpose of the study is to evaluate the correlation between food accessibility and its affect in hypertension rates in the Black community living in DeKalb and Fulton counties. The primary hypothesis of this research study is a) neighborhoods with fewer supermarkets or food stores are more likely to be lower income; b) residents of neighborhoods with fewer supermarkets or food stores have higher rates of hypertension compared to the higher income neighborhoods. The second hypothesis of this the study is to ascertain if the residents of neighborhoods with a higher number of accessible supermarkets or food stores will have lower rates of hypertension.

Chapter II: Literature Review

In order to get a better understanding of the public health problem at hand, it is important to research and provide current knowledge on the variables in the proposed research project. The researcher seeks to ascertain the correlation between food accessibility and its effect on hypertension rates in Black communities residing in DeKalb and Fulton counties. The type of journal articles selected for the literature review focused on the following themes: the burden of hypertension, the burden of cardiovascular diseases, diet and hypertension, hypertension and Blacks, mapping environmental factors, measuring food accessibility, and lastly food deserts and their impact on a community's health status. Although food accessibility is one of the major variables in this proposed study, we must first understand the role of hypertension and the burden it places on society if it is not adequately controlled.

Hypertension

What is currently known about hypertension is stated below from a variety of resources. According to the American Heart Association, hypertension or high blood pressure, is defined in three categories. The first stage is *prehypertension* which is defined as having a systolic blood pressure reading of 120 - 139mmHg *or* a diastolic reading of 80 – 89mmHg. A systolic reading of 140 – 159mmHg *or* diastolic reading of 90 – 99mmHg is classified as hypertension stage 1 diagnosis. A stage 2-hypertension reading would be considered 160mmHg or higher *or* a diastolic reading of 100mmHg or higher. Any systolic blood pressure reading of 180mmHg or higher or a diastolic reading of 110mmHg or higher would require emergency care and is classified as a hypertensive

crisis (American Heart Association, 2014). Often there are social behavioral and biological risk factors that contribute to hypertension. Some of these risk factors include: being Black, being a woman, one's heredity, and advanced age, lack of physical activity, poor diet, increased sodium intake, obesity, alcohol use, stress, smoking, and sleep apnea. In other cases, hypertension can be caused by a pre-existing problem such as kidney abnormalities.

It is widely known in the medical and non-medical fields that undiagnosed hypertension can lead to dire cardiovascular diseases. These cardiovascular diseases and diagnoses include: coronary heart/artery disease, heart failure, stroke, aneurysms, kidney disease, myocardial infarction or "heart attack", hypertensive heart disease, cardiomyopathy, heart arrhythmia, valvular heart disease, carditis, aortic aneurysms, peripheral artery disease, and arteriosclerotic vascular diseases (Mendis S, 2011). Previous data acknowledged that more than 360,000 American deaths in 2013 included high blood pressure as a primary or contributing cause; on a macro scale, this is cause of concern because pre-hypertension affects as many as 1 of 3 adults (Nwanko T, 2013). In addition, high blood pressure costs the nation $46 billion each year. This total includes the cost of health care services, medications to treat high blood pressure, and missed days of work (Mozaffarian D, 2016). Most literature on hypertension focused on subcategories such as race, gender, socio-economic status, diet, or other diseases. This paper will focus on Blacks or Black Americans, diet and hypertension, and the added variable of investigating food accessibility. The effects of *food accessibility on hypertension* is what is missing in some literature and this thesis proposes to address that

gap. However, one must investigate what is currently known about hypertension and Blacks specifically.

High Blood Pressure & Blacks

Hypertension in Blacks is a growing topic among public health researchers and it is a significant topic to investigate. Current research suggests that Blacks have higher rates of coronary heart disease, stroke, and heart disease mortality caused at least in part by hypertension, which Blacks are more prone to developing earlier in life than their white counterparts (Moulton, 2009). In addition, several studies noted that when compared to their white counterparts, Blacks with hypertension are more likely to have lower adherence to self-management behaviors (Dickson M, 2008), (Shaya FT, 2009), (Bosworth HB, 2008), (Flynn SJ, 2013). One method of self-management behavior adjustment is eating healthy foods. One study identified, through interviews with their participants, that there were a few barriers to maintaining their hypertension due to either lack of access to fresh fruits and vegetables, poor quality of produce, or the expensive cost of available produce, or a combination of all three (Flynn SJ, 2013). In addition to high mortality rates and poor adherence to self-management behaviors, several studies have identified Blacks as more likely to have masked hypertension than any other race (Larsen, 2014) (Shimbo D, 2012) (Cacciolati C, 2011) (Hanninen MR, 2011).

Masked hypertension is a known situation when a patient has a normal blood pressure reading during a clinical or office visit, but the blood pressure remains elevated throughout the rest of the day. The presence of masked hypertension is associated with markers of impaired vasodilation and endothelial dysfunction, which are early

manifestations of coronary artery disease (Kabutoya T, 2013). The information from these studies is significant to this particular study because it provides background information on the study population and information surrounding hypertension in this particular sub-group. All in all, the published materials indicate that Blacks have a higher rates of hypertension stemming from an early age; are more likely to have masked hypertension; and least likely to adhere to hypertension treatment often leading to cardiovascular diseases and organ damage in the long run.

Diet & Hypertension

The literature on diet and its influence on reducing hypertension were overwhelmingly positive. Studies have found that fresh produce can drastically reduce hypertension and other cardiovascular diseases. Recent evidence suggests that dietary interventions aimed at reducing sodium and increasing potassium intake may not only lead to lower blood pressure, but also reduce risk for cardiovascular diseases (Bloch & Basile, 2009). However, potassium is not the only mineral aimed at reducing cardiovascular diseases, but fiber and antioxidants have also been proven to reduce the same diseases. Many studies have supported other data concluding that greater consumption of fruits and vegetables in particular green leafy vegetables and vitamin-C rich fruits and vegetables, aid in the protective effect against the risk of coronary heart disease (Bloch & Basile, 2009) (Joshipura, 2001). Another study also found that most Blacks do not eat the recommended 4.5 cups of fruit and vegetables daily; that is the amount needed to stay healthy and to prevent chronic diseases (Carson, 2012).

Dietary Approaches to Stop Hypertension (DASH) Diet

Three studies in particular noted how effective the DASH diet was in lowering and reducing hypertension in their study populations (Reusser & McCarron, 2006), (Chan, Stamler, & Elliot, 2015), (Liu & Manson, 2000). The DASH diet is a nutritionally complete diet rich in fruits vegetables and low-fat dairy foods. This diet in particular has been utilized in randomized, controlled trials with the Black population and has documented great benefits in hypertensive Blacks (Reusser & McCarron, 2006). The DASH diet is not only known for reducing cardiovascular disease risk, but also for reducing the incidence rates of some cancers and osteoporosis. It is well-documented that the adoption of the DASH diet is the simplest, yet most effective dietary approach for the prevention and reduction of hypertension in the Black population (Appel, TJ, E, & al, 1997).

Food Accessibility & Impact on Health

Adverse dietary patterns such as higher intake of processed meats, fats, and limited intake of fruits and vegetables are common in lower-income neighborhoods in the United States and may be influenced by the local availability of affordable healthy foods (Suarez, Isakova, & al, 2015). Thus living in a disadvantaged neighborhood can be tied to risk for hypertension and cardiovascular diseases. Past researchers have speculated that the migration of supermarkets to the suburbs and the lack of transportations available to low-income communities are contributing to malnutrition among the poor (Morland, Wing, Roux, & Poole, 2002), (House Select Coomittee on Hunger, 1987). Other studies concur with these findings, reporting that because of the sharp decline of supermarkets in

low-income areas, residents are forced to depend on small stores with limited selections of foods at substantially higher prices (Curtis & S, 1995). Even fewer studies have attempted to address locality as a factor that may hinder one's ability to achieve a healthy diet. The studies that have addressed locality have not investigated the correlations between the food store locality and the resident's hypertension rates.

Some studies have addressed the role of food corner stores. Small corner stores play an important role in the consumption patterns of low-income consumers with limited access to transportation and could be particularly important for small fill-in shopping for perishable items like produce (Bodor, Rose, Farley, Swalm, & Scott, 2007). These foods tend to be of lesser quality and more expensive than that of a supermarket. In addition, several studies have found associations between access to supermarkets and healthier food intakes (Morland, Wing, Roux, & Poole, 2002), (Laraia, Siega-Riz, Kaufman, & Jones, 2004), (Cheadle, Psaty, Curry, Wagner, Diehr, & al, 1991). For example, Moreland et al. found that fruit and vegetable intake increased with each additional supermarket in a census tract, and that increase was nearly three times as large for Blacks (Morland, Wing, Roux, & Poole, 2002). All in all, the literature surrounding food accessibility and its impact on health is very much conclusive. The location of a food store in a neighborhood has a direct correlation to an individual's food intake and overall health status. This is important when studying food accessibility in predominately Black neighborhoods.

Measuring Food Accessibility in Research Studies

A few research studies have utilized different ways of measuring food accessibility. Susan Algert et al. measured food accessibility in Pomona, CA by dividing food stores into categories based on onsite inspections, phone call interviews regarding produce content, or inference from the stores description. In their methodology, they categorized stores that sell four or fewer produce items as categorized as "limited" while those serving more produce were categorized as having a "variety". Access was measured by distance from a store offering a variety of produce. The addresses of food stores were geocoded into a GIS Mapping tool. Further, those living outside a "walkable" distance to a store selling a variety of produce (about a 15 minute walk) were highlighted as not having access to a variety of produce (Algert, Agrawal, & Lewis, 2006). Other studies had other ways to measure accessibility in their research studies including using zip codes.

In 1997, Alwitt and Donley measured food accessibility in Chicago, Illinois by examining the number of retail stores of different types and sizes in "poor" zip codes. Poor zip codes were defined as: 1) poverty rate in highest quartile of zip codes in Chicago, 2) lowest quartile of high school graduation rates, 3) lowest quartile of labor force participation, and/or 4) highest quartile of unemployment rate. The number of employees working at the supermarket defined the store size and they used these figures to determine food accessibility rates (Alwitt & Donley, 1997).

Another study conducted in St. Louis, Missouri, measured food accessibility by utilizing supermarket audits. The audits were used to assess "healthy food" availability in stores, where healthy food was defined by USDA dietary intake guidelines. The

auditors came up with a checklist of canned, fresh or frozen fruits and vegetables, dairy, lean meats, and poultry. A composite score was developed based on these audits and then the scores were divided into tertiles of high, medium, and low availability. The census tracts were divided into racial composition and poverty levels (Baker, 2006).

