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Health care in the United States has been a contentious subject for many years and various aspects of health care have been subject to numerous legislative debates, news pieces, and research papers. One subject that has not been focused on enough is primary healthcare accessibility in small and medium urban areas. This study seeks to fill in the gap with a focus on Forsyth County, North Carolina, a medium sized county.

This study uses Geographic Information Science (GIS) to measure the distance from Census block groups to the nearest primary care facility. Data used for analysis included primary care facilities in Forsyth County and facilities just outside of the county limits. Block group demographic data was obtained from the United States Census Bureau.

Most block groups in Forsyth County were close to a facility with most being around one mile to the nearest facility. The county's biggest city, Winston-Salem, had the most facilities and were the closest to facilities overall. The rural edges of the county had fewer facilities and were further away from facilities. This study does not account from population behavior, as residents may not use their nearest facility. Factors for this include cost and transportation. This study does provide a foundation for future studies in Forsyth County and in other small and medium sized urban areas.

GEOGRAPHY OF PRIMARY HEALTHCARE
IN FORSYTH COUNTY,
NORTH CAROLINA

by
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APPROVAL PAGE

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CHAPTER I

INTRODUCTION

Healthcare in the United States has been a contentious subject for many years and various aspects of healthcare have been subject to numerous legislative debates, news pieces, and research papers. There has been an uptick of discussion surrounding health care in the last decade, spurred on by the passage of the Affordable Health Care Act (ACA) in 2010, the rising cost of healthcare, and the closure of rural hospitals and the general disparity of health care between rural and urban areas. The disparity of health care between rural and urban areas is wide. Rural areas are significantly more underserved by healthcare institutions, including doctors and hospitals, than urban areas (Health Policy Institute, n.d.). Reasons for this are economic, just like any other business or service, health facilities tend to go where there are more potential customers and better paying customers. In other words, the supply goes to where there is more demand (Graham, 2018). In general, urban areas are served far better than rural areas, with more facilities and doctors located closer by. While urban areas are better served than rural areas, not all urban areas are evenly served. Some areas of a city may have better access to health care than other areas of a city. Factors include the median age of a community, the income, the racial background, or a mixture of these of factors. While there are numerous studies on urban health care accessibility, the literature on accessibility in smaller urban areas, such as areas with a population of less than 500,000, is generally

lacking. This paper seeks to help fill this void with a case study of a medium sized urban county, Forsyth County, North Carolina. This study maps primary care facilities in the county to determine which parts of the county are closer to facilities than others and to look at the demographic differences between those areas that are well served and those areas that are less well served. The health care facilities that were located and mapped include primary care for children and adults, urgent care centers, and hospitals that provide emergency services. US Census data are used to analyze the demographics of the population to determine if certain populations are overserved or underserved.

Importance of Primary Care

In 2010, the United States Department of Health and Human Services launched an initiative called Health People 2020. The initiative outlined goals to be achieved by the end of the decade which would lead to healthier communities. One of these goals was to improve healthcare access. Access to healthcare is important “...for promoting and maintaining health, preventing and managing disease, reducing unnecessary disability and premature death...” (ODPHD, 2010).

One of the most important outlets for a foundation of quality healthcare access is primary care. The World Health Organization defines primary care as

...a whole-of-society approach to health and well-being centered on the needs and preferences of individuals, families and communities. It addresses the broader determinants of health and focuses on the comprehensive and interrelated aspects of physical, mental and social health and wellbeing (2019).

Primary care physicians help with everyday health issues and with improving lifelong health, and fall into several categories, including family medicine, internal medicine, pediatrics, and obstetric/gynecologic care, the latter two being a form of specialized primary care (Novant Health; Wake Forest Baptist Health). To put it in simple terms, primary healthcare can help treat current medical issues, such as illness, and can prevent medical issues that might become a problem in the future.

Primary care has several characteristics that distinguishes it from specialty care. These are first contact, longitudinal, comprehensive, and coordination. First contact refers to providing health care, so it is accessible to those who need it and when they need it. Longitudinal care is not geared to treating a specific ailment but rather is focused on a person's health over a stretch of time. This requires what is called a usual source of care, i.e. a regular doctor. Comprehensive refers to the idea of treating a wide range of medical problems. Coordination is required when a patient must go to a specialist for treatment for a health problem. The specialist receives information from the primary care and the primary care receives information about the treatment from the specialist. (Starfield, 1993)

There have been many studies focusing on spatial access to healthcare in larger urban areas. However, there seems to be a lack of studies done on small or medium urban areas. The federal government classifies Forsyth County as a medium metro county as it has between 250,000 and 1,00,000 people. Its largest city, Winston-Salem, has a population of around 250,000. Previous health care studies have looked at either rural areas, large metropolitan areas with populations of 1,000,000 or more, or large regions of

a state. Some studies, such as Cunningham and Kemper (1998), did include smaller and medium metropolitan areas in its analysis of uninsured patients. Luo and Qi (2009) and Luo (2004) also covered less populated urban areas, in studies that focused on areas in Illinois. There are studies that use smaller urban areas as case studies, but there is still a lack of diversity in the field of accessibility studies, especially those using Geographic Information Systems (GIS) to analyze the spatial patterns of healthcare.

There has been one recent study of healthcare in Forsyth County. The nonprofit Forsyth Futures conducted a study looking into the state of health care in Forsyth County in 2014. According to their findings, while Forsyth County does not have a lack of health practitioners on the county level, there are primary care shortages in certain areas, particularly within Winston-Salem. The study found that in those underserved areas, over 25% of the population did not have access to a vehicle. While there are bus routes running through the areas, transportation is still identified as a barrier to healthcare access and to making and keeping appointments.

Previous studies have shown that there is uneven access to health care via primary care facilities, so many individuals rely on other sources of care. Health care access is also available from health clinics and hospital emergency departments. Field, Hussein, and Roux (2016) explored whether lower-income residents are associated with poorer access to usual sources of primary care (i.e. seeing a doctor regularly). In a 10-year survey of Philadelphia and the surrounding areas, it was found that lower-income neighborhoods were not associated with a lack of care. However, residents living in lower-income neighborhoods were associated with a lower reliance on doctor offices and

a greater reliance on community health clinics and outpatient clinics in hospitals. Some of the reasons for this include health clinics are more likely to accept patients on Medicaid or uninsured patients. Health clinics are more concentrated in lower-income neighborhoods which makes them more convenient.

While neighborhood clinics can close the gap in spatial access, clinics often cannot treat every health issue and every patient that comes through their doors. Forsyth Futures identified four barriers to providing health care at Forsyth County clinics: coordination of care between other providers and clinics, complexity of care due to specific issues (such as chronic conditions) paired with socioeconomic factors, the inability to provide some services, and some clinics had to turn away people due to the volume of patients. Hawthorne and Kwan (2012) found that in lower-income areas in Columbus, Ohio, residents bypassed community health clinics that were closer to them but were perceived as having lower quality of care. Some neighborhood clinics do not serve their neighborhood well.

One area of concern is preventable emergency department usage. In a study done by Fishman, McLafferty, and Galanter (2018) which sampled Emergency Departments (EDs) in Chicago, those living in Medical Underserved Areas (MUAs) were more likely to use EDs and those living in an area with higher spatial access to healthcare offices were less likely to use EDs. They also found that women, younger people, and those with non-white backgrounds used EDs more. Lastly, people living in areas with higher median incomes were less likely to use EDs and had higher levels of primary care usage. Forsyth Futures found that around half of the visits to EDs in Forsyth County were from health

issues that were treatable at a primary care facility or could have been prevented through regular visits to a primary care physician.

Definition of Accessibility

What is healthcare accessibility? According to the Institute of Medicine Committee on Monitoring Access to Personal Health Care Services (1993), access is defined as “the timely use of personal health services to achieve the best possible health outcomes.” The study states that defining access is difficult, as many people think of access as healthcare coverage or how many healthcare facilities and physicians are available nearby. It is more complicated than that, as healthcare accessibility compasses many different factors, some geographical and some not. Various researchers and committees have attempted to define accessibility. The following section highlights some of those attempts.

Guagliardo (2004) writes that there are multiple ways to define access to care, however, each has difficulties in its definition. Access can be defined as spatial or aspatial (social). Spatial access is influenced by a distance variable and is more directly geographic. Aspatial access is influenced by non-geographic elements but can still have a geographic component (Khan, 1992). Access can also refer to either the potential for healthcare use or to the act of using or receiving healthcare. There is a difference between having the ability to receive health care and actually receiving health care. In order to cut down on confusion, Guagliardo writes that it would be helpful to think of access in terms of “stages.” These two stages include the “potential” for receiving healthcare and “realized” delivery of health care. Potential is where a population in need of care and a

health care system is willing and able to give it. Realized, or actualized, care is where healthcare is delivered to those in need. In order to get to the realized stage, the barriers to care must be overcome.

Not everyone has easy access to healthcare. Barriers to receiving health care can be difficult to overcome at times. In an often-cited study, Thomas and Penchansky (1981) identified five barriers to healthcare: availability, accessibility, affordability, accommodation, and acceptability. Availability is the supply of services and resources to a population. This can include the number of physicians available and the number of hospitals and clinics in an area. Accessibility refers to the location of services and the location of the population they are designed to serve. Accessibility considerations include travel time, travel cost, and available transportation. Affordability is the ability to pay for care, and considering the high costs of healthcare, this hinges on whether an individual has health insurance. Accommodation refers to how services accept patients. For example, how appointments are made (by phone or online), whether an office accepts walk-ins, the hours an office is open (some offices are open evenings or on weekends), and so forth. Acceptability refers to the attitudes towards certain patients. For example, a practice might provide services for Spanish-speaking patients, or a clinic might be sensitive to individuals living in a low-income neighborhood. It can also refer to patients' attitudes towards doctors as well. A lower income patient may not be comfortable in a practice that typically serves a more affluent population or is not accommodating to non-English speakers. Accessibility and availability are considered spatial barriers while affordability, accommodation, and acceptability are considered non-spatial barriers.

Barriers to health care can result in patients delaying care for health ailments or avoiding health care, which can lead to preventable hospitalization or even early death.

Since the rise of new technology such as smartphones and virtual visitations, some have suggested the need to redefine access in 21st century terms. Fortney, et al (2011) suggest adding a “digital” dimension to access. Digital access includes connectivity to healthcare providers and access to digital health applications. It also includes whether patients have access to the technology to use these new tools. Since much of the technology is relatively new, digital access has not usually been included in accessibility studies. With this newer technology, some people may use telehealth instead of traditional healthcare facilities. As a result, the geographic accessibility factors may not matter as much. Of course, serious concerns will still require face-to-face treatment and not everyone has access to digital means, or the ability to utilize it, and many are simply not comfortable using it. Still, as technology improves, it will be increasingly used.

One of the most common ways to measure the access to the availability of healthcare in a given area is through the number of primary care physicians. According to the Health Resources and Services Administration, a Medically Underserved Area (MUA) is a geographic area that is identified as an area with a lack of primary care. MUAs can cover a whole county—often a rural county— a census tract, or another geographic division. The designation of a MUA is based on what is known as an Index of Medical Underservice (IMU). The IMU is based off the population to providers ratio, the

percent of population below the poverty level, the population over the age of 65, and the infant mortality rate.

CHAPTER II

REVIEW OF LITERATURE

There has been a great variety of studies conducted on spatial access to healthcare with a multitude of ways of measuring spatial access. These studies are useful in understanding how healthcare is geographically distributed across varying social, economic and geographic landscapes. Some focus on the distribution of physicians (by using a ratio between number of doctors and population) while others focus on travel time to and from medical facilities. Still others focus on the distribution of facilities in certain areas, such as lower income areas.