Lastly, a study conducted by Block et al. in New Orleans, Louisiana measured food accessibility by geocoding all the fast food restaurants and used 1-mile and 0.5-mile radius as buffers around Census tracts to determine "shopping areas" in each tract. The number of fast food restaurants per square mile calculated fast food restaurant density. Fast food restaurants that had two or more of the following characteristics: expedited food service, takeout business, limited or no wait staff, and payment tendered prior to receiving food were categorized into different restaurant types. The data was then compared with neighborhood characteristics such as percentage of Black population and low-income (Block & Scribner, 2004).

In summary, a number of studies used different methodologies to determine food accessibility and each one is very different from the other. Some studies used a combination of food prices, produce quality, distance to stores, zip codes, store inventory, fast food restaurant density, GIS mapping tools, and food desert locations to investigate food accessibility in a variety of settings and with different populations. The different ways of measuring food accessibility creates advantages and disadvantages to conducting food accessibility research. One advantage is, there are several ways to conduct this type of research and still have valid, reliable data and it allows room for innovation and creativity. On the other hand, if there is no standardized way to measure food accessibility, results can be biased and less generalizable to the entire population. Most

of the studies reviewed all had different methodologies for measuring food accessibility and even similar studies had slight differences. A recommendation for future research in measuring food accessibility is to focus on standardizing measures and in return, studies can be conducted and implemented across a broader range of the population.

Food Deserts

Food deserts are defined by the U.S. Department of Agriculture as low-income communities located more than one mile from a reliable source of fresh produce and other healthy whole foods. Residents of food deserts who lack a reliable source of transportation are often forced to shop at corner and/or convenience stores where prices are higher than full-service supermarkets. In convenience and corner stores, food selections are typically limited to processed foods high in fat, sodium, and sugar (Staples G. , 2016). Most of the literature surrounding food deserts show that residents living in a food desert area are more likely to have higher systolic blood pressure readings and were more likely to be Black or Hispanic (Suarez, Isakova, & al, 2015). One study noted that living in food deserts is associated with a higher burden of cardiovascular risk factors. The same study concluded the neighborhood characteristics that affect the availability of healthy foods contribute to an increased risk of cardiovascular disease beyond their effects on traditional risk factors such as: smoking, lack of physical exercise, alcohol consumption, age, race, and gender (Kelli, Ahmed, & al, 2016).

Geographical Mapping Methods

Public health research has increasingly become more focused on topics such as how access to resources affects health behaviors. Mapping environmental factors, for example, mapping the distance to a supermarket from a home, can identify interventions for improving food access in low-income and minority neighborhoods (Jaskiewicz, Block, & Chaves, 2015). Traditionally in research, GIS technology has supported the development of research examining whether spatial access to sources of healthy foods influences dietary behavior (Larson, Story, & Nelson, 2009). There is not one standard way to measure locations using mapping methods. There are several accessibility measures past studies have used to measure access within a given spatial group. The first is the *container* method, which is used to count the number of stores within a given geographic area. These results depend on the size and number of geographic units studied (Guagliardo, 2004). The second measure, *coverage*, counts the number of stores within a specific distance (Guagliardo, 2004). The third cumulative opportunity measure, *minimum distance,* calculates the distance to the closest store. The fourth measure calculates the *average distance* to all stores in a geographic location. None of these measures take into account the impact of distance or travel time on access (Jaskiewicz, Block, & Chaves, 2015). Gravity-based measures of accessibility take into account the "cost" for distance or travel time. First, *gravity kernel* is a measure, which divides the density of stores by the density of the population. The second gravity measure is *two-step floating catchment (two-step FCA)*, which weights stores by their size and surrounding population before calculating population access (Jaskiewicz, Block, & Chaves, 2015). The United States Department of Agriculture Economic Research Service's Food Access

Research Atlas uses data based on the 2010 census tract polygons to locate food desert areas. In the new Food Access Research Atlas, food access indicators for census tracts using ½-mile and 1-mile demarcations to the nearest supermarket for urban areas, 10-mile and 20-mile demarcations to the nearest supermarket for rural areas, and vehicle availability for all tracts are estimated and mapped. One study in particular identified store and other community locations utilizing street addresses and pointing them on a map using Google Earth and the data can be incorporated into other mapping software (Lefer, Anderson, & al, 2008). This thesis proposes to use similar mapping methods utilizing Google Earth.

In conclusion, the literature provided a general idea of what is currently known about hypertension, hypertension in Blacks, diet, and food accessibility measures. In reference to Black Americans, past research studies revealed that Blacks are more likely to develop hypertension earlier in life and in correlation, Blacks have higher morbidity and mortality rates from cardiovascular disease and organ damage stemmed from hypertension. It is widely proven that proper and a healthy diet is key to reducing hypertension, cardiovascular diseases, diabetes, and other chronic diseases. It has been documented that access to fresh produce remains desolate in Black communities. Previous research has identified "food accessibility" as having a direct impact on food intake behaviors. This puts Blacks living in food deserts at a disadvantage in addition to putting this population at risk for developing hypertension and other related chronic diseases. To date, few studies have investigated fruit and vegetable accessibility and the correlation of hypertension rates in Blacks. This thesis paper will elude to fill the missing

gap of knowledge on fruit and vegetable accessibility as a risk factor for hypertension in Blacks specifically living in DeKalb & Fulton County, GA.

Chapter III: Methods

Introduction

Attempting to find a possible correlation between food accessibility and hypertension rates in Blacks involves a mix-method approach to the methodology and data collection. Most of the data will require access to census level data and state level health data. Based on the literature reviews, it is common and best practice to utilize U.S. Census data for county level descriptions, GIS tools for mapping food locations, and using databases such as OASIS Web Query Tool, the Online Analytical Statistical Information System to obtain current health statuses on county residents. Food accessibility was estimated as the distance to the nearest supermarket or large grocery store. The proposed methodologies for collecting data was reviewed by the Emory Institutional Review Board (IRB). The thesis proposal was approved and further exempt from IRB review on June 1st, 2016.

Population and Sample

The target population to be researched are specifically Blacks. The inclusion criteria for the population being studied was classified as "any adult who self-identified as Black on the 2010 U.S. Census and resides within the Fulton or DeKalb County limits". Those who did not meet the inclusion criteria were excluded from the population sample. Data for population demographics for each county was retrieved from web queries in AmericanFactFinder.com, a U.S. Census Bureau database.

Research Design

Measurement of Local Food Accessibility

A list of businesses where people can buy food in DeKalb and Fulton counties was compiled using the SNAP Retailer Locator; provided by the USDA's Food and Nutrition Services. Additions to the list were made by ground checking, or physically going to certain neighborhoods and verifying a store's existence. Of the 1505 food stores obtained, 1,317 were excluded because they did not fall in the category of a large food retailer. Excluded stores included: gas stations, convenience stores based on names, drug stores, food marts, and non-food retailers as it is assumed that fresh, quality fruits and vegetables would not be sold at these locations. Duplicates were also deleted leaving a total number of 71 and 117 for both **DeKalb** and **Fulton** counties respectively. Once the final list of stores was completed, they were plotted on Google Earth maps. The investigator compared the number of stores within one zip code to the population of Blacks in the same zip code. This gave us the food accessibility rates for Blacks in DeKalb and Fulton County (Apparicio, Cloutier, & Shearmur, 2007). Also known as a cumulative measure method, the *container* measure of food accessibility is what was chosen to measure accessibility. The literature review section has more details on the *container* measurement method. Results and rates of food accessibility measurement are in table format, see tables 4A and 4B. After the supermarkets were plotted on the maps, (see figures 4.1 – 4.5 in the Results chapter), a table was created depicting each zip code in both DeKalb and Fulton counties and their relative population of Blacks and total populations. On the same table, the number of food stores per zip code was listed and compared to the number of Blacks living in said zip codes. This calculated the rate of

food stores per Black population. The rates of food accessibility were categorized using the following key terms: high, moderate, low, and no accessibility. The researcher concluded that food stores that served a population of less than 5,000 people per zip code was categorized as "high"; "moderate" was categorized as serving a population of 5,000 to 10,000 people; "low" accessibility meant the food stores served a population of 10,000 or more. No accessibility meant there were no food stores located in the zip code (see tables 4A and 4B).

County Demographics & Health Statuses

The demographics for each county were obtained by creating custom queries in the online database, American Fact Finder provided by the U.S. Census Bureau. Information pertaining to resident's income, race, household status, etc. was obtained from this database and the data was organized in a table format. Similarly, the current mortality, morbidity, and health statuses of DeKalb and Fulton residents were gathered from OASIS Web Query Tool, the Online Analytical Statistical Information System managed by the Georgia Department of Public Health's Data Warehouse. The results of the queries run using this OASIS database can be found in the following results chapter.

Measure of Hypertension and Major Cardiovascular Disease Morbidity and Mortality

The Online Analytical Statistical Information System managed by the Georgia Department of Public Health's Data Warehouse was utilized to perform web query search for the morbidity and mortality numbers and rates for Blacks living in DeKalb and Fulton County. These disease rates and numbers were put into table format. The numbers were

be compared to the total number of Blacks living in a zip-code with “high”, “medium”, and “low” food accessibility to better understand if food accessibility and hypertension rates are correlated.

Data Analysis Methodology

Multivariate statistical analysis was applied to identify the key determinants of areas with low access to supermarkets and large grocery stores. Data will be analyzed by compiling the number of stores and household residences that will be geo-coded using GIS software and by using population density measures, the number of food stores within a specified radius of the target population’s residence or zip-code. In turn, the researcher will calculate the number of food stores per area unit. Thus, the relative risk was calculated to determine the probability of developing hypertension or a cardiovascular disease in those who live in “low” food access areas compared to the probability of the event happening in the population that does not live in “low” or “no” food accessible area.

Chapter IV: Results

Introduction

The methodology required a mix-methods approach in order to find a correlation between fruit and vegetable accessibility and hypertension rates in Blacks. Thus, the results will need to be interpreted collectively and wholesomely. The mix-methods approach requires all of the data and results to be looked at as one unit in order to address the hypothesis question rather than alienating the results and making a determination based on individual results. The results are organized and listed individually, however, they each play an important part in collectively determining if there is a possible correlation between fresh produce accessibility and hypertension rates within an at-risk population.