Previous Studies

Gaskin, Dinwiddie, Chan, and McCleary (2012) examined the role of racial segregation in the availability of primary care in metropolitan statistical areas (MSAs). They used ZIP code level data for primary care physicians with income, demographic, and segregation data from the Census. They classified an area as having a primary care shortage area if a ZIP code had either no primary care physicians or had a low population to primary care physician ratio. The study concluded that the odds of an area with a majority African American falling into the shortage category were high—67 percent higher than other groups.

The relationship between neighborhoods and the usage of healthcare is unclear. Cunningham and Kemper found that uninsured persons have an easier time obtaining

healthcare in some cities than others. Neighborhood demographics do not always explain healthcare disparities. Prentice (2006) found that neighborhood environment varies from neighborhood to neighborhood and can affect how individuals access healthcare. Factors include neighborhood information networks, behavior norms towards healthcare, social capital, and healthcare resources.

Mudd, et al. (2019) performed a longitudinal study which looked at neighborhood level access to pediatrician primary care in Philadelphia. They defined a neighborhood as a census tract and used a 5-minute drive time buffer from a health care service to determine whether a neighborhood had access to that service. They found that while some neighborhoods had high accessibility, many in the city do not. The neighborhoods with the lowest access had a high proportion of non-Hispanic black residents. Guagliardo et al. (2004) found similar results in their study of access to pediatrician care in Washington D.C. While overall the city had a high supply of pediatricians, areas with a high rate of African Americans had a low rate of accessibility.

Accessibility to healthcare facilities requires convenient transportation connections such as bus or train stops near the facilities or facilities being built near major roads. In a paper by Frazzano, Popick, and Trachtenberg (2009) which looked at access to health care in Rhode Island, physicians' offices typically cluster around hospitals and other primary care facilities. They also found that most of the hospitals and clinics in the state tend to cluster around bus lines for easy transportation.

Tayyab, Bell, and Wilson (2016) compared health care access across metropolitan areas in Canada. They found that in the cities surveyed, neighborhoods with the highest

access were located in the downtown area and decreased in areas surrounding the downtown and decreased even more in the periphery of the city. In cities that had multiple downtowns or core areas, the spatial distribution differed, possibly due to overlapping downtown areas. They explained that the center of the city there is more commercial space for offices while there are more residential areas in outlying neighborhoods which would explain this disparity of access in different parts of the city. Within the cities, they found that the neighborhoods with poor access tended to have disadvantaged groups such as recent immigrants, single-parent households, lower levels of education, and the aboriginal.

Harrington, Rosenberg, and Wilson (2014) compared health care access between five of Canada's largest cities. There was variation of health care access between the cities, largely depending on how health care was offered or how large the investment of health care was in a particular city. Within all of the cities investigated, they found that certain populations were more likely to not have a regular doctor: males, recent immigrants (living in the country for less than 10 years), and lower income people.

Aspatial factors, such as acceptability, can impact spatial health care access and there can be variations of access between neighborhoods. Bell et al. (2013) studied neighborhood access in Mississauga, Ontario in Canada. One of their findings was that languages spoken, and immigration status played a role in access. For example, while there was high access for French speakers (an official language in Canada), there was lower access for speakers of non-official languages such as Urdu. In the United States, where there is a large immigrant population, language barriers could be a problem as

well. Problems can arise in accessibility when health care facilities cannot accommodate speakers of other languages.

Some studies used the ratio of physicians to population, with travel time factored in, to determine access. Luo and Wang (2003) used the Chicago area as a case study, and found that areas with hospitals, but fewer residents, had the best access. These areas were all near interstates which provided easy transportation access. Luo and Qi (2009) used a slightly different method to measure physician shortages in northern Illinois. They found that shortages were found between the more populated areas and in the edges of their study area, areas which were rural. They noted that since physician data from neighboring areas was not included, the actual access in the edges of the study area was unclear. Other studies that used the physician to population ratio method included Guagliardo et al., Bell et al., and Luo (2004).

Method Review

There are many different methods to determine spatial health care access, many utilizing GIS. This section reviews some of the studies and the methods used. Higgs (2004) identified five different measures of accessibility, including container, coverage, minimum distance, travel cost, and gravity. Container is the number of facilities located (or contained) within a certain area, in a Census tract, for example. Coverage is the number of facilities that are within a certain distance from a specified location. Minimum distance is the distance between a location and the nearest facility. Travel cost is the average distance between a location and all facilities. Gravity is the weighted sum of facilities and is divided by what is called the “frictional effect” of distance.

When developing an method for measuring spatial access, one study suggested that such an accessibility index should: include a population based measure, be reflective of the mobility of the population with the inclusion of distance-decay and distance range elements, use a weighted estimate of the availability of services, and yield scores that can be compared across different places (Khan, 1992). An early study (Parker and Campbell, 1998) using GIS to determine access to medical facilities included measuring distances with straight line and network distances and placing patients within designated buffer zones by address.

Some studies use a spatial analysis method called the Two-Step Floating Catchment Area Method (2SFCA) which measures access as a physician to population ratio and incorporates travel times. This model can be used to identify physician shortage areas. The method was used originally in business accessibility studies but was later adapted for healthcare accessibility studies (Luo, 2004). Luo and Wang (2003) used this method in their analysis of health care access in the Chicago area. First, the catchment area for every physician location is defined by the population that is within a threshold travel time (for example, a 15-minute drive) of that physician. After that, the ratio of physicians to population is calculated for each catchment area. The next step is essentially the reverse of the first step, requiring the ratio of population to physicians instead. After that, the two ratios are added up. The larger the sum of the ratios, the better the access.

There are several different modifications of the 2SFCA method. One such is the 3SFCA, which can be used for different sized neighborhoods, as used in Shah, Bell, and

Wilson (2016). This method follows the same steps as the 2SFCA approach, then adds a third step, which creates a neighborhood area ratio. Another modification is the enhanced floating catchment area method (E2FCA). The 2SFCA method has limitations as it assumes that all locations within the catchment area have equal access to services (it does not account for any differentiations within the catchment), and any location outside of the catchment area has no access. The E2FCA takes both of these conditions into account by turning the measure into a population to service ratio (Luo and Qi, 2009). Still others made modifications based on the needs of their study area, such as densely populated Asian cities (Kim, Byon, and Yeo, 2018).

Yang, Goerge, and Mullner (2006) compared the 2SFCA method, which is vector based, and the kernel density (KD) method, which is grid based, in their case study of access to dialysis service centers in Chicago. They found that the accessibility ratios calculated by the two methods differed significantly. There were more problems with the KD method, most importantly that the ratios calculated with this method did not identify areas with lower access well. They concluded that the 2SFCA method calculated better accessibility ratios, although there is room for improvement.

Apparicio et al (2008) reviewed different methods and compared results and discrepancies which used different distance types and aggregation methods. There are four different parameters of geographical accessibility measures. These four parameters are, a spatial unit of reference for the population (a definition of residential areas), an aggregation method, (to account for the distribution of population in the residential area), a measure of accessibility, and a type of distance for computing the accessibility

measures selected. Apparicio, et al determined that utilizing different parameters can change the results and lead to significant discrepancies.

Apparicio et al identified three different ways to evaluate the accessibility of a service (i.e. a doctor's office) for people living in an area (census block, etc.). The first method consists in computing the distance between the centroid of the area and the service. The second method consists of calculating the population-weighted mean center of the areas and then evaluating the distance between this new location and the service. The third method consists of computing the distance between the services and each centroid of spatial units completely within census tracts, and then calculating the average of these distances weighted by the total population of each unit. Their findings conclude that the latter method is the most accurate.

Apparicio et al. found that there are five commonly used measures in accessibility studies, including: the distance to closest healthcare service, the numbers of those services within a particular distance or time, the mean distance to all healthcare services, the mean distance to a certain number of closest services, and the gravity model.

Finally, there are four types of distances used to calculate accessibility measures: Euclidean distance and Manhattan distance, which are called Cartesian distances, and shortest network distance and shortest network time, which are called network distances. The difference between network distance and network time is that network distance evaluates the path between point A and point B while traveling on foot while network time evaluates the path while traveling by other means.

They compared different methods in their own accessibility study of the Montréal, Canada area. They found that the comparison of distance types showed that Cartesian distances and network distances are correlated with each other. However, there were variations in the correlation in places such as the suburbs where the Cartesian distances were not as accurate.

In a later study (Apparicio et al, 2017), these issues are revisited, and the study was repeated with a few updates. They added additional types of time-distances measures: walking, biking, public transit, and by car. They added another aggregation method based on land use maps. They also discussed different accessibility methods, such as the two-step floating catchment area (2SFCA) method and its modifications.

Accessibility is also largely determined by travel time to a health care facility. Delamater, Messina, Shortridge and Grady (2012) compared how travel time is represented with raster and vector models. Their study looked at limited access areas in Michigan and used the two models to determine healthcare access by travel time. In health care research, distance can be measured as travel time over a road network in a vehicle calculated using a GIS, or it can be measured by travel distance or Euclidean distance. Travel time is more accurate in measuring the cost of travel. Travel time is the function of distance and travel speed which can be thought of as the cost of movement.

While there are differences between raster and vector data models, the methods to calculate travel time are similar. Vector data models are made up of a series of points (nodes) which are connected by lines (edges). The cost of traveling along an edge is defined by its length and its travel speed. When an edge meets a node, a time penalty or a

turn delay can be applied, depending on if there is a turn (a directional change) at the node.

Raster models are made up of cells (pixels). In raster data models, travel is represented as a cell to cell movement. Each cell has a movement cost, which represents the travel time to cross the cells. Since road data is usually available as vector features, the data must be converted in order to use it in a raster-based system.

In Delamater et al, they found that the raster model identified more people in underserved areas and in limited access areas than the vector model. As for estimating travel times on roads, both models had their strengths and weaknesses. Raster models worked well when estimating time for non-vehicle travel while the vector model worked well for vehicle travel.

There are many different methods to measure healthcare accessibility with GIS, some are more accurate or useful than others. The method that researchers choose depends on what aspect of accessibility they want to study. Those researching closest facilities, by distance or travel times should choose a different method than those researching physician shortages. The use of GIS in research has enhanced many fields, including healthcare accessibility studies.

CHAPTER III

STUDY AREA AND METHODS

Study Area

The area of study for this research is Forsyth County, North Carolina. Forsyth County is located in the Piedmont Triad with the county seat being Winston-Salem, its largest city (Figure 1 & 2). Other towns include Kernersville, Clemmons, Lewisville, Walkertown, Rural Hall, Pfafftown, along with several others. In 2019, the county population was approximately 379,000, which makes it the fourth most populated county in North Carolina. It has a median income around \$50,000, which the 16th highest in the state. Its median age is 38.3, with 15.2 percent over the age of 65 and 23.4 percent under the age of 18 (U.S. Census Bureau).