Measurement of Local Food Accessibility

First, a list of grocery stores and supermarkets were obtained using the SNAP Retailor Locator. The results were downloaded into an Excel spreadsheet and reviewed for quality assurance. From the raw data list of 1505 food stores, the investigator excluded and removed names from the list that did not fit the standard criteria for a supermarket or conventional grocery store or carry an abundance of fresh fruits and vegetables. Only 71 food stores for DeKalb and 117 food stores for Fulton County remained. The final approved list can be seen in **Appendix A.**

Once the final list of food store addresses was determined, the stores were mapped using Google Earth and pin-dropping the locations of the grocery stores. The results were noticeable for DeKalb County solely by visible observation of the placement

of the supermarket stores. By simple observation, southern DeKalb County had fewer food stores than the northern half of the county and the stores were more likely to be sporadic in their placement, see figures 4.1 & 4.2. The southern side of DeKalb County has a higher rate of Black residents, according to the OASIS County Population Number for DeKalb and Fulton Counties, see figure 4.6. The "red" areas in Figure 4.6 indicate a majority Black population. A complete list of the color representation can be found in **Appendix B**. The food store mappings results were not as visually noticeable for Fulton County. However, when figures 4.5 and 4.6 are compared to each other, one will notice that in the heavily populated Black neighborhoods, the amount of food store locations is low and sparse. In addition, Fulton County has a high Black population and according to the results, they are more likely to live in a southern zip code area of Fulton County. In order to ascertain the food accessibility rates for both counties, the zip codes were analyzed by finding out the population rate of Blacks and the number of food stores per the population (see Tables 4A & 4B). Depending on the rate of food stores per the Black population, the zip codes were then categorized into "low", "moderate", "high", or "no" accessibility. The results were consistent with the other findings that Blacks were more likely to live in food desert areas. All of the zip codes with "low" accessibility had higher rates of Blacks; all were over 60% Black regardless of the county.

County Demographics & Health Statuses

It is important to investigate and report the demographics of both counties as it plays a key role in providing significant background information. Based on demographics alone, Fulton County has about 230,000 more residents than DeKalb County. Over 54% of DeKalb County's residents are Black, whereas Fulton County has a 44% Black

resident rate. More details can be seen in Tables 4D and 4E. In addition to the demographics, the health statuses as it relates to hypertension and cardiovascular diseases were assessed. In order to understand the mortality and the prevalence of hypertension and cardiovascular diseases in Blacks living in DeKalb and Fulton counties, the researcher queried from the Georgia Department of Public Health to obtain the most current rates and numbers for the following variables:

1. Death rate from cardiovascular disease in Blacks
2. Death rate due to hypertension in Blacks
3. Emergency room visit rate for cardiovascular diseases in Blacks

Below, the following tables 4G – 4H display the results of the three queried searches.

Table 4F - Deaths & Death Rate, Major Cardiovascular Diseases, Black or African-American, Not Hispanic or Latino by Residence (2014)

County	Deaths	Death Rate
DeKalb	670	173.2
Fulton	1,011	234.1
County Summary	1,681	205.3

Source: Georgia Department of Public Health, Office of Health Indicators for Planning.

Table 4G - Deaths & Death Rate, High Blood Pressure, Black or African-American, Not Hispanic or Latino by Residence (2014)

County	Deaths	Death Rate
DeKalb	80	20.7
Fulton	70	16.2
County Summary	150	18.3

Source: Georgia Department of Public Health, Office of Health Indicators for Planning.

Table 4H - Table ER Visits and ER Visit Rate, Major Cardiovascular Diseases, Black or African-American by Residence (2014)

Place	ER Visits	ER Visit Rate
Georgia	38,313	1,203.4
DeKalb	3,502	885.0
Fulton	5,354	1,213.0
County Summary	8,856	1,058.0

Source: Georgia Department of Public Health, Office of Health Indicators for Planning.

Data Analysis

The relative risk was utilized to calculate the risk of developing hypertension or a cardiovascular disease if you live in a food desert. Table 4C shows the data for the number of hypertension emergency room visits and the cardiovascular related deaths as it relates to the number of Blacks living in **no** or **low access** to fresh fruits and vegetables. These numbers are compared to the "control group" or the Blacks who live in **moderate** to **high** accessibility areas. In terms of the relative risk, in order to show an association between two variables and in this case the association between food accessibility and hypertension rates, the relative risk number needs to be greater than one. To show a negative association or possible correlation between the variables, the number would need to be less than one. The results show there were slight associations between hypertension prevalence and food accessibility for DeKalb county (RR= 1.004). The opposite was found for DeKalb County's cardiovascular morbidity relative risk factor (RR = 0.5367). There was no significance between fruit and vegetable accessibility and hypertension rates in Fulton County. However, there was an association between cardiovascular related deaths and food accessibility (RR = 1.0002) for Fulton County.

Chapter V: Discussion

Introduction

Overall, the purpose of the study was to evaluate the correlation between food accessibility and its effect on hypertension rates in the African-American communities living in DeKalb and Fulton counties. A mixed methods approach was implemented in an attempt to test the primary and secondary hypotheses. Our testing methods were able to answer parts of the hypothesis but not all. There are several limitations to note as these findings may have an influence on the data and interpretation. Furthermore, to better understand food accessibility and its effect on chronic diseases, more research needs to be done on several key factors. Although not all of the hypotheses were able to be answered, the research did provide a number of key findings relevant to future public health research.

Summary of Study

In metro Atlanta, from 2008 to 2012, the second leading cause of hospitalizations for Black DeKalb County residents was cardiovascular related disease. Blacks had the highest morbidity rates for cardiovascular diseases including high blood pressure, heart disease, and stroke. Numerous studies have noted how a proper diet consisting of plenty of fresh produce can drastically reduce hypertension and cardiovascular related diseases in any population. The problem is the majority of Blacks living in DeKalb or Fulton County are more likely to live in a food desert area causing this vulnerable population to be at risk for developing hypertension or cardiovascular diseases. The purpose of the study was to evaluate the correlation between food accessibility and its effect on

hypertension rates in the African-American communities. The primary hypothesis of this research study is a) neighborhoods with fewer supermarkets or food stores are more likely to be lower income; b) residents of neighborhoods with fewer supermarkets or food stores have higher rates of hypertension compared to the higher income neighborhoods. The second hypothesis of this the study is to ascertain if the residents of neighborhoods with a higher number of accessible supermarkets or food stores will have lower rates of hypertension.

A mixed method approach used to address the hypertension and food accessibility hypotheses. Data was obtained using the U.S. Census Bureau database to gather data for population demographics. A list of businesses where people can buy food in DeKalb and Fulton County was compiled using the SNAP Retail Locator. Gas stations, food marts, convenience stores, and non-food retailers were excluded from the list. The final list of stores was plotted on a map via GIS technology. The rates of food stores per Black resident was calculated. The following rates of food accessibility were categorized into high, moderate, low, and no accessibility. Web-based data queries were performed to find out the morbidity and mortality numbers are rates for Blacks living in DeKalb and Fulton county. The numbers were compared to the total number of Black living in a zip code that was categorized as “high”, “medium”, and “low: food accessibility. The relative risk was calculated to determine the probability of developing hypertension or a cardiovascular disease for those living in a “low” or “no” accessibility area compared to the probability of the event happening in the population that lives in a “moderate” or “high” accessibility area.

The results showed that the southern side of DeKalb County has a high rate of Black residents and had fewer food stores than the northern half of the county. Blacks were also more likely to live in the southern zip codes of Fulton County; however, the mapping results did not produce anything of significance, meaning from the mapping results, the stores appeared to be evenly distributed across Fulton County unlike DeKalb County. The results were consistent with the other findings that Blacks were more likely to live in food desert areas. All zip codes with "low" accessibility had the highest proportion of Black residents (over 60%). In terms of relative risk, the results show that there was a slight association between hypertension prevalence and food accessibility for DeKalb County. In addition, there was a positive association between cardiovascular related deaths and food accessibility for Fulton County. There was no association between fresh produce accessibility and hypertension rates in Fulton County.

Limitations

There are several limitations within this research study worth noting. When collecting population numbers for the county zip codes, there were several zip codes that overlapped between both Fulton and DeKalb counties, thus the total population for the zip-codes that overlap with other counties may not be truly represented. In addition, some residents may have been double counted. Additionally, being that zip codes were used as a form of measuring accessibility, this allowed for several measurement errors such as: missed stores, closed stores, or even miscategorized stores. Points of residence were used to assume that residents utilize the supermarkets in their neighborhoods, however, it did not take into account those who shop at food stores by their jobs, schools or recreational spaces, which may have better shopping choices. Similarly, the role of travel and time

versus distance has not been taken into account and can influence food accessibility. Walkability and drivability were not assessed when identifying measures for food accessibility due to time constraints and lack of resources available to collect the data.

The results to these data collection methods may not be completely linear as several data either were not available or could not be collected. First, the hypertension and cardiovascular disease deaths rates could not be obtained for specific zip codes. Thus, the current rates had to be obtained using county level data and then attributed to the specific zip codes. The results still show a possible correlation between food accessibility and hypertension rates, however, it is important to understand that it does not show causation.

In addition, eating behaviors are complex and food access certainly influences eating behaviors however it is not the only determinant. One limitation is that the data was collected using primarily secondary resources, thus the researchers was not able to gather information directly from the residents themselves. Obtaining information qualitatively via questionnaires, surveys, or through thorough interviews directly from the residents themselves could have provided insight to other contributing factors to eating behaviors.

Recommendations for future study

Several recommendations are listed for future study in understanding how food accessibility plays a role on the health status of vulnerable communities. First, there is a need for more interventions or more studies on measuring food accessibility so that researchers can come up with a standardized way of measuring food accessibility. This is important when generalizing results and studies can be done across the board with any

target population. Susan Algert et al. measured food accessibility in Pomona, CA by dividing food stores into categories based on onsite inspections, phone call interviews regarding produce content, or inference from the stores description. Alwitt and Donley measured food accessibility in Chicago, Illinois by examining the number of retail stores of different types and sizes in "poor" zip codes. Another study conducted in St. Louis, Missouri, measured food accessibility by utilizing supermarket audits. Currently, there is no standard way to measure food accessibility.

Another recommendation is to conduct more research on the walkability and drivability as it pertains to food accessibility. There was very little research providing insight how walking and driving distances play a role in eating behaviors. It is also recommended that more research on the relationship between shopping at food stores at home versus work/school/recreational places be conducted as these too can have a significant impact on the eating behaviors of all populations.

Lastly, the literature review provided insight as to when the studies on food accessibility were conducted. Many were almost ten to twenty years ago. There needs to be more current research on food accessibility in the United States and in turn demonstrate how this is affecting the health statues of communities all across the country. In 2009, a report to congress was submitted to Congress highlighting access to affordable and nutritious foods. The report measured food deserts all across the country and reported the consequences. Perhaps an updated report is needed to get legislation to change the local zoning laws and promote more food stores accessibility in food desert areas. Additionally, the fact that these studies were done so long ago also raises questions about why there have not been policy changes or interventions to address the problem.

Increasing accessibility to fresh produce via local Farmer's Markets or allocating land for community gardens can be a potential solution.

Conclusion

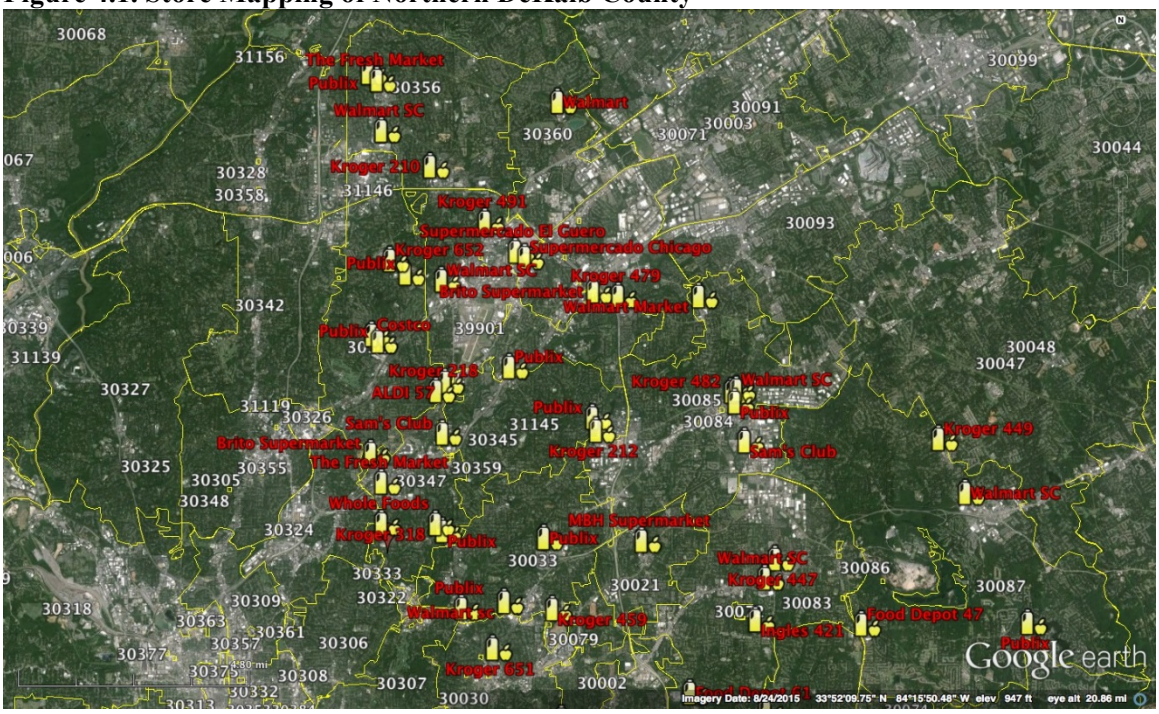
We found that although we were not able to answer the primary hypothesis and determine if there is a direct correlation between hypertension rates and food accessibility, there was an association between hypertension prevalence and fresh produce accessibility. This study confirmed previous studies which found that Blacks had higher rates of cardiovascular disease morbidity and mortality. The literature review and our study results mirror each other in suggesting that living in a food desert area can contribute to higher blood pressure prevalence and one is more likely to develop a cardiovascular disease. The research presented here also confirms that there are less major grocery retailers in predominately Black neighborhoods in DeKalb and Fulton County. The results also supports previous research indicating that there is a slight association between hypertension prevalence and food accessibility in DeKalb County. In addition, an association was found between cardiovascular related deaths and food accessibility in Fulton County. Thus the study results are in line with previous research.

It is critical to investigate the relationship between food accessibility and chronic disease rates in vulnerable populations. Results from such studies can contribute to public health research by driving more policy to providing adequate food stores in neighborhoods that have "little" to "no" access to fresh foods and vegetables. Perhaps more can be done to ensure all residents in DeKalb and Fulton County have adequate access to fresh and quality produce on a consistent basis. Improving food accessibility

could mean an improvement in the incidence and prevalence rates of hypertension and chronic diseases in the Black community.