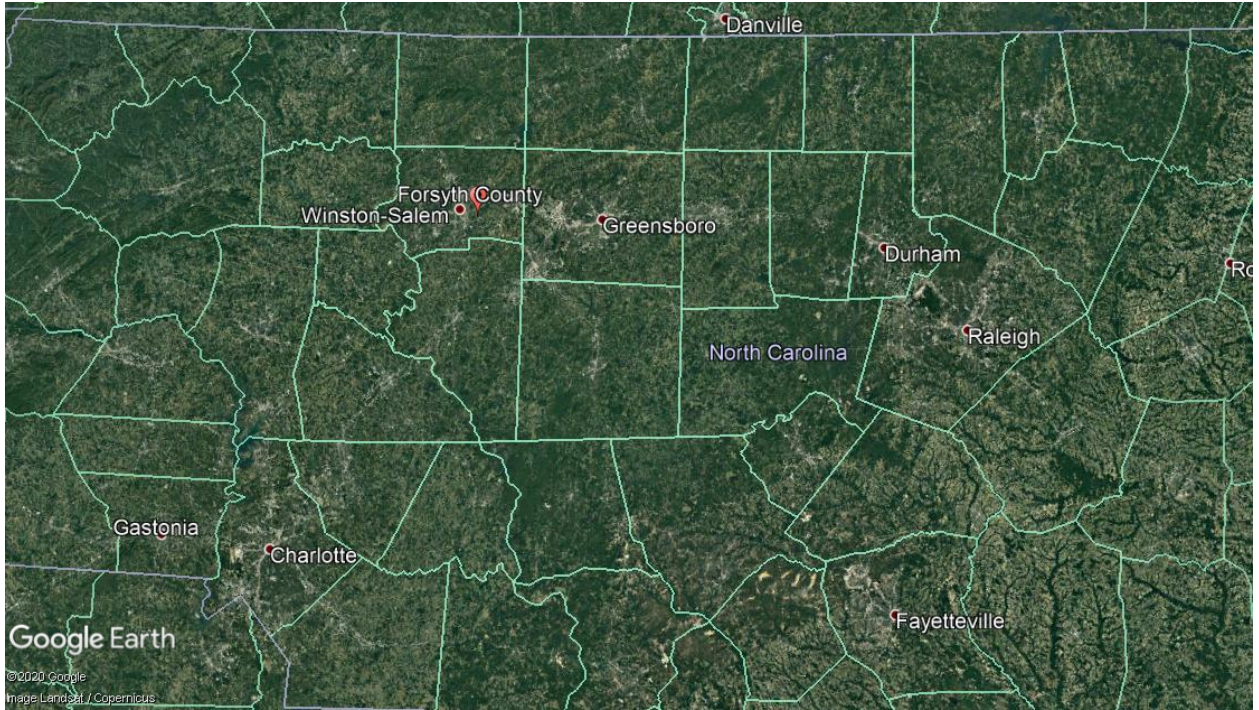


Figure 1 Location of Forsyth County (source: Google)

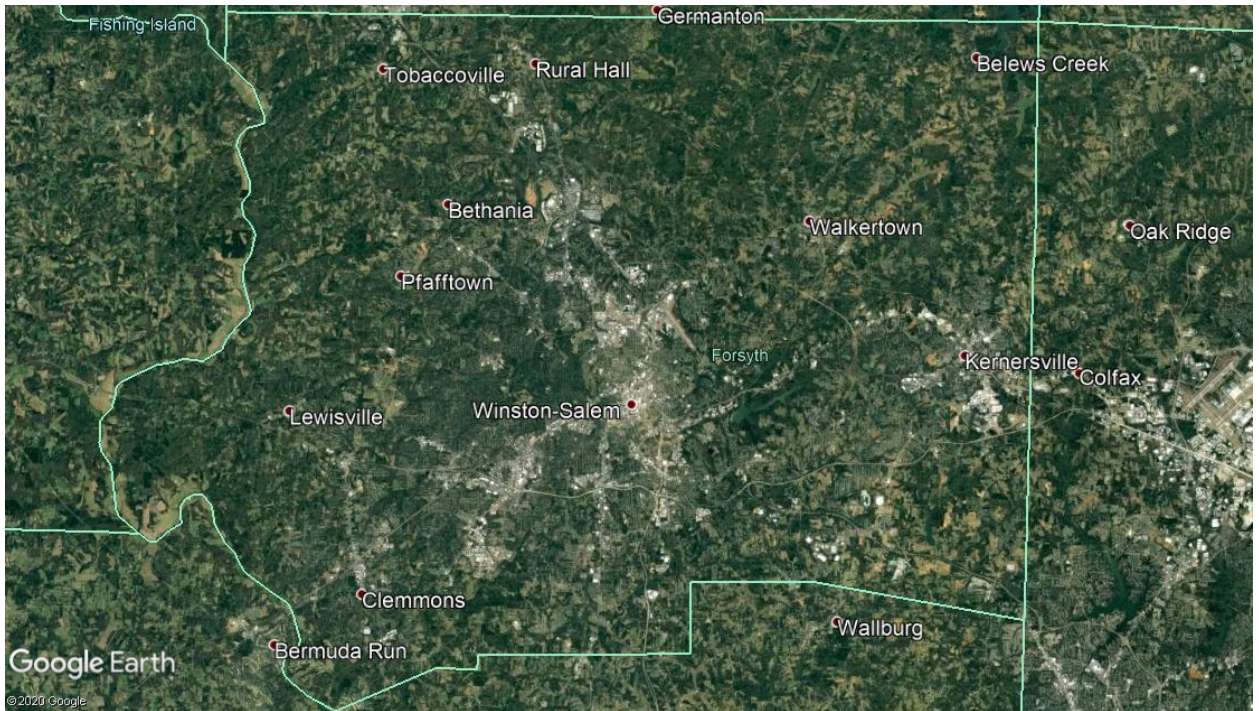


Figure 2 Detailed Map of Forsyth County (source: Google)

Many of the health care facilities in Forsyth County are affiliated with one of two health care systems. Novant Health is a health care system that serves North Carolina, South Carolina, Virginia, and Georgia. According to their website, they operate 15 medical centers, in addition to physician offices, outpatient centers, medical plazas, and other services (Novant Health). Wake Forest Baptist Health is affiliated with Wake Forest University in Winston-Salem and is a network that serves northwest North Carolina and southwest Virginia. It operates several hospitals, with the largest located in Winston-Salem, as well as numerous clinics and physician offices (Wake Health).

There are four medically underserved areas in Forsyth County: Census tracts 0802, 0200, 0301, and 0500 (Figure 3). These areas are all located within the city of Winston-Salem, north and south of the downtown area. Census tract 0802 had a median income of \$14,946 and 27.39 percent of households had no vehicle access. It had a median age of 20.8 with 25.1 percent under the age of 18 and 4.9 percent over the age of 65. Census tract 0200 had a median income of \$18,352 and 37.81 percent of households had no vehicle access. It had a median age of 39.7 with 14.5 percent under the age of 18 and 4 percent over the age of 65. Census tract 0301 had a median income of \$16,985 and 42.58 percent of households had no vehicle access. The median age was 35.6 with 29.2 percent under the age of 18 and 15.9 percent over the age of 65. Census tract 0500 had a median income of \$20,369 and 35.72 percent of households without access to a vehicle. It had a median age of 27.8 with 26.8 percent under the age of 18 and 8.2 over the age of 65.

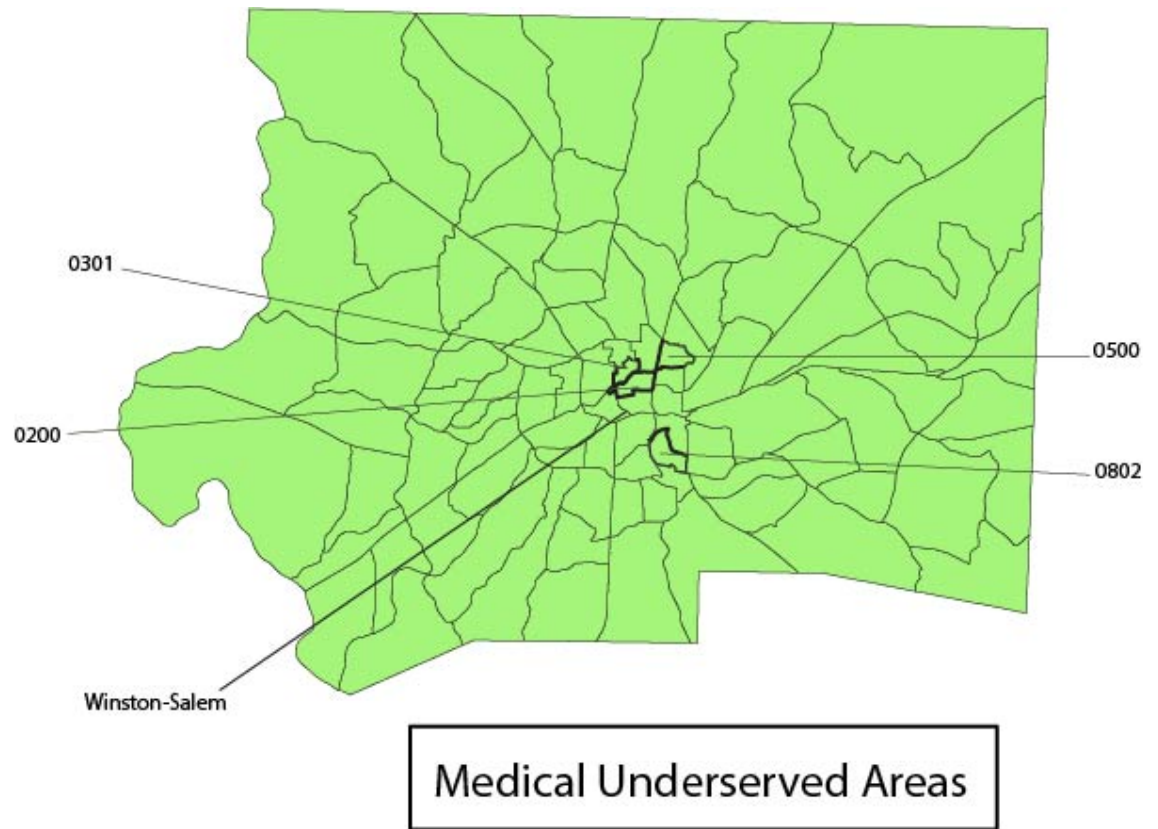


Figure 3 Medical Underserved Areas (Census tracts)

It is interesting to note that some of the same areas designated as Medical Underserved Areas are also designated as food deserts according to the USDA. In 2016, the Winston-Salem planning board conducted research that found that large parts of the most urbanized areas of Winston-Salem have a lack of food security. The latest data available is from 2016, so it is unclear if conditions have improved since the time of writing this paper. The report not only mapped Census tracts that were defined as food deserts, it also looked at households without vehicle access. The lack of vehicle access is a critical barrier to food security. Food security and healthcare accessibility overlap in

several ways, barriers to access often result in a geographic area lacking in proper access to both.

The nonprofit Forsyth Futures conducted a study into the state of health care in Forsyth County in 2014. According to their findings, while Forsyth County does not have a lack of health practitioners on the county level, there is a primary care shortage in certain areas, particularly within Winston-Salem. In these underserved areas, over 25% of the population does not have access to a vehicle. While there are bus routes running through the area, transportation was still identified as a barrier getting to appointments.

Methods

For this study, the medical facilities used in the analysis included family practices, internal medicine, and pediatrics and obstetrics and gynecology (OB/GYN) offices which are considered specialty primary care. This study also included urgent care centers and hospitals with emergency departments. To widen the scope of analysis, facilities located in surrounding counties that were located on or near the border of Forsyth County were included as well. Facility locations were obtained from the Novant Health and the Wake Forest Baptist Health websites, and additional locations were obtained from Google Maps searches. Urgent care centers are typically open later in the day and on weekends which can be convenient for the working population. Urgent care facilities are also used by those who need to see a doctor after hours but do not want to visit the emergency room. While hospitals offer a wide variety of services, a hospital's emergency department is one of the most important. While the main purpose of an Emergency Room (ER) is the treatment of the most serious of cases that either cannot be treated at a regular physician's

office or is a serious emergency. ERs also provide primary care to uninsured patients. Forsyth County has five hospitals: Wake Forest Medical Center, Forsyth Medical Center, Medical Park, Clemmons Medical Center, and Kernersville Medical Center. Medical Park Hospital was not included as the facility deals mainly with outpatient surgery. Davie Medical Center was also included, as it is approximately one mile outside of Forsyth County. The facility locations are accurate as of February 2020.