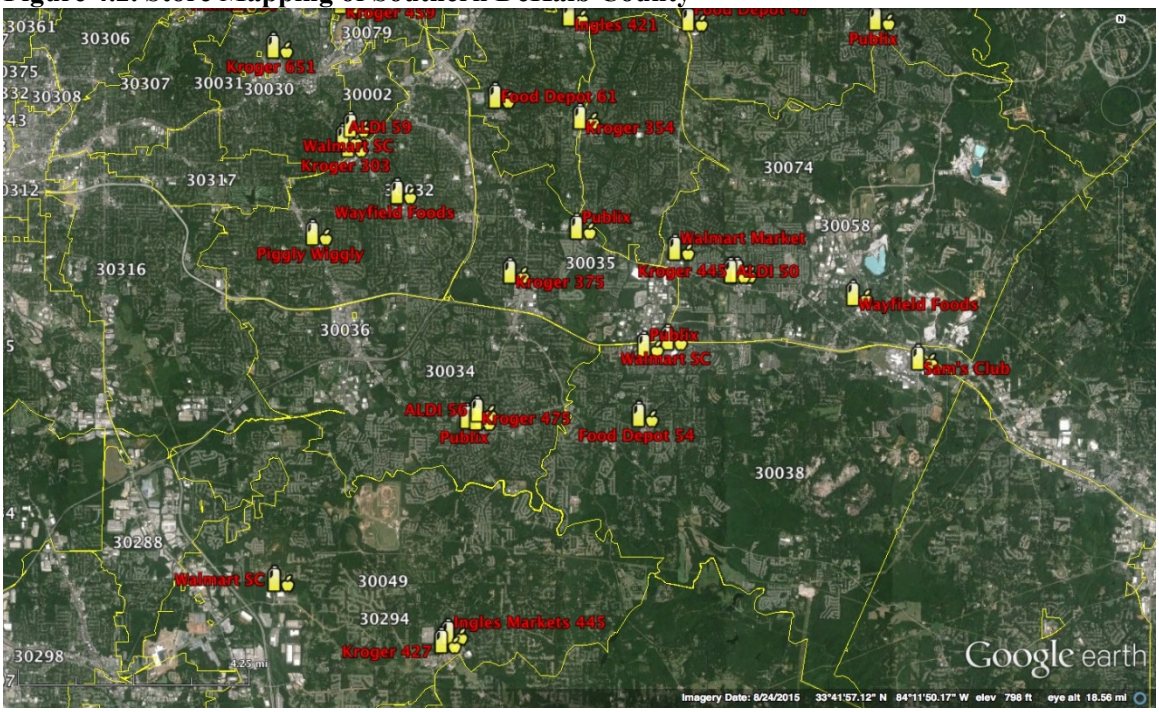
Figures

Figure 4.1. Store Mapping of Northern DeKalb County



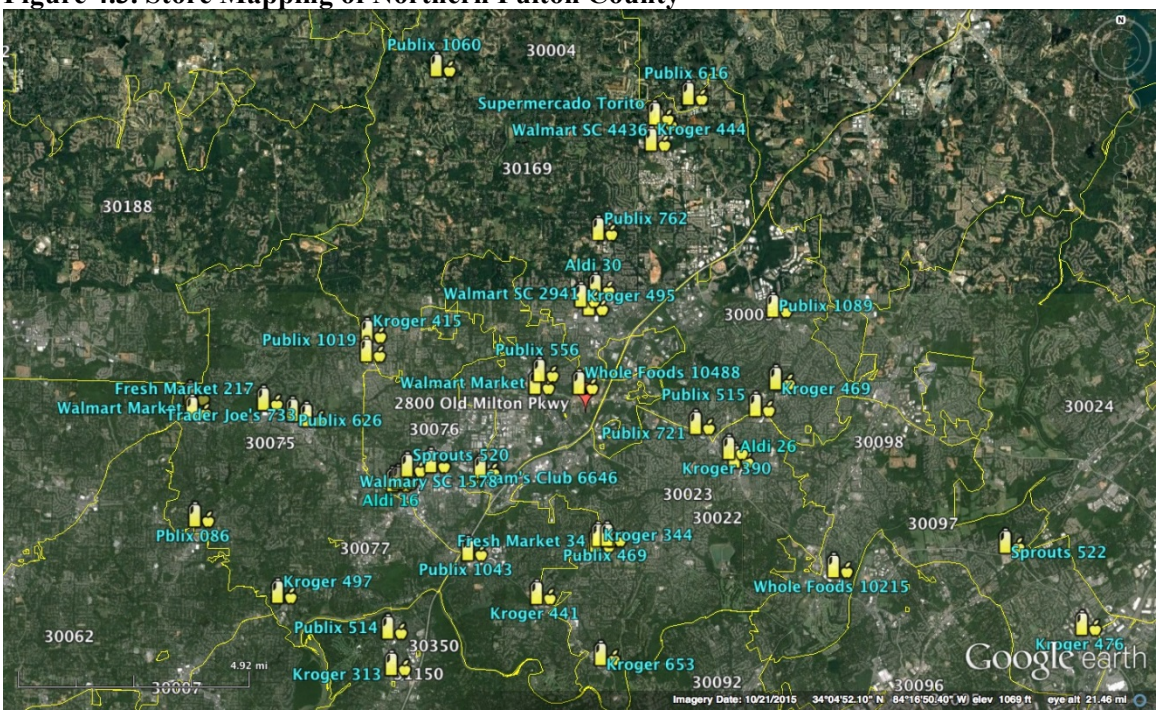
Source: Google Earth

Figure 4.2. Store Mapping of Southern DeKalb County



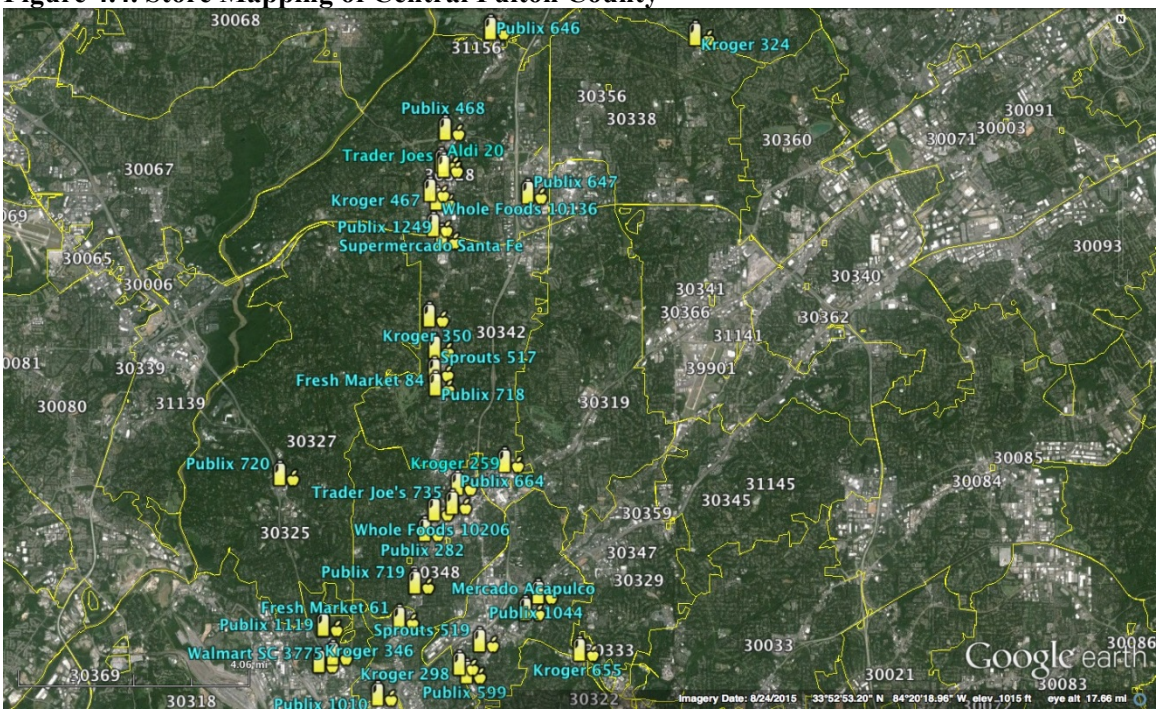
Source: Google Earth

Figure 4.3. Store Mapping of Northern Fulton County



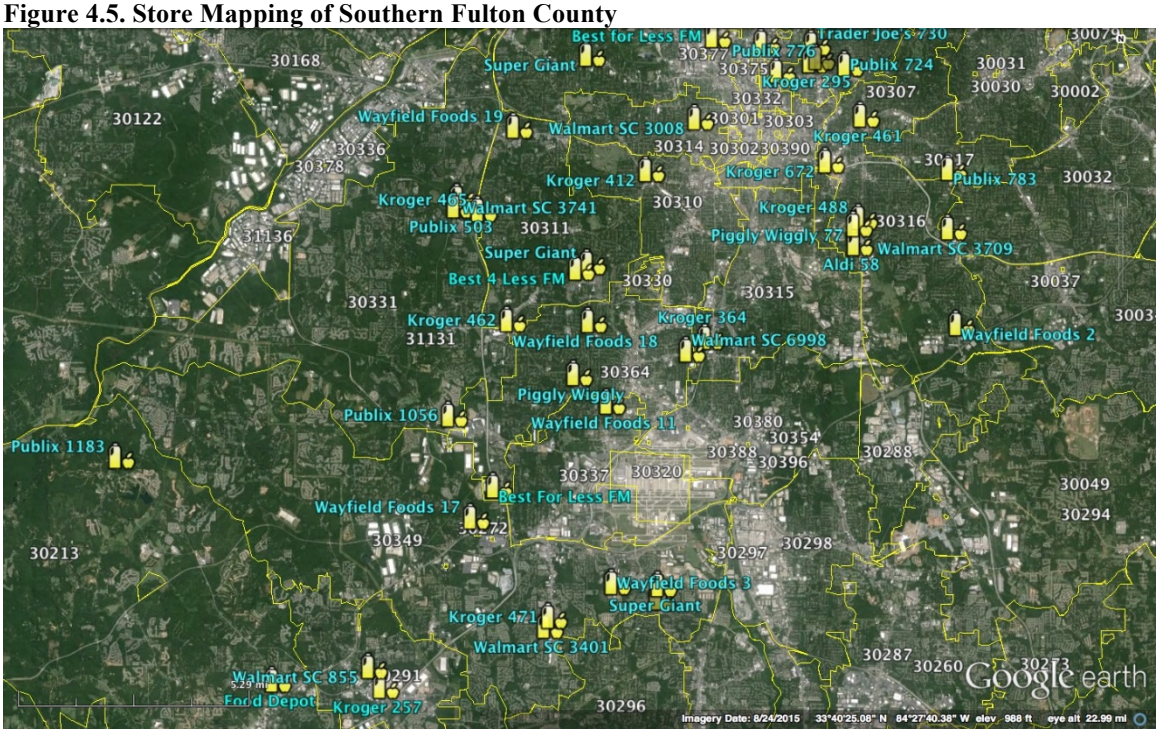
Source: Google Earth

Figure 4.4. Store Mapping of Central Fulton County



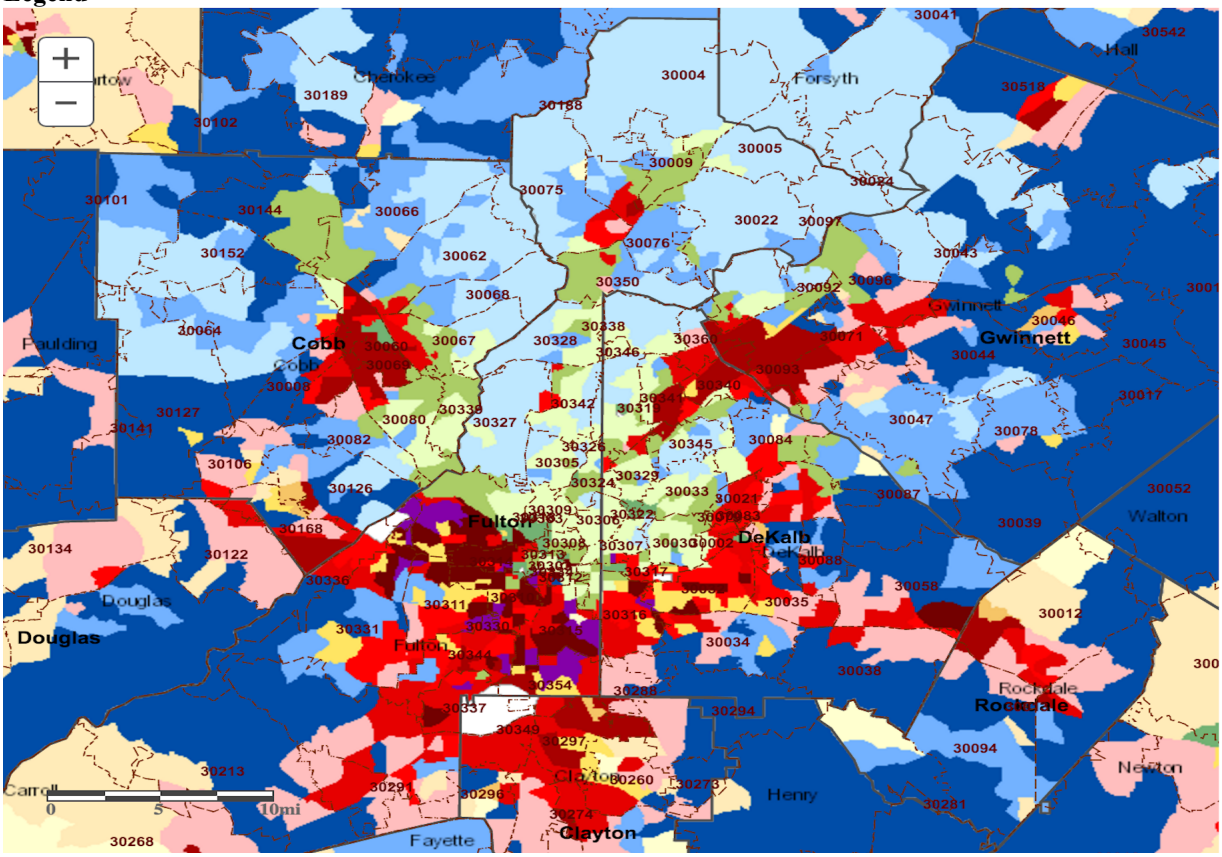
Source: Google Earth

Figure 4.5. Store Mapping of Southern Fulton County



Source: Google Earth

Figure 4.6. Demographic Distribution of DeKalb & Fulton Counties (2014). See Appendix B for Legend



Source: Online Analytical Statistical Information System, Georgia Department of Public Health

Tables

Table 4A. Food Accessibility and Black Population Rates, DeKalb County

Zip Code	Total population of Blacks in Zip Code	Population in Zip Code (all races)	Percentage of Black population in Zip Code	Number of Food Stores per Zip Code	Rate of food stores per Black population	**Food Accessibility** (High= Less than 5,000 people per store, Moderate = 5,000 - 10,000 persons per store, Low= 10,000+ persons or more per store
DeKalb County						
30002	2,089	5,861	35.64%	0	0	No Accessibilty
30021	13,574	21,989	61.73%	1	1 per 13,574 persons	Low
30030	5,730	26,473	21.64%	2	1 per 2,865 persons	High
30033	3,736	30,763	12.14%	3	1 per 1,245 persons	High
30034	41,225	43,113	95.62%	3	1 per 13,742 persons	Low
30035	18,802	20,396	92.18%	2	1 per 9,401 persons	Moderate
30038	34,915	37,233	93.77%	4	1 per 8,729 persons	Moderate
30058	49,091	52,945	92.72%	4	1 per 12,273 persons	Low
30079	1,914	2,960	64.66%	0	0	No Accessibilty
30083	39,454	50,384	78.31%	4	1 per 9,864 persons	Moderate
30084	7,813	35,921	21.75%	5	1 per 1,563 persons	High
30087	22,644	36,761	61.60%	4	1 per 5,661persons	High
30088	22,902	25,257	90.68%	1	1 per 22,902 persons	Very Low
30288	6,760	8,929	75.71%	0	0	No Accessibilty
30294	33,138	39,865	83.13%	3	1 per 11,046 persons	Low
30306	1,359	22,246	6.11%	2	1 per 680 persons	High
30307	2,803	18,004	15.57%	1	1 per 2,803 persons	High
30316	19,558	31,110	62.87%	7	1 per 2,794 persons	High
30317	7,043	11,970	58.84%	0	0	No Accessibilty
30319	3,192	38,423	8.31%	4	1 per 798 persons	High
30322	232	2,023	11.47%	0	0	No Accessibilty
30329	4,019	28,539	14.08%	7	1 per 574 persons	High
30338	3,955	33,617	11.76%	4	1 per 989 persons	High
30340	4,869	29,394	16.56%	2	1 per 2,435 persons	High
30341	5,765	31,793	18.13%	6	1 per 961 persons	High
30345	3,605	23,129	15.59%	5	1 per 721 persons	High
30346	1,062	4,696	22.61%	0	0	No Accessibilty
30360	1,624	14,536	11.17%	1	1 per 1,624 persons	High
Totals	362,873	728,330	49.82%	75		

Source: AmericanFactFinder, U.S. Census Bureau, 2010 Census.

Table 4B. Food Accessibility and Black Population Rates, Fulton County

Zip Code	Total population of Blacks in Zip Code	Population in Zip Code (all races)	Percentage of Black population in Zip Code	Number of Food Stores per Zip Code	Rate of food stores per Black population	**Food Accessibility** (High= Less than 5,000 people per store, Moderate = 5,000 - 10,000 persons per store, Low= 10,000+ persons or more per store
Fulton County						
30004	4,674	53,033	9%	12	1 per 382 persons	High
30005	3,431	34,442	10%	2	1 per 1,716 persons	High
30009	1,489	13,722	11%	2	1 per 745 persons	high
30022	7,030	64,359	11%	8	1 per 879 persons	High
30075	3,990	52,573	8%	10	1 per 399 persons	High
30076	5,626	42,678	13%	3	1 per 1,875 persons	High
30097	4,608	41,715	11%	3	1 per 1,536 persons	High
30188	3,362	52,380	6%	0	0	No Accessibilty
30213	22,213	29,384	76%	2	1 per 11,107 persons	Low
30268	4,479	9,090	49%	0	0	No Accessibilty
30291	17,402	21,010	83%	2	1 per 8,701 persons	Moderate
30303	3,540	5,934	60%	0	0	No Accessibilty
30305	1,943	22,999	8%	5	1 per 389 persons	High
30306	1,359	22,246	6%	2	1 per 680 persons	High
30308	6,009	15,413	39%	4	1 per 1,502 persons	High
30309	3,739	21,845	17%	2	1 per 1,870 persons	High
30310	24,318	26,912	90%	1	1 per 24,318 persons	Very Low
30311	30,583	32,218	95%	5	1 per 6,117 persons	Moderate
30312	10,921	19,360	56%	0	0	No Accessibilty
30313	3,214	9,945	32%	0	0	No Accessibilty
30314	21,066	22,020	96%	1	1 per 21,066 persons	Very Low
30315	27,371	33,857	81%	1	1 per 27,371 persons	Very Low
30318	29,255	49,736	59%	5	1 per 5,851 persons	Moderate
30324	4,578	24,267	19%	5	1 per 916 persons	High
30326	855	4,802	18%	1	1 per 855 persons	High
30327	937	22,208	4%	1	1 per 937 persons	High
30328	4,251	30,348	14%	6	1 per 709 persons	High
30331	51,125	54,094	95%	3	1 per 17,042 persons	Low
30336	878	971	90%	0	0	No Accessibilty
30342	3,662	29,879	12%	7	1 per 523 persons	High
30344	23,333	31,776	73%	3	1 per 7,778 persons	Moderate
30349	62,034	67,602	92%	7	1 per 8,862 persons	Moderate
30350	10,943	34,740	31%	4	1 per 2,736 persons	High
30354	9,866	14,857	66%	0	0	No Accessibilty
30363	1,050	2,680	39%	1	1 per 1,050 persons	High
Totals	415,134	1,015,095	41%	108		

Source: AmericanFactFinder, U.S. Census Bureau, 2010 Census.

Table 4C. Relative Risk Ratio (Food Accessibility and Hypertension Rates in Blacks (2014)

Relative Risk Ratios & Calculations	Total African-American population for Zip Codes w/ **"No"** or **"Low"** access to FV	Total African-American population w/ **"Moderate"** or **"High"** access to FV	**Exposed Group ("No" or "Low" Accessbility)**		**Control Group ("Moderate" or "High" Accessbility)**		**Relative Risk Ratio**	**Significance Level**
			# with positive hypertension outcome (African-American population)	# with negative hypertension outcome (African-American population)	# with positive hypertension outcome (African American population)	# with negative hypertension outcome (African-American population)		
DeKalb County (2014)								
Hypertension emergency room visits. ER Visit Rate (.0059)	179,030.00	183,843.00	1,058.00	177,972.00	1,086.00	182,757.00	1.0004	P = .9924
Cardiovascular related deaths. Rate (.0019)	179,030.00	183,843.00	335.00	178,695.00	641.00	183,202.00	0.5367	P < 0.0001
Fulton County (2014)								
Hypertension emergency room visits ER Visit Rate (.0079)	182,353.00	232,781.00	1,440.00	180,913.00	1,840.00	230,941.00	0.999	P = 0.9781
Cardiovascular related deaths Rate (.0024)	182,353.00	232,781.00	438	181915	559	232,222.00	1.0002	P = 0.9972

Source: AmericanFactFinder, U.S. Census Bureau, 2010 Census. OASIS GA Dept. of Public Health

Table 4D. County Demographic Profile for DeKalb County (2010)

Subject	Number	Percent
SEX AND AGE		
Total population	**691,893**	**100.0**
Male population	331,355	47.9
Female population	360,538	52.1
RACE		
One Race	675,381	97.6
White	230,156	33.3
Black or African American	375,725	54.3
American Indian and Alaska	2,479	0.4
Asian	35,426	5.1
HISPANIC OR LATINO		
Hispanic or Latino (of any race)	67,824	9.8
Other Hispanic or Latino [5]	24,076	3.5
HOUSEHOLDS BY TYPE		
Total households	271,809	100.0
Family households (families) [7]	161,453	59.4
Husband-wife family	97,335	35.8
With own children under 18	43,525	16.0
Male householder, no wife	14,244	5.2
With own children under 18	5,787	2.1
Female householder, no	49,874	18.3
With own children under 18	26,966	9.9
HOUSING OCCUPANCY		
Total housing units	304,968	100.0
Vacant housing units	33,159	10.9
All other vacants	7,610	2.5

Source: AmericanFactFinder, U.S. Census Bureau, 2010 Census.

Table 4E. County Demographic Profile for Fulton County (2010)

Subject	Number	Percent
SEX AND AGE		
Total population	**920,581**	**100.0**
Male population	448,267	48.7
Female population	472,314	51.3
RACE		
One Race	900,302	97.8
White	409,697	44.5
Black or African American	405,575	44.1
American Indian and Alaska Native	2,259	0.2
Asian	51,569	5.6
HISPANIC OR LATINO		
Total population	920,581	100.0
HISPANIC OR LATINO AND RACE		
Hispanic or Latino	72,566	7.9
HOUSEHOLDS BY TYPE		
Total households	376,377	100.0
Family households (families) [7]	209,215	55.6
Husband-wife family	134,308	35.7
With own children under 18 years	63,732	16.9
Male householder, no wife present	15,769	4.2
With own children under 18 years	6,685	1.8
Female householder, no husband	59,138	15.7
With own children under 18 years	33,786	9.0
HOUSING OCCUPANCY		
Total housing units	437,105	100.0
Vacant housing units	60,728	13.9
All other vacants	15,705	3.6

Source: AmericanFactFinder, U.S. Census Bureau, 2010 Census.

Appendices

Appendix A

Store Name	ADDRESS	Column1	City	State	Zip Code	Column2	County
Aldi 30	12990 Highway 9 N		Alpharetta	GA	30004	3609	FULTON
KROGER 415	12460 CRABAPPLE RD	Ste 300	ALPHARETTA	GA	30004		FULTON
KROGER 495	12870 STATE HWY 9		ALPHARETTA	GA	30004		FULTON
PUBLIX 0762	13800 Highway 9 N	Ste E	Alpharetta	GA	30004	4590	FULTON
PUBLIX 616	4900 Highway 9 N		Alpharetta	GA	30004	2921	FULTON
PUBLIX 1019	270 Rucker Rd		Alpharetta	GA	30004	4045	FULTON
PUBLIX 1060	980 BIRMINGHAM RD		ALPHARETTA	GA	30004		FULTON
PUBLIX 556	11800 HAYNES BRIDGE RD	Ste 100	ALPHARETTA	GA	30004		FULTON
Sam's Club 6646	10600 Davis Dr		Alpharetta	GA	30004	4746	FULTON
SUPERMERCADO EL TORITO	5445 Atlanta Hwy	Ste B	Alpharetta	GA	30004	5924	FULTON
Walmart S/C 2941	5200 Windward Pkwy		Alpharetta	GA	30004	3842	FULTON
Walmart Supercenter 4436	5455 Atlanta Hwy		Alpharetta	GA	30004	2928	FULTON
KROGER STORE 469	11875 Douglas Rd		Alpharetta	GA	30005		FULTON
PUBLIX 1089	5180 McGinnis Ferry Rd		Alpharetta	GA	30005	1792	FULTON
Walmart NEIGHBORHOOD MARK	11770 Haynes Bridge Rd		Alpharetta	GA	30009		FULTON
Whole Foods Market 10488	2800 Old Milton Pkwy		Alpharetta	GA	30009	2201	FULTON
MBH Supermarket LLC 1	4212 E Ponce De Leon Ave		Clarkston	GA	30021	1820	DEKALB
Aldi 26	10955 Jones Bridge Rd		John's Creek	GA	30022		FULTON
KROGER 344	3000 Old Alabama Rd		Alpharetta	GA	30022	5860	FULTON
KROGER 390	10945 State Bridge Rd		Alpharetta	GA	30022	8164	FULTON
KROGER 444	5665 GEORGIA HWY #9		ALPHARETTA	GA	30022		FULTON
KROGER 653	8465 HOLCOMB BRIDGE RD		ALPHARETTA	GA	30022		FULTON
PUBLIX 515	11585 Jones Bridge Rd Ste 500		Alpharetta	GA	30022	8173	FULTON
Publix 469	9925 Haynes Bridge Rd		Johns Creek	GA	30022		FULTON
The Fresh Market 034	3005 Old Alabama Rd		Alpharetta	GA	30022		FULTON
KROGER 459	501 Dekalb Industrial Way		Decatur	GA	30030	1704	DEKALB
KROGER 651	720 Commerce Dr		Decatur	GA	30030	2622	DEKALB
ALDI 59	3480 Memorial Dr		Decatur	GA	30032	2708	DEKALB
KROGER 303	3479 MEMORIAL DR		DECATUR	GA	30032		DEKALB
PIGGLY WIGGLY 658	2112 Candler Rd		Decatur	GA	30032	5500	DEKALB
Walmart Supercenter 3710	3580 Memorial Dr		Decatur	GA	30032		DEKALB
WAYFIELD FOODS 16	1757 Columbia Dr		Decatur	GA	30032	4618	DEKALB
PUBLIX 0723	2155 N Decatur Rd		Decatur	GA	30033	5307	DEKALB
PUBLIX 665	3870 N Druid Hills Rd		Decatur	GA	30033	3002	DEKALB
Walmart Supercenter 3118	2525 N Decatur Rd		Decatur	GA	30033	6126	DEKALB
ALDI 56	4900 Flat Shoals Pkwy		Decatur	GA	30034	5209	DEKALB
KROGER STORE 475	4919 Flat Shoals Pkwy	Ste 100	Decatur	GA	30034	5256	DEKALB
PUBLIX 269	3649 Flakes Mill Rd		Decatur	GA	30034	5218	DEKALB
KROGER 375	2385 Wesley Chapel Rd		Decatur	GA	30035	2803	DEKALB
PUBLIX 0804	2075 S Hairston Rd		Decatur	GA	30035	2504	DEKALB
Food Depot 54	3590 Panola Rd		Lithonia	GA	30038	2731	DEKALB
PUBLIX 0752	3045 Panola Rd		Lithonia	GA	30038	2317	DEKALB
Sam's Club 4810	2994 Turner Hill Rd		Lithonia	GA	30038	2526	DEKALB
Walmart S/C 1340	5401 FAIRINGTON RD		LITHONIA	GA	30038		DEKALB
ALDI 50	6650 Covington Hwy		Lithonia	GA	30058	4814	DEKALB
KROGER 445	6678 Covington Hwy		Lithonia	GA	30058	4814	DEKALB
Walmart Neighborhood Market 4	6152 Covington Hwy		Lithonia	GA	30058	8377	DEKALB
WAYFIELD FOODS 10	2636 Max Cleland Blvd		Lithonia	GA	30058	4454	DEKALB
Aldi 16	600 Mansell Rd		Roswell	GA	30075		FULTON
KROGER 431	570 E Crossville Rd		Roswell	GA	30075	3034	FULTON
KROGER 441	2300 HOLCOMB BRIDGE RD		ALPHARETTA	GA	30075		FULTON
Kroger 497	900 HWY 120		Roswell	GA	30075		FULTON
PUBLIX 0086	4401 SHALLOWFORD RD		ROSWELL	GA	30075		FULTON
PUBLIX 0825	4750 OLD ALABAMA RD NE	#80	ROSWELL	GA	30075		FULTON
Publix 626	885 Woodstock Rd	Ste 100	Roswell	GA	30075	2276	FULTON
The Fresh Market 217	1125 Woodstock Rd	Ste 400	Roswell	GA	30075	2293	FULTON
Trader Joe's 733	635 W Crossville Rd		Roswell	GA	30075	2500	FULTON
Walmart Neighborhood Market 2	4651 Woodstock Rd		Roswell	GA	30075		FULTON
PUBLIX 1043	1425 Market Blvd	Ste 600	Roswell	GA	30076	6711	FULTON
Sprouts Farmers Market 520	10800 Alpharetta Hwy	Ste C-410	Roswell	GA	30076		FULTON
Walmart S/C 1578	970 Mansell Rd		Roswell	GA	30076	1506	FULTON
Food Depot 61	4100 Redan Rd		Stone Mountain	GA	30083	5038	DEKALB
Ingles Markets 421	4815 Rockbridge Rd		Stone Mountain	GA	30083	4250	DEKALB
KROGER 447	965 N Hairston Rd		Stone Mountain	GA	30083	2880	DEKALB
Walmart SuperCenter 3188	5935 Memorial Dr		Stone Mountain	GA	30083	3429	DEKALB
KROGER 212	3959 Lavista Rd Ste A		Tucker	GA	30084	5152	DEKALB
PUBLIX 544	4422 Hugh Howell Rd		Tucker	GA	30084	4905	DEKALB
Sam's Club 6409	1940 Mountain Industrial Blvd		Tucker	GA	30084	6619	DEKALB
Walmart Neighborhood Market 3	3201 Tucker Norcross Rd		Tucker	GA	30084		DEKALB