Physicians offering specialty care were not included as they treat specific health issues and do not offer primary care. Smaller health clinics, such as the Minute Clinics which are available in some CVS stores were also not included. While they operate as a healthcare “safety net” community health clinics were also not included. Information for health clinics in Forsyth County was scarce and possibly outdated. As mentioned in Guagliardo, et al., health clinics have uneven open hours and sometimes not fully staffed and mentioned that they had issues contacting health clinics for their own research.

The locations of medical facilities were mapped using GIS. The base map for the county and Census Block Groups was retrieved from the Census Bureau website as a Topologically Integrated Geographic Encoding and Referencing file (TIGER/Line). Population weighted centroids for each block group were generated and used to calculate the distances to the nearest medical facility. The nearest neighbor analysis works in three different ways: point to point, point to line, or point to node (ESRI, 2019). This study used the point to point analysis, with the population centroids as the input features and the medical facilities as the features used for analysis. In addition, the contain method was used to calculate the number of medical facilities located in each block group.

One of the simpler methods of measuring spatial access is minimum distance, which records the closest distance between two points. This study used the minimum distance method, measuring the distance between the weighted center of the population in a block group and the nearest medical facility. Justification for using this method was that many medical facilities employ several doctors. Even if a patient's physician is not available, another physician or physician assistant (PA) in the office can still tend to the patient. In addition, there are many nurse practitioners and physician assistants who work in doctor's offices that can administer primary care: In many cases nurse practitioners and PAs serve as a patient's primary care doctor. Many of the studies that use the ratio method only use physicians to determine healthcare shortages. Since it is becoming increasingly common that nurse practitioners and PA's to administer healthcare, they need to be included in the study.

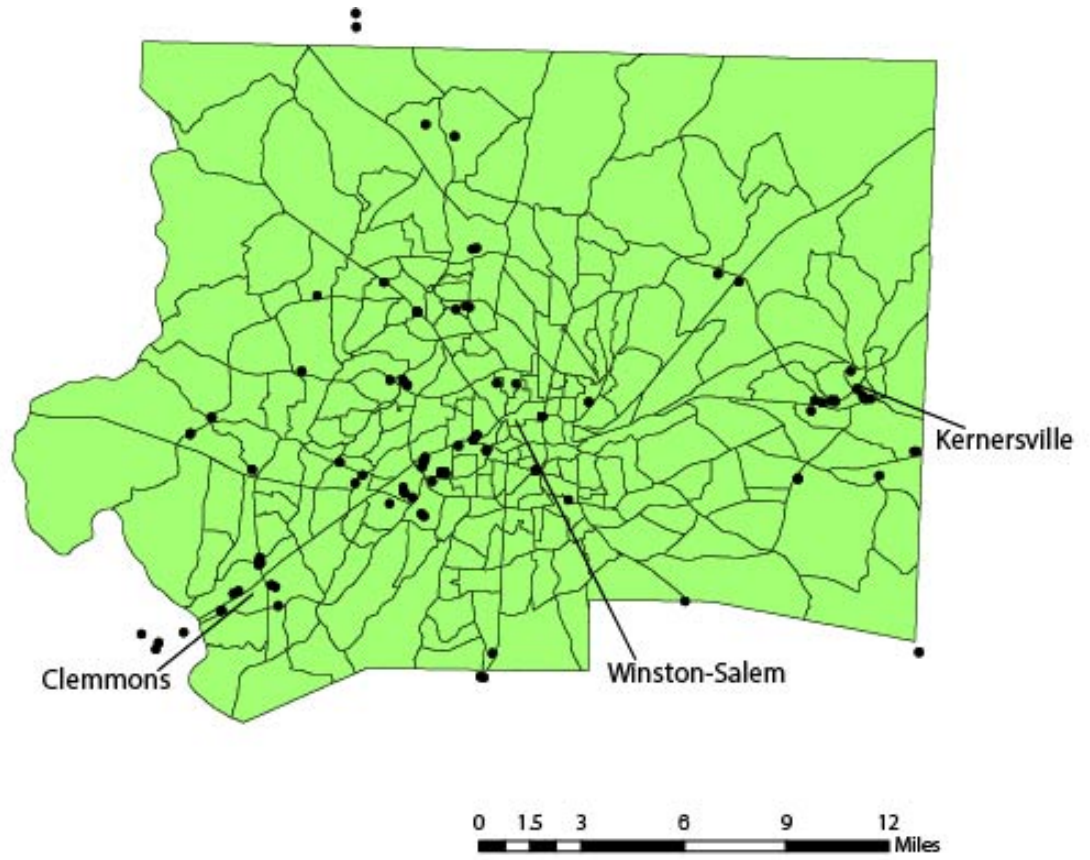
While this study included a variety of facilities that provide primary care, family medicine practices are the most common and numerous. Anyone can use these facilities (with proper insurance) and doctors there usually know the patient's medical history the best and can refer patients to specialties as needed. A separate layer containing only family medicine practices was used for analysis due to their importance. While urgent care centers and emergency departments offer primary care, having a regular doctor is recommended (Solvhealth, n.d.) The following layers were used for the analysis; a layer containing all primary care facilities in Forsyth County, one that contained additional locations in surrounding counties, one that contained only family medicine practices in Forsyth County, and one that included family medicine practices outside of the county.

Demographic data at the Census block group level was obtained from the Census 5-year 2018 American Community Survey, which covers 2014-2018. The ACS contains the latest Census data that are used by researchers and others. The ACS data are statistical estimates derived for analytic purposes and are based on annual surveys mailed to 3.5 million households annually between the decennial Census. The website PolicyMap, which aggregates data from a wide range of sources, was also used for vehicle data.

CHAPTER IV

RESULTS

The locations of ninety medical facilities located in or near Forsyth County were used in this study (Figure 4). Of these, 35 were classified as family medicine or adult primary care (Figure 5). Seven were classified as internal medicine. Eighteen were pediatrics. Twelve were OB/GYN. Thirteen were urgent care centers. Five were hospitals which had emergency departments. And one offered a range of services. These facilities were often clustered around hospitals or other medical facilities. While having a different name, some facilities shared the same building or had nearly the same address which may result in points appearing on top of one another on the maps. For example, “Suite 113-A” versus “Suite 113-B.” A couple of facilities were located within other facilities, such as primary care offices located inside hospitals or pediatrics located together with family medicine practices. Not surprisingly most of the facilities (52) were located in Winston-Salem as it is the biggest city in Forsyth County. The next two largest towns in Forsyth, Kernersville and Clemmons, had the second and third highest number of facilities. Kernersville had sixteen facilities and Clemmons had thirteen facilities. The remaining 7 facilities were scattered across the county.



Medical Facilities in Study Area

Figure 4 All medical facilities in study area

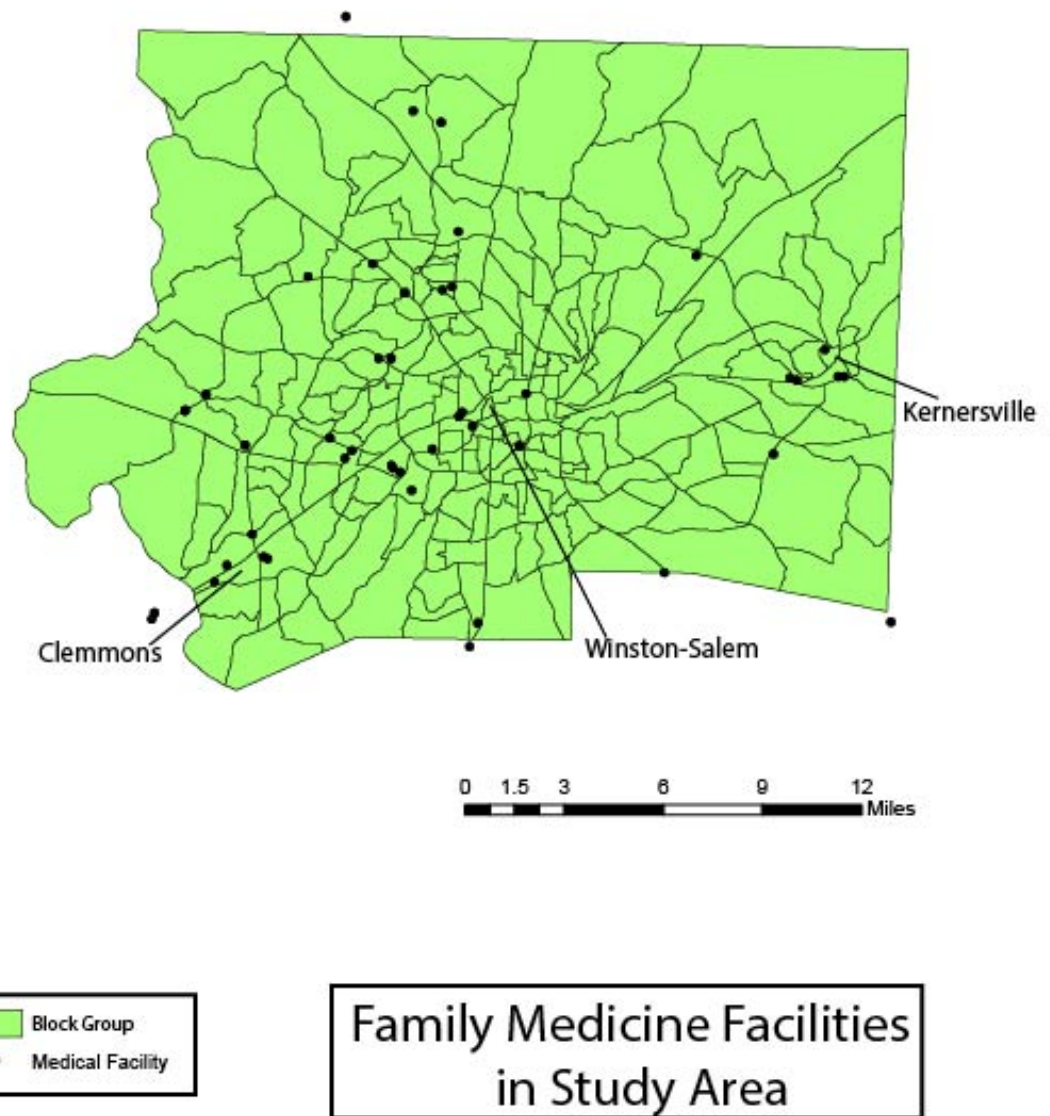


Figure 5 Family medicine facilities in study area

Figure 6 shows the number of facilities by block group. At the block group level, the block group with the highest number of facilities was 0022001, with eleven facilities (Figure 7). This block group is located in a busy commercial area in Winston-Salem and while Forsyth Medical Center is just outside of its borders, it contains many medical

facilities surrounding the hospital. Residents living in this area lived less than half a mile away from a facility. Since this area is mostly commercial, only around 600 people live there. The next two highest were block groups 0022002 and 0032021, both containing five facilities each. Block group 0022002 is located adjacent to the block group with the highest number of facilities described earlier and is also a busy section of Winston-Salem. Block group 0022002 contains Wake Forest Baptist Medical Center and residents living here were also less than half a mile away from the nearest facility. Block 0032021 is located in Kernersville in one of its main commercial centers. Residents living here were located less than a quarter of a mile away from a facility. The next two highest block groups were 0038051 and 0040131 with four facilities each. Block group 0038051 is located in Winston-Salem in a commercial area with multiple specialty care offices and also dental offices. Residents living here were located 0.082 mile away from a facility, the shortest distance in the county. Block group 0040131 is located in Clemmons. While mostly residential, the facilities in this block group belongs to a Wake Forest Baptist medical plaza that contains an urgent care and several other primary care offices. Residents living here were located half a mile away from a facility. One of the attributes that all of these areas share is that they are a part of a commercial area and the facilities tend to cluster around either other primary care facilities or other medical facilities. There are some block groups that contain either three or two facilities, or just one facility, but the majority of block groups have no facilities.