Mercado Acapulco	2179 Cheshire Bridge Rd NE		Atlanta	GA	30324	4275	FULTON
Publix 1044	2325 Cheshire Bridge Rd NE		Atlanta	GA	30324	3725	FULTON
PUBLIX 599	1544 PIEDMONT AVE.		ATLANTA	GA	30324		FULTON
Sprouts Farmers Market 519	1845 Piedmont Ave NE	Apt 500	Atlanta	GA	30324	5141	FULTON
PUBLIX 664	3535 PEACHTREE STREET		ATLANTA	GA	30326		FULTON
PUBLIX 0720	1250 W Paces Ferry Rd NW		Atlanta	GA	30327	2306	FULTON
Aldi 20	6336 Roswell Rd NE		Atlanta	GA	30328	3210	FULTON
KROGER 467	227 SANDY SPRINGS PL		SANDY SPRINGS	GA	30328		FULTON
PUBLIX 0468	6615 Roswell Rd NE		Atlanta	GA	30328	3103	FULTON
PUBLIX 647	1100 HAMMOND DR.		ATLANTA	GA	30328		FULTON
Trader Joe's 731	6277 Roswell Rd NE		Sandy Springs	GA	30328	3207	FULTON
WHOLE FOODS MARKET 10136	5930 Roswell Rd NE		Atlanta	GA	30328	4908	FULTON
Brito Supermarket	3020 Buford Hwy NE		Atlanta	GA	30329	1804	DEKALB
KROGER 318	2205 Lavista Rd NE		Atlanta	GA	30329	3917	DEKALB
KROGER 218	3855 Buford Hwy NE		Atlanta	GA	30329	1003	DEKALB
Walmart S/C 2584	4375 Lawrenceville Hwy		Tucker	GA	30084	3702	DEKALB
FOOD DEPOT 47	5741 Rockbridge Rd Ste 100		Stone Mountain	GA	30087	5702	DEKALB
KROGER 449	1227 ROCKBRIDGE RD		STONE MOUNTAIN	GA	30087		DEKALB
PUBLIX 494	380 N Deshong Rd		Stone Mountain	GA	30087	4797	DEKALB
Walmart STORE 1184	1825 ROCKBRIDGE RD		STONE MOUNTAIN	GA	30087		DEKALB
KROGER 354	1232 S Hairston Rd		Stone Mountain	GA	30088	2715	DEKALB
KROGER 476	6505 Sugarloaf Pkwy	Ste 200	Duluth	GA	30097		FULTON
Sprouts Farmers Market 522	2220 Peachtree Industrial Blv	Ste 200	Duluth	GA	30097		FULTON
WHOLE FOODS MARKET 10215	5945 STATE BRIDGE RD		DULUTH	GA	30097		FULTON
Food Depot 30	80 NW Broad St		Fairburn	GA	30213	1483	FULTON
PUBLIX 1183	5370 CAMPBELLTON FAIRBURN RD		FAIRBURN	GA	30213		FULTON
KROGER 247	4550 Jonesboro Rd		Union City	GA	30291	2050	FULTON
Walmart Supercenter 855	4735 Jonesboro Rd		Union City	GA	30291	1915	FULTON
INGLES MARKETS 445	100 Fairview Rd		Ellenwood	GA	30294	2723	DEKALB
KROGER 427	101 Fairview Rd		Ellenwood	GA	30294	2722	DEKALB
Walmart Supercenter 3609	2940 Anvil Block Rd		Ellenwood	GA	30294	2403	DEKALB
KROGER 259	3330 Piedmont Rd NE		Atlanta	GA	30305	1726	FULTON
PUBLIX 0719	2365 Peachtree Rd NE		Atlanta	GA	30305	4147	FULTON
PUBLIX 282	2900 PEACHTREE ROAD NW		ATLANTA	GA	30305		FULTON
Trader Joes 735	3183 Peachtree Rd NE		Atlanta	GA	30305	1851	FULTON
WHOLE FOODS MARKET 10206	43 W Paces Ferry Rd NW		Atlanta	GA	30305	1301	FULTON
KROGER 655	1799 BRIARCLIFF RD NE		ATLANTA	GA	30306		FULTON
PUBLIX 0724	1001 Ponce de Leon Ave NE		Atlanta	GA	30306	4215	FULTON
KROGER 461	1225 Caroline St NE		Atlanta	GA	30307	2705	FULTON
KROGER 295	725 Ponce de Leon Ct NE		Atlanta	GA	30308	1809	FULTON
PUBLIX 0776	595 PIEDMONT RD		ATLANTA	GA	30308		FULTON
Trader Joe's 730	931 Monroe Dr NE		Atlanta	GA	30308	1793	FULTON
WHOLE FOODS MARKET 10196	650 PONCE DE LEON AVE NE		ATLANTA	GA	30308		FULTON
PUBLIX 1061	950 W PEACHTREE ST NW		ATLANTA	GA	30309	3854	FULTON
The Fresh Market 061	2099 Peachtree Rd NE		Atlanta	GA	30309	1431	FULTON
KROGER 412	590 Cascade Ave SW		Atlanta	GA	30310	2467	FULTON
Best 4 Less Food Mart	2200 Campbellton Rd Sw		Atlanta	GA	30311	4608	FULTON
KROGER 465	3425 CASCADE RD		ATLANTA	GA	30311		FULTON
KROGER STORE 462	3030 HEADLAND DR SW		ATLANTA	GA	30311		FULTON
Super Giant Food	2080 Campbellton Rd SW		Atlanta	GA	30311	4812	FULTON
WAYFIELD FOODS 19	3050 Martin Luther King Jr Dr	Ste H	Atlanta	GA	30311	1500	FULTON
Walmart SUPERCENTER 3008	825 Martin Luther King Jr Dr		Atlanta	GA	30314		FULTON
KROGER 364	2685 Metropolitan Pkwy SW		Atlanta	GA	30315	7900	FULTON
Aldi 58	1461 Moreland Ave SE		Atlanta	GA	30316	3128	FULTON
Kroger 672	800 Glenwood Ave SE		Atlanta	GA	30316	1814	FULTON
KROGER STORE 488	1160 Moreland Ave SE		Atlanta	GA	30316	3256	FULTON
Piggly Wiggly 77	1257 Moreland Ave SE		Atlanta	GA	30316	3183	FULTON
PUBLIX 0783	2235 Glenwood Ave SE		Atlanta	GA	30316	2319	FULTON
Walmart SUPERCENTER 3709	2427 Gresham Rd SE		Atlanta	GA	30316	3709	FULTON
Wayfield Foods 2	2532 Bouldercrest Rd SE		Atlanta	GA	30316	4838	FULTON
Best For Less	1001 Northside Dr NW		Atlanta	GA	30318	5421	FULTON
KROGER 346	1715 Howell Mill Rd NW		Atlanta	GA	30318	3113	FULTON
PUBLIX 1119	2020 Howell Mill Rd NW	Ste A	Atlanta	GA	30318	1732	FULTON
SUPER GIANT FOOD	2176 Donald Lee Hollowell Pkwy NW		Atlanta	GA	30318	4788	FULTON
Walmart Supercenter 3775	1801 Howell Mill Rd NW		Atlanta	GA	30318	911	FULTON
Costco Wholesale 1084	500 Brookhaven Ave		Atlanta	GA	30319		DEKALB
KROGER 652	2036 JOHNSON FERRY RD		ATLANTA	GA	30319		DEKALB
PUBLIX 601	3435 Ashford Dunwoody Rd NE		Atlanta	GA	30319	2546	DEKALB
Publix 1363	104 Town Blvd	Ste A100	Atlanta	GA	30319		DEKALB
KROGER 298	1700 Monroe Dr NE		Atlanta	GA	30324	5033	FULTON