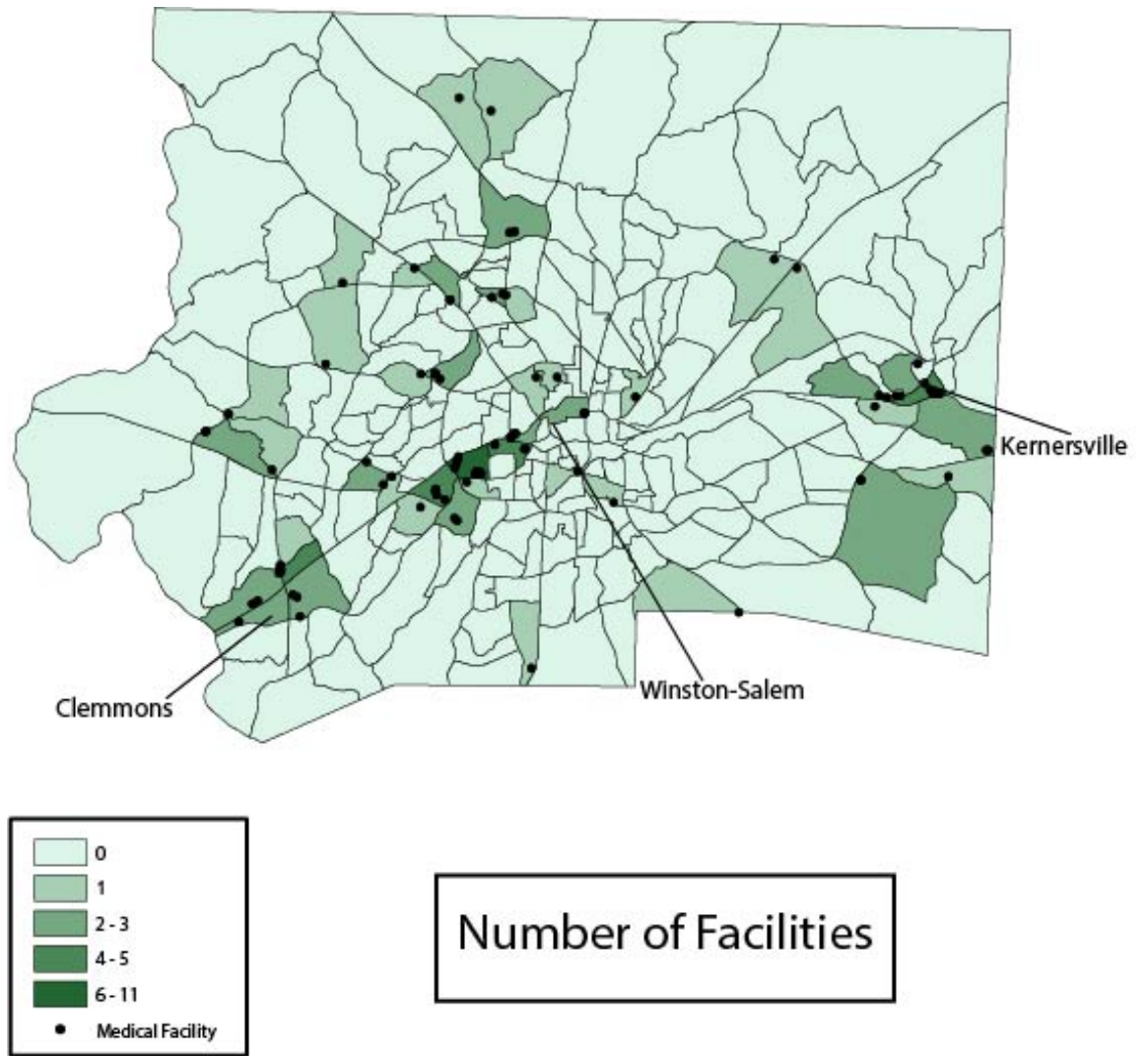


Figure 6 Number of facilities by block group

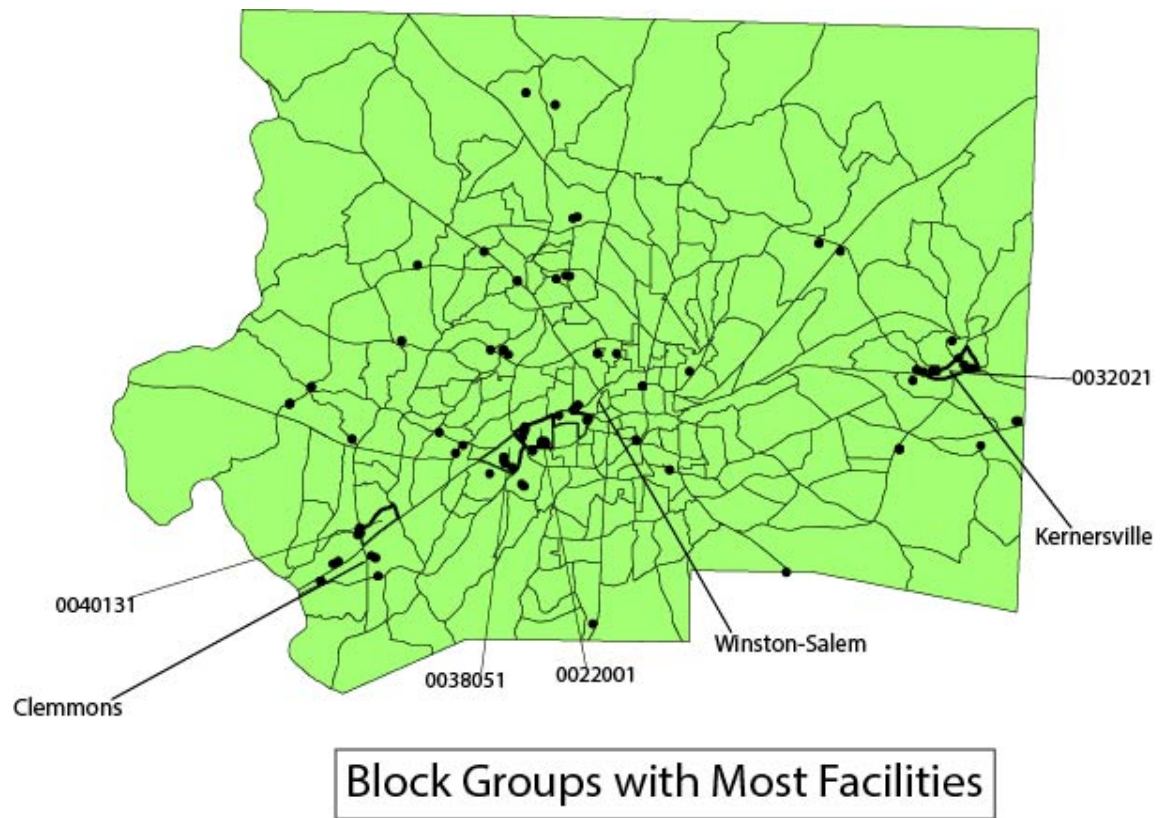


Figure 7 Block groups with the most facilities

There are 243 block groups in Forsyth County. Of those block groups, as measured from the center of their population, 53 of those were located less than half a mile from a facility, 78 were located between half a mile and a mile away, 100 were one mile away, 37 were located two miles away, 11 were three to four miles away, and four were located over five miles away. The closest distance was 0.082 mile and the greatest distance was 6.469 miles, and the average distance was 1.356 mile. When only family medicine locations were factored in, 31 locations were located less than half a mile away, 62 were located between half a mile and a mile away, 79 were a mile away, 49 were two miles away, 18 were three to four miles away, and four were over five miles away. The

closest distance was 0.109 mile and the greatest distance was 6.469 miles, and the average distance was 1.557 mile. The difference between the distances between any primary care facility and a family medicine facility was not very large, averaging around .20 mile. With only these facilities in consideration, the nearest facility for 18 of the block groups was located around one more mile further. The nearest family care practice for one block group (0022141), was located more than two miles further away than the location of a generic primary care facility (such as an urgent care center).

There were an additional eight facilities, including Wake Forest Baptist Health - Davie Medical Center, that were located close to the border of Forsyth County. These primary care facilities were located in Davie County, Davidson County, Guilford County, and Stokes County. The distance to the closest facility for some block groups decreased. Block group 0028011, whose nearest Forsyth County facility was over six miles away, had an outside facility located four miles away, and in block group 0033131, accessibility improved by a mile. The average distance for these locations was 1.366 mile, and the shortest distance was 0.081 mile and the greatest distance was 5.406 miles.

Of the five block groups that were located nearest to a facility, the distance ranged from 0.082 mile to 0.197 mile (Figure 8). These locations were located mainly in Winston-Salem in some of the city's busiest and most commercialized areas, and the population for this group was around 7,376. The location that was the closest to a facility was block group 0038051 which is located in a heavily commercial area near Forsyth Medical Center and was 0.081 mile away from a facility. Block group 0027034 which is located in the northern part of Winston-Salem was located 0.109 mile away from the

nearest facility. Block group 0003021 which is located north of downtown Winston-Salem was located 0.187 mile away from the nearest facility but increased to 1.395 mile when only factoring in family medicine facilities. Block group 0032021 is located in Kernersville and was 0.195 mile away from a facility. Block group 0016022 is located northeast of downtown Winston-Salem and was 0.197 mile away from a facility, however, this increased to 1.45 mile with only family medicine considered.

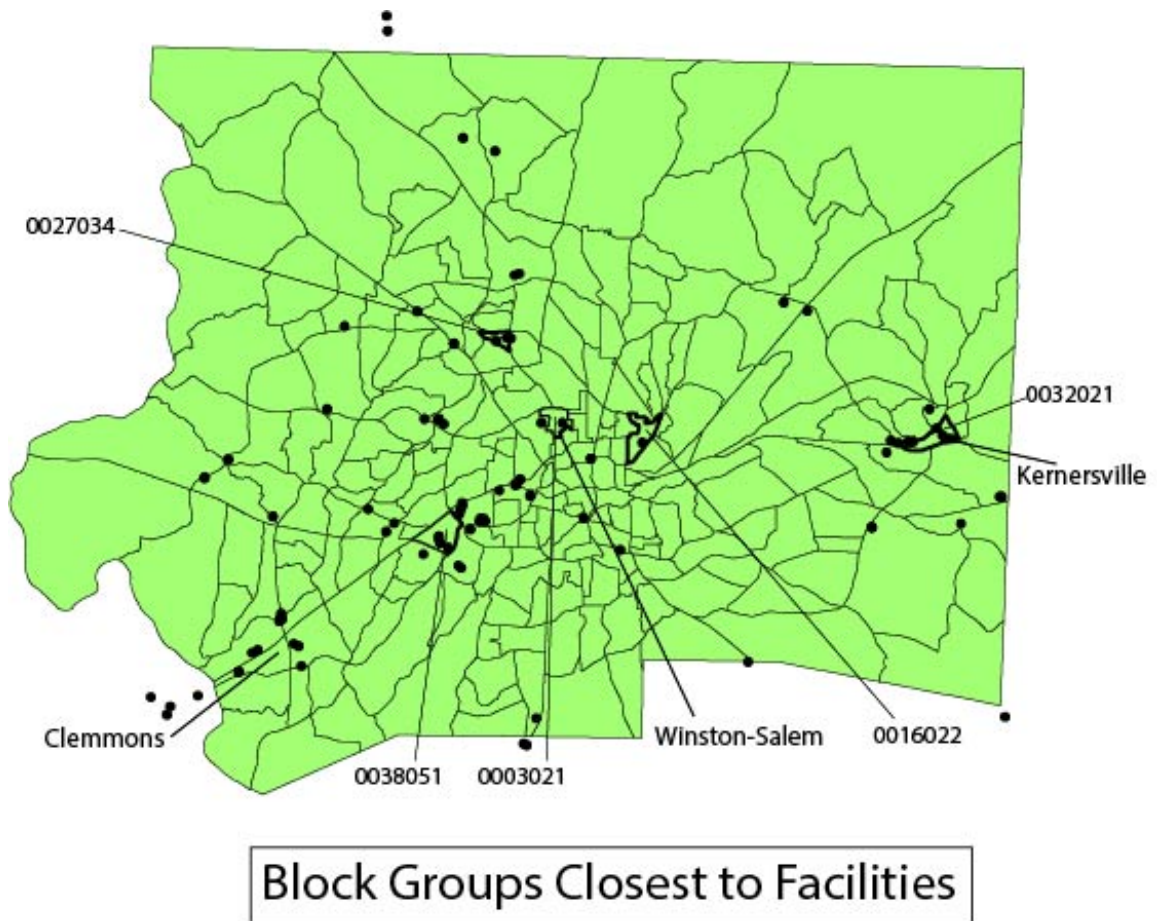


Figure 8 Block groups closest to facilities

There were four block groups that were located over five miles from the nearest facility (Figure 9). These block groups were more rural, located on the edges of the county. The total population for this group was around 4,737. Block group 0028012 is located in the northwest corner of Forsyth County and was 5.39 miles away from the nearest facility. Due to its location, a facility in neighboring Stokes County was half a mile closer than facilities within Forsyth. Block group 0031061 is located in the northeast corner of Forsyth County and was 5.39 miles away from the nearest facility. Block group

0029042 is located in the northern part of the county, north of Walkertown and south of Walnut Grove and is 5.41 miles away from a facility. Block group 0028011 is located just south of King and was 6.47 miles away from a facility, which was the longest distance in the county. However, due to its proximity to the town of King, located in Stokes County, this distance is shortened to 4.49 miles.

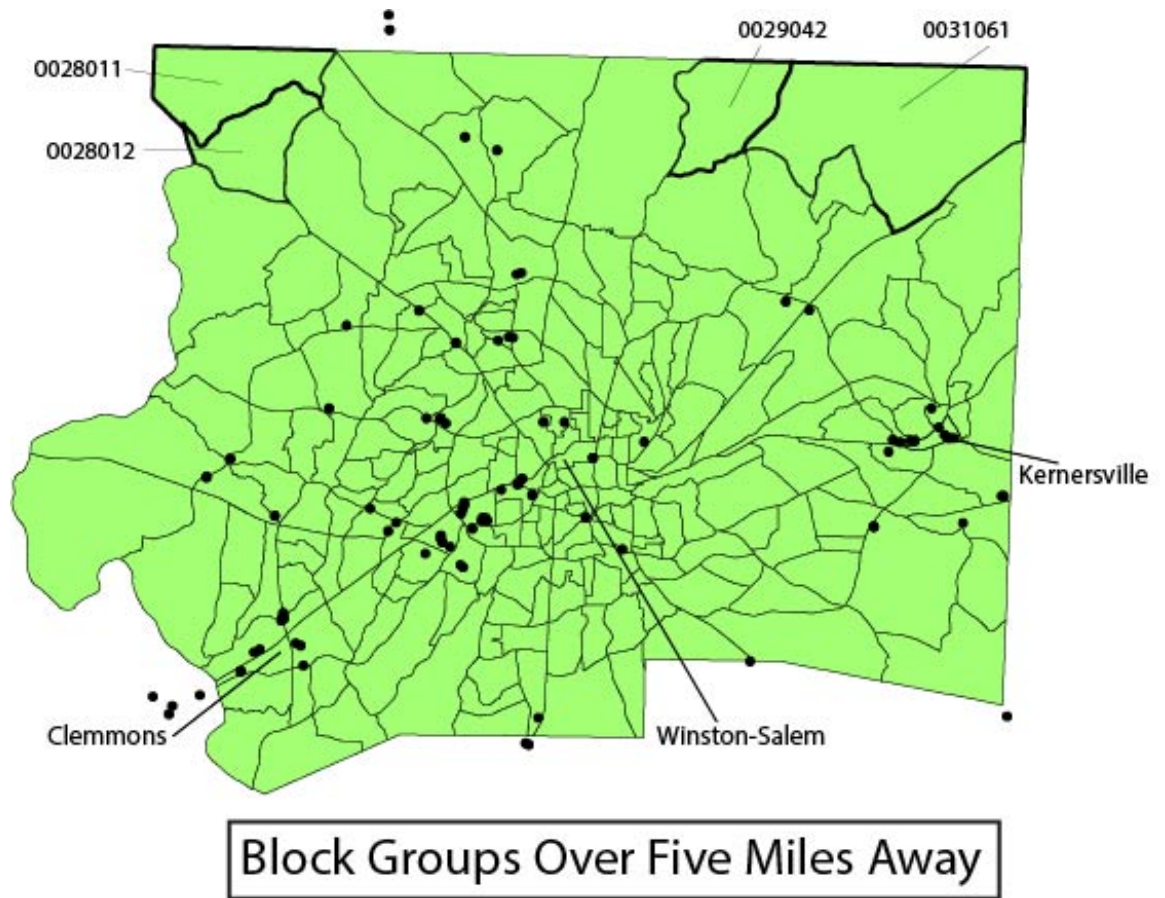


Figure 9 Block groups over five miles away from a facility

There were eleven locations that were more than three miles and less than five miles away from a facility and the population was approximately 16,238. Of this group,

there were five that were three and a half miles or more away from the nearest facility and the population was around 8045 (Figure 10). Block group 0031033, located in the northeast of the county above Kernersville, was located 4.751 miles away for a facility. Block group 0041021, located in the west part of the county and north of Lewisville, was located 3.915 miles away from a facility. Block group 0033131, located in the southeast corner of the county near High Point in Guilford County, was 3.66 miles away from a facility. When facilities outside the county were included, such as one in neighboring High Point, the distance drops to 2.14 miles. Block group 0029034, located north of Winston-Salem, was 3.62 miles away from a facility. Block group 0028013, located northwest of Winston-Salem, was located 3.50 miles away from a facility.

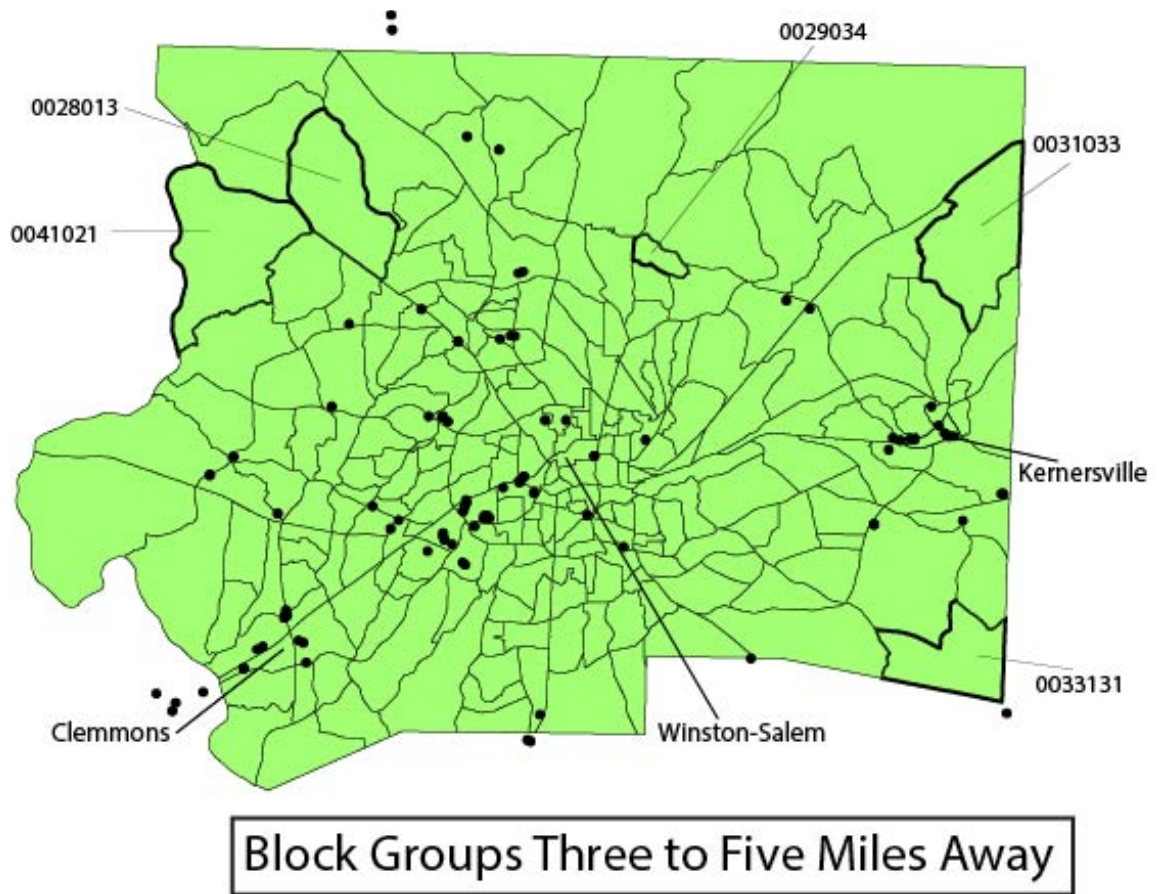


Figure 10 Block groups three to five miles away from a facility

Winston-Salem has four Census tracts that are designated as MUAs. In the block groups that make up these areas, the facilities were located half a mile away to over one mile away. These distances are not great, given that the block groups are located closer to downtown and thus are closer to commercial areas where medical facilities are likely to be located.

Discussion

Before discussion on areas and their closest facilities, it is worth devoting a small section to block groups and the facilities within them.

Of the block groups that had zero facilities within their borders, there were no readily apparent connections between them. The block group with the lowest median income (\$11,000) located in Winston-Salem near Winston-Salem State University had no facilities while the block group with the highest income (\$248,250) which is part of Winston-Salem's Buena Vista neighborhood had no facilities as well. Block groups with no facilities did not share any location in common: block groups located in the county's rural outskirts and in the middle of Winston-Salem are examples of areas without facilities. Since there are so many block groups and particularly in urban areas they are spatially quite small, the lack of shared traits between tracts without facilities is not surprising.

The demographics of the five block groups that had four or more facilities also showed considerable variation. The total population of these 5 block groups was around 7000. They had rather low median incomes, ranging from \$21,000 to \$41,000 which seems typical for commercial areas. The percentage of household without vehicle access ranged from 2 percent to 11 percent, with 39 percent as an outlier. Four of the groups had a median age in the 30s with one at 51. These areas had no racial demographics in common, nor did they have percentages of under-18 or over-65 in common. The main trait that these block groups shared was the fact they were in commercial areas. Counting the number of facilities in an area is useful for determining whether a neighborhood has an abundance of facilities in it. Eleven facilities within a block group could be classified as "abundance."

The following sections look at the block groups that were the closest and the farthest away from healthcare facilities and discusses their demographic make-up and vehicle access.

The five block groups that were closest to a facility were all located less than .20 mile away. The median income for these areas ranged from around \$18,000 to around \$31,000. In 3 of the block groups over 30 percent of households was without vehicle access, which is among the highest in the county. The other two block groups had percentages of 18 and 3 without vehicle access. The demographics varied, with some being majority white and some majority black and some had no clear majority. The median age ranged from 35 to 41 with 11 to 29 percent under the age of 18 and 3 to 20 percent over 65. Overall, residents living in these areas have less income and more do not have access to vehicles and likely rely on bus service to get around. Fortunately, they are located nearest to facilities compared to other areas.