PUBLIX 0773	2969 N Druid Hills Rd NE		Atlanta	GA	30329	3909	DEKALB
Sam's Club 6643	2901A Clairmont Rd NE		Atlanta	GA	30329	1611	DEKALB
The Fresh Market 202	2480 Briarcliff Rd NE	Ste 19C	Atlanta	GA	30329	3034	DEKALB
WHOLE FOODS MARKET 10094	2111 Briarcliff Rd NE		Atlanta	GA	30329	3719	DEKALB
PUBLIX 0503	3695 CASCADE ROAD		ATLANTA	GA	30331		FULTON
PUBLIX 1056	3730 Carmia Dr SW	Ste 200	Atlanta	GA	30331	6259	FULTON
Walmart Supercenter 3741	1105 Research Center Atlanta D		Atlanta	GA	30331		FULTON
WAYFIELD FOODS 11	3465 Main St		College Park	GA	30337	1910	FULTON
KROGER 210	4498 CHAMBLEE DUNWOODY RD		DUNWOODY	GA	30338	6201	DEKALB
PUBLIX 0765	5550 Chamblee Dunwoody Rd		Dunwoody	GA	30338	4111	DEKALB
The Fresh Market 043	5515 Chamblee Dunwoody		Dunwoody	GA	30338	4106	DEKALB
Walmart Supercenter 2360	4725 Ashford Dunwoody Rd		Dunwoody	GA	30338		DEKALB
SUPERMERCADO CHICAGO	5263 Buford Hwy NE		Doraville	GA	30340	1106	DEKALB
Supermercado El Guero	3658 Shallowford Rd		Doraville	GA	30340		DEKALB
Brito Supermarket	3322 Chamblee Tucker Rd		Atlanta	GA	30341	4353	DEKALB
KROGER 491	3871 N Peachtree Rd		Atlanta	GA	30341	1921	DEKALB
KROGER STORE 479	3559 Chamblee Tucker Rd		Atlanta	GA	30341	4409	DEKALB
SUPERMERCADO LA FAVORITA	3245 Chamblee Dunwoody R	Ste B100	Atlanta	GA	30341	2994	DEKALB
Supermercado Talpa 2	4317 Buford Hwy		Atlanta	GA	30341	5027	DEKALB
Walmart SUPERCENTER 3621	1871 Chamblee Tucker Rd		Chamblee	GA	30341	2737	DEKALB
KROGER 350	4920 ROSWELL RD		ATLANTA	GA	30342		FULTON
PUBLIX 0718	4279 ROSWELL RD NE		ATLANTA	GA	30342		FULTON
PUBLIX 1249	5630 Roswell Rd NE		Atlanta	GA	30342	1102	FULTON
PUBLIX 721	4305 STATE BRIDGE RD		ALPHARETTA	GA	30342		FULTON
Sprouts Farmers Market 517	4600 Roswell Rd	Ste A100	Sandy Springs	GA	30342	3047	FULTON
Supermercado Santa Fe	178 Northwood Dr NE		Atlanta	GA	30342	1019	FULTON
The Fresh Market 084	4405 Roswell Rd		Atlanta	GA	30342	3316	FULTON
Piggly Wiggly	3100 Washington Rd		Atlanta	GA	30344	5415	FULTON
Walmart Supercenter 6998	844 CLEVELAND AVE		EAST POINT	GA	30344	2907	FULTON
WAYFIELD FOODS 18	2020 Headland Dr		East Point	GA	30344	2135	FULTON
Aldi 57	3963 Buford Hwy NE		Atlanta	GA	30345		DEKALB
KROGER 482	4357 LAWRENCEVILLE HWY		TUCKER	GA	30345		DEKALB
KROGER 634	8876 DALLAS ACWORTH HWY		DALLAS	GA	30345		DEKALB
PUBLIX 0800	2562 Shallowford Rd NE		Atlanta	GA	30345	1202	DEKALB
PUBLIX 691	2162 Henderson Mill Rd NE		Atlanta	GA	30345	3762	DEKALB
ALDI 55	5820 Riverdale Rd		College Park	GA	30349	6202	FULTON
Best Supermarket	4515 Washington Rd		Atlanta	GA	30349	2203	FULTON
KROGER 471	6055 Old National Hwy		College Park	GA	30349	4325	FULTON
Super Giant Mart	5658 Riverdale Rd	Ste M	Atlanta	GA	30349	7316	FULTON
Walmart SUPERCENTER 3401	6149 OLD NATIONAL HWY		COLLEGE PARK	GA	30349		FULTON
WAYFIELD FOODS 17	3435 ROOSEVELT HWY		ATLANTA	GA	30349		FULTON
Wayfield Foods 3	5432 Riverstation Blvd		Atlanta	GA	30349	9199	FULTON
KROGER 313	8331 Roswell Rd		Atlanta	GA	30350	2810	FULTON
KROGER 324	2090 DUNWOODY CLUB DR		DUNWOODY	GA	30350		FULTON
PUBLIX 646	7525 Roswell Rd		Atlanta	GA	30350	4838	FULTON
PUBLIX 514	8725 Roswell Rd	Ste G	Atlanta	GA	30350	7500	FULTON
Walmart Neighborhood Market 3	5025 Winters Chapel Rd		Dunwoody	GA	30360		DEKALB
PUBLIX 1010	1380 Atlantic Dr NW	Ste 14135	Atlanta	GA	30363	1144	FULTON

Appendix B

Demographic Clusters of Georgia

By Frank Millard
Revised by Kim Zhou, July, 2012

Demographic clusters were created from EASI Demographics data (2011) available at the census block group level of the 2010 census geographies, containing 25 variables relating to age, income, family structure, housing value and type, education attainment and employment type.

A classification model composed of Two-Step-Clustering and Discriminant Analysis was used to classify census block groups based on the 25 selected variables. The census block groups were first classed into four major groups, which were further partitioned into a total of eighteen distinct demographic clusters.

The legend is arranged by the derived socioeconomic status, from "higher" to "lower", within the four major groups and their respective demographic clusters.

A.1 Georgia's wealthiest cluster is primarily populated by "new money" executives and professionals living in tract mansions of metropolitan suburbs and exurbs. Predominantly White with an above average index for Asians, this highly educated cluster is composed of married couples in their middle adulthood ages (45-64) with young and adolescent children.

A.2  This well-educated, suburban cluster, dominated by professionals and managers, has the second highest level of affluence in the state. Mostly White with a high percentage in their middle or late adulthood (55+), they have adolescent and grown children.

A.3  Found in the metro suburbs, this mixed-ethnicity with majority of Whites and high index for African-Americans, more youthful cluster is populated by married couples in their late 20's through early 40's with young children. The majority has some college degree or are college graduates. Most are employed in sales and other white-collar jobs, while some are high-earning blue-collar families. This cluster has a median household income well above the state average.

B.1 This cluster is characterized by its high concentration of White and Asian non-family households renting in upscale apartments. With easy access to major highways, this cluster is the home for young managers and professionals in their late 20's through early 40's, predominately with college degrees and beyond. They live a modern urban lifestyle in the most densely populated urban neighborhoods before they establish families and move to suburban areas.

B.2 This small cluster is populated by military personnel in their early and young adulthood ages (18-34) with some college degrees. Majority of the population are White. They live in rented apartments and condos in urban areas. Their median income is around the state average.

B.3  This is a mixed-ethnicity cluster with a high index of Asian and Multiracial non-family households living in middle-range value apartments in urban/suburban areas. Although many have some college degrees or are college graduates, their median income is below the state average due to their recent entry into the workforce.

B.4  This mixed-ethnicity cluster mainly represents the college populations in Georgia (populations living in group quarters). They are mostly between 18-24 years of age and have incomes lower than the state average.

C.1 This is a White, middle-class rural cluster dominated by married families of people aged 55 years and over. They are mainly home owners, but the value of their housing is lower than in some of the urban and suburban clusters. Many in this cluster are high school graduates. Found predominantly in N/NE rural counties of Georgia, this cluster is highly represented in farming, production, and construction.

C.2 This rural cluster is dominated by married families of people in their middle adulthood ages with young and adolescent children. Found widespread in rural counties of Georgia, the cluster is White with some African-American population. Many people are in construction and production jobs; their incomes are average compared to the state.

C.3 Found in relatively populated areas in rural counties, this mixed-ethnicity cluster with high index of African-Americans is populated by older people living in old houses. With mixed levels of education, people in this cluster mainly work in lower paying service, sales and managerial jobs earning below state average incomes.

C.4  This rural cluster is composed of married and single parent families of predominantly White population with or without children. Most have high school diploma or less; they mainly work in farming, production, and construction earning well below the state average income.

D.1 An urban cluster, this mixed-race group has a high representation of single-parent families with or without children. Most have a high school diploma or less; this group mainly works in the service industry earning lower than state average income. They live in rented apartments or old houses of low housing values.

D.2  This is a small cluster composed of military personnel in their early and young adulthood ages (18-34) with some college degrees. A mixed-ethnicity group with majority of Whites, this cluster is populated by married and single families with young children. The percentage of population 18 years of age and younger is higher than any other cluster in the state.

D.3  This is the oldest urban cluster with high proportion of 55 years of age and older. Primarily African-American with a high index for non-Hispanic Whites, this cluster is characterized by single family or non-family households living in their own old houses in urban/suburban areas. They work in low-paying service and sales jobs earning incomes lower than the state average.

D.4  This cluster is composed predominantly of African-Americans with a high percentage of single family households with or without children. It is relatively young among urban clusters with a high percentage of population between 18-34 years of age. They are primarily renters, have high school or less than high school educations and work in service industry--making 30% below the state average in income.

D.5  This is a mixed-ethnicity cluster with a high index of Hispanics and Multiracial groups. Most have high school diploma or less; they mainly work in low-paying blue collar jobs in production and construction industries. The cluster's housing is half owner-occupied and half renter- occupied with a high percentage of vacant housing.

D.6  This cluster is predominantly populated by African-Americans with high percentage of population in their 60's and over. Most have a high school diploma or less; they mainly work in service industries. Their median income is second lowest in the state.

D.7  This cluster is predominantly composed of very young African-Americans with more females than males. The cluster has the highest percentage of population less than 18 years of age in non-military clusters in the state, of whom most live in female-headed households. Most have a high school diploma or less; they work in low-paying jobs and live in rental units. The median household income in this cluster is the lowest in the state.

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