The four block groups that were over five miles away from a Forsyth County facility were well off compared to other areas in the county. The median income ranged from \$40,000 to \$70,000. Due to its location, the vast majority of residents living in these areas had access to vehicles, with 5 percent being the highest number of those without vehicle access. The demographics for these block groups were majority white and older. Three of the block groups were over 90 percent white with one block group 86 percent white. The median age ranged from 40 to 52 with 16 to 26 percent under the age of 18 and between 11 and 20 percent over 65. The residents living in these areas were mostly whiter and older than other areas in the county. These residents also had higher incomes

and more access to vehicles, which is essential when living outside of cities where public transportation does not run. Even if residents live farther away from healthcare facilities, they have the means to travel to these facilities in a relatively short time.

Five block groups were located three and a half miles to nearly five miles away from a facility. The median income within these block groups ranged from \$38,000 to \$94,000. Again, these areas were mainly located on the heavily vehicle-dependent county edges, with only five percent of households without vehicle access. The demographics for these areas were similar to the areas further away from a facility. The population in all of the groups was above 80 percent white. The median age ranged from 40 to 51 with 15 to 23 percent under the age 18 and 15 to 24 percent over 65. This group was very similar to the group of areas that were located over five miles from a facility. Again, higher incomes and more access to vehicles overall which makes reaching further away facilities easier.

To summarize, the block groups which were the farthest from a facility were overwhelming white and middle aged. The median household income was higher than the average in Forsyth County. The percent of households without access to a vehicle was low which is important in a car dependent county such as Forsyth. The greatest distance was six miles away from a Forsyth County facility, which is not a very long distance, especially when considering that the majority of residents in these outlying areas had vehicle access. The block groups that were three or four miles away were located throughout the county, some in rural areas while others were in urban areas. There was no area within the county that was a great distance away from a facility, providing that

residents have vehicle access. For those without reliable access to personal vehicles, going to a facility is a bit more difficult.

While most of the population in the county is relatively close to a facility, as measured from their block group to the nearest facility, these distances are longer for those without access to a personal vehicle. In 20 of Forsyth County's block groups, over 30 percent of households do not have access to a vehicle (Figure 11). Of these, the five with the highest percentages ranged from nearly 47 percent to 64 percent (Figure 12). These locations were no further than a mile away from the nearest facility, even when only accounting for family medicine facilities. This is not wholly surprising as these block groups are mainly located in Winston-Salem, the most urban area of the county, which is served by bus routes. It is interesting to note that these block groups are all located relatively close to each other. The block group (0007001) with the highest percentage had 64.3 percent of households without access to a vehicle. The next highest was block group 0005002, which is located in North Winston. It had a percentage of 60.19 without access to a vehicle. Block group 0037011, located in Winston-Salem and is bordered by major roads, had a percentage of 55.23 without access to a vehicle. Next is block group 0009001, which is south of the downtown Winston-Salem area, had a percentage of 47.43 without vehicle access. The next block group 0006001, which is north of the downtown Winston-Salem area, had a percentage of 46.87 without vehicle access. These block groups had lower incomes, with the average income less than \$22,000.

These areas consisted of mostly black communities with the exception of block group 09001 which was more diverse. The median age varied widely, ranging from 27 to 49. The under 18 population varied as well, ranging from 9 percent to 28 percent. The over 65 population was low except for block group 07001, which had 21 percent over the age of 65. These block groups were located half a mile from the nearest facility to nearly one and a half miles from the nearest facility. Without access to a vehicle, getting to appointments can be difficult, as bus service can sometimes be unreliable or not available at the times needed.

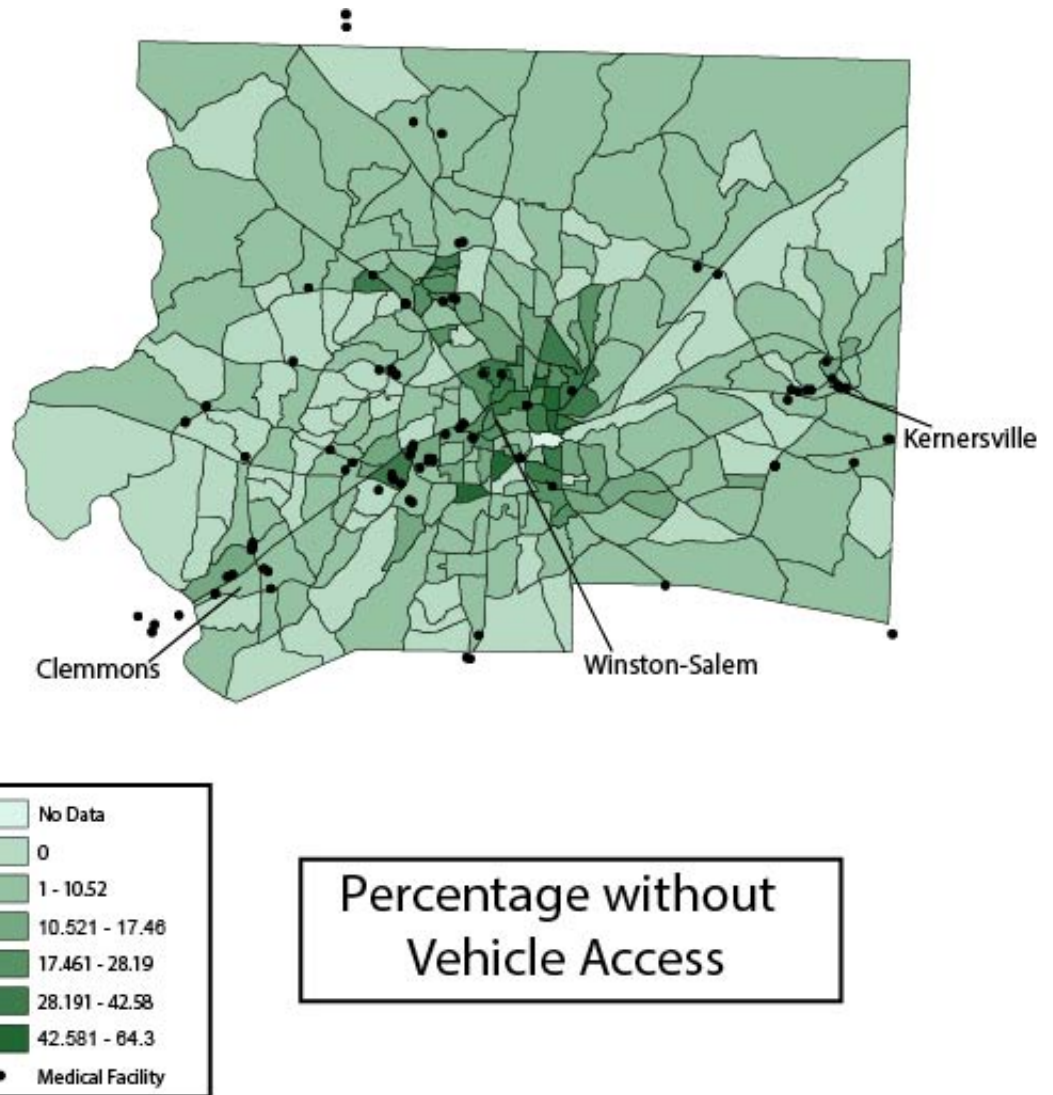


Figure 11 Percentage of households without access to a vehicle by block group

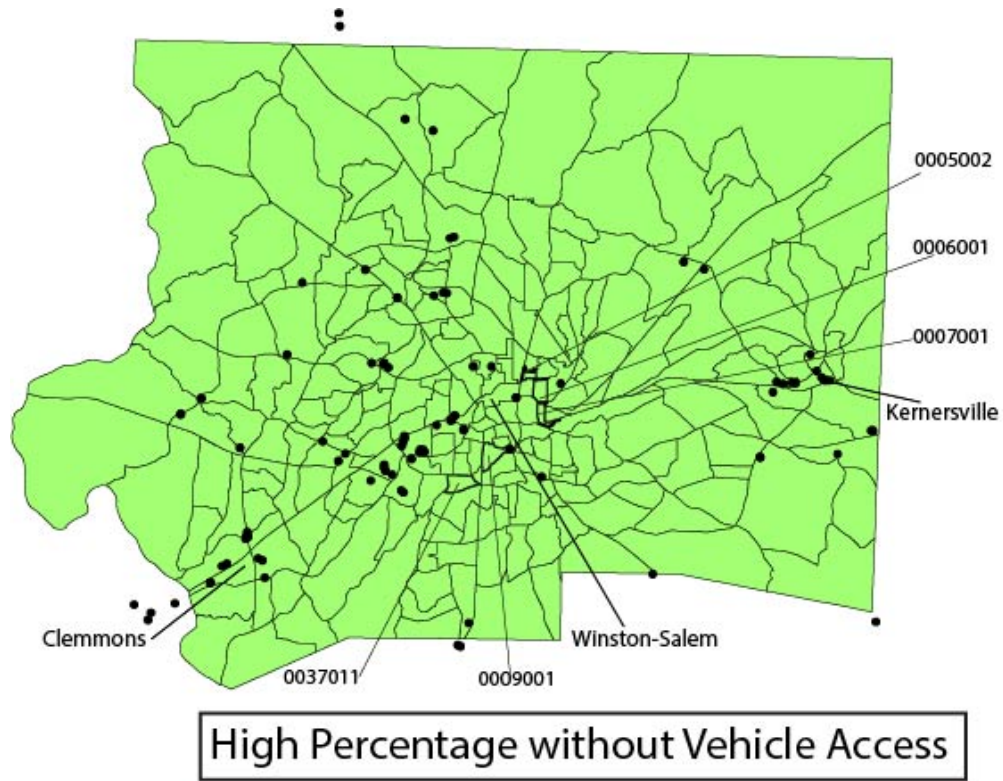


Figure 12 Block groups with a high percentage of households without vehicle access

Comparing block groups can be difficult, as block groups can vary in both size and population. For Forsyth County, the smallest, least populated block groups were located in highly populated urban areas (in this case, Winston-Salem), while the biggest block groups were located in the less urban areas (Figure 13). The most populated block groups were located over a mile away from the nearest facility. However, the distances

for the least populated block groups varied, ranging from half a mile away to nearly 3 and a half miles away.

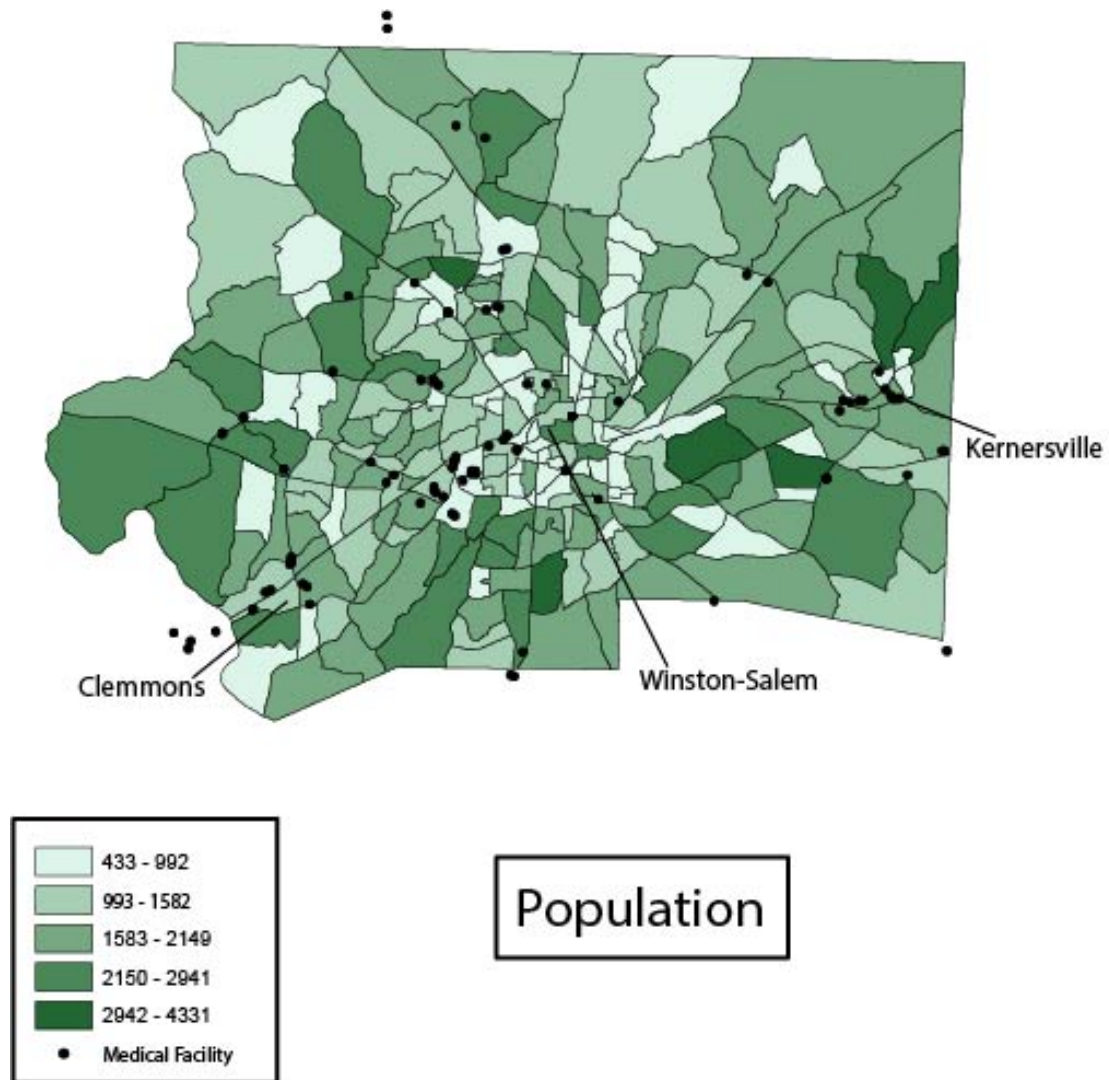


Figure 13 Population by block group

Race and ethnicity can tell a lot about an area but can also lead to misleading conclusions, so caution is needed. The block groups that contained the highest percentage

of white people were most frequently located over a mile away from a facility, and some as much as three or five miles away (Figure 14). The block groups with the highest percentages of black people were located less than a mile away from a facility with a few exceptions (Figure 15). This is reflective of the fact that the majority white block groups were located along the county edges and the majority black block groups were located in more urban areas, mainly in Winston-Salem. But which block groups had better access? Before drawing any conclusions from this information, a few other data points need to be considered. The areas with a high percentage of white people also had above average median incomes and low percentages of households without vehicle access. The areas with high percentages of black people had some of the lowest median incomes in the county, well below the county average and had the highest percentage of households without vehicle access. Taking all of this information together, the block groups that had higher percentages of black people, while being closer to facilities, may have a harder time actually accessing the facilities, facing barriers due to a lack of personal transportation and financial means to pay for care, in comparison to those living in the block groups that were further away from facilities but had private transportation and were better off financially.

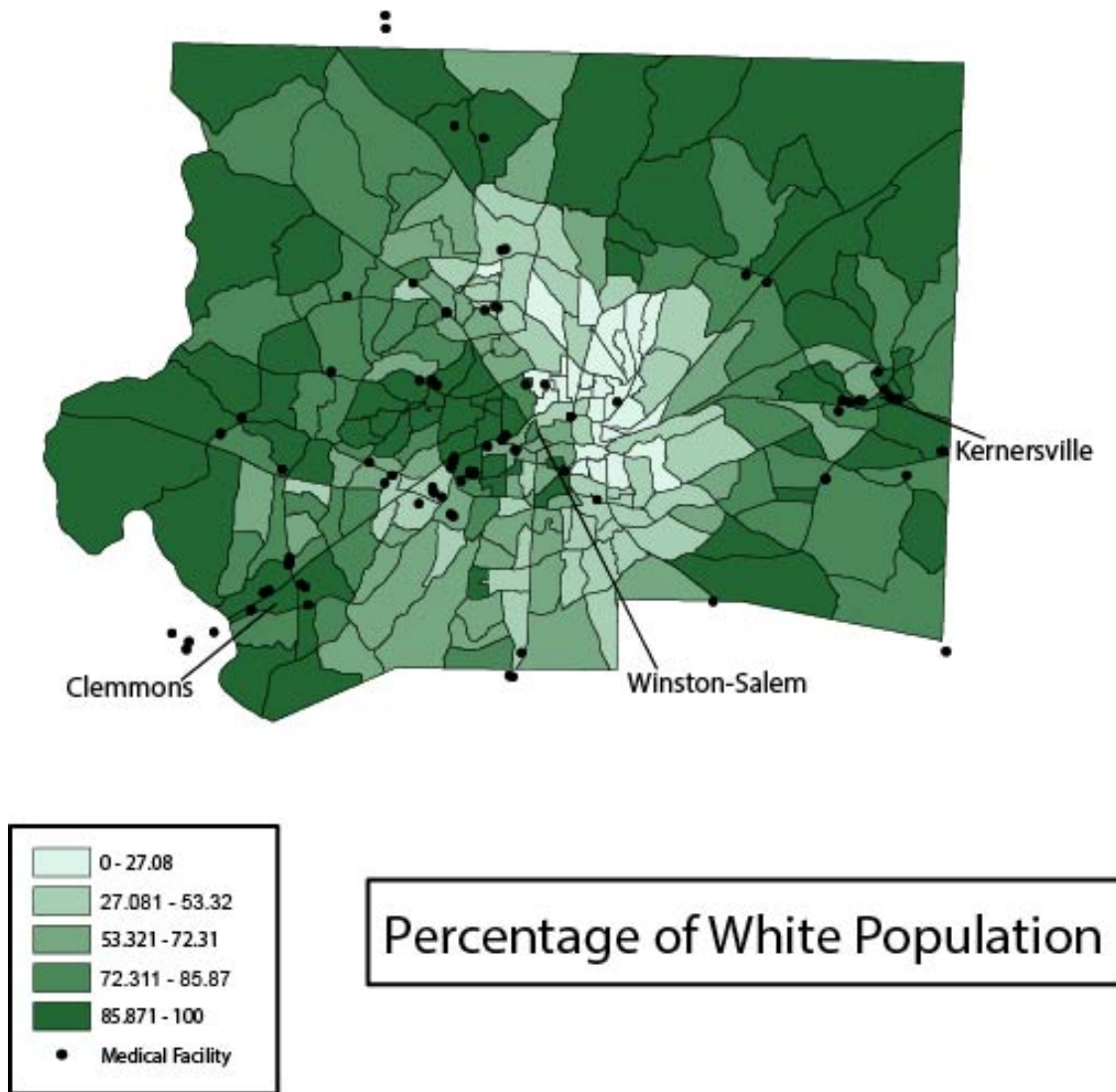


Figure 14 Percentage of white population by block group

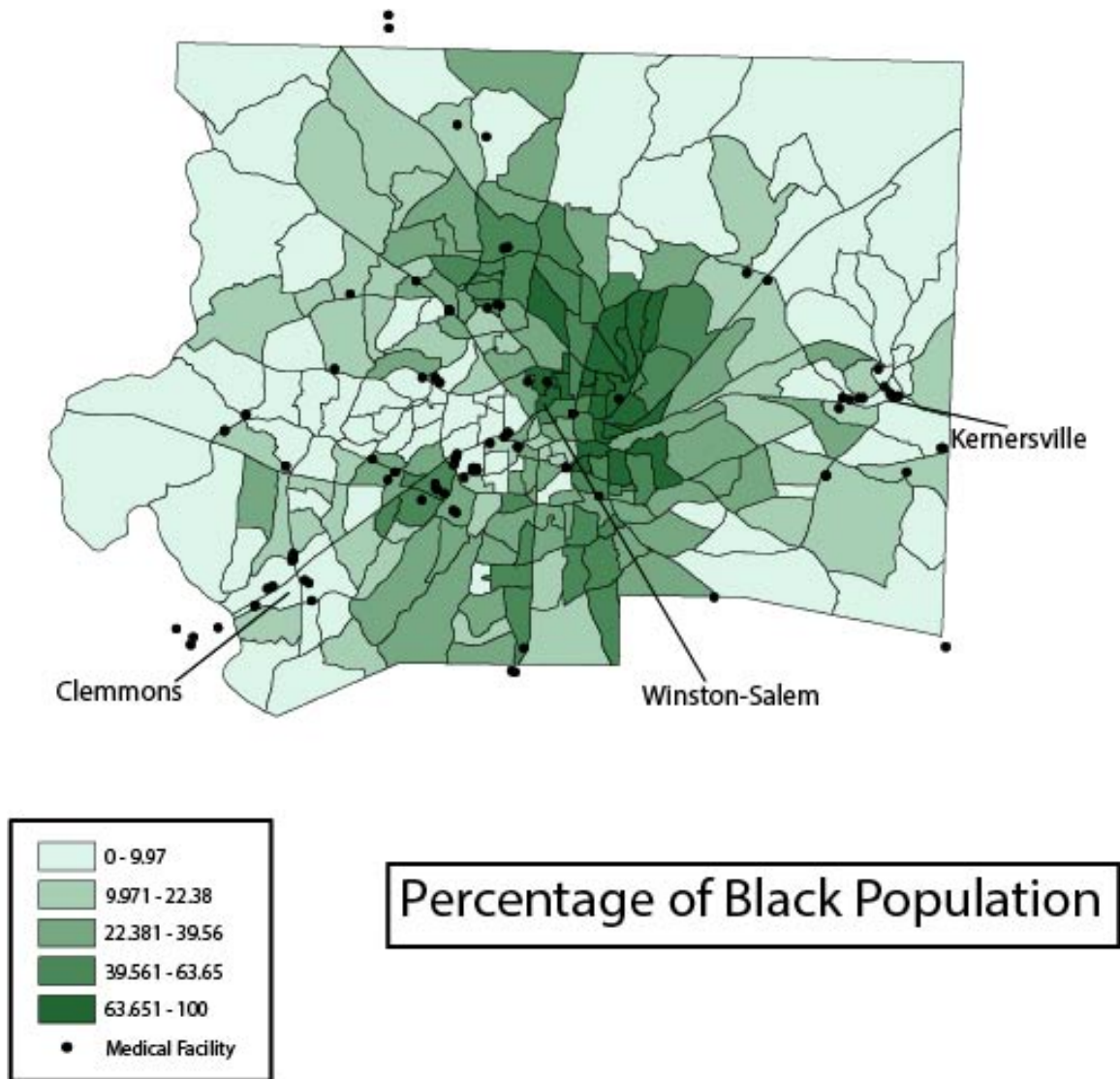


Figure 15 Percentage of black population by block group

For block groups that had large percentages of people identifying as Latino or Hispanic, the distance varied anywhere from half a mile to two and a half miles (Figure 16). This is reflective of the spatial distribution of Latinos and Hispanics, who lived throughout the county, unlike the white-majority block groups and black-majority block

groups. In this case, it is more difficult to draw conclusions based on the distances to the nearest facilities.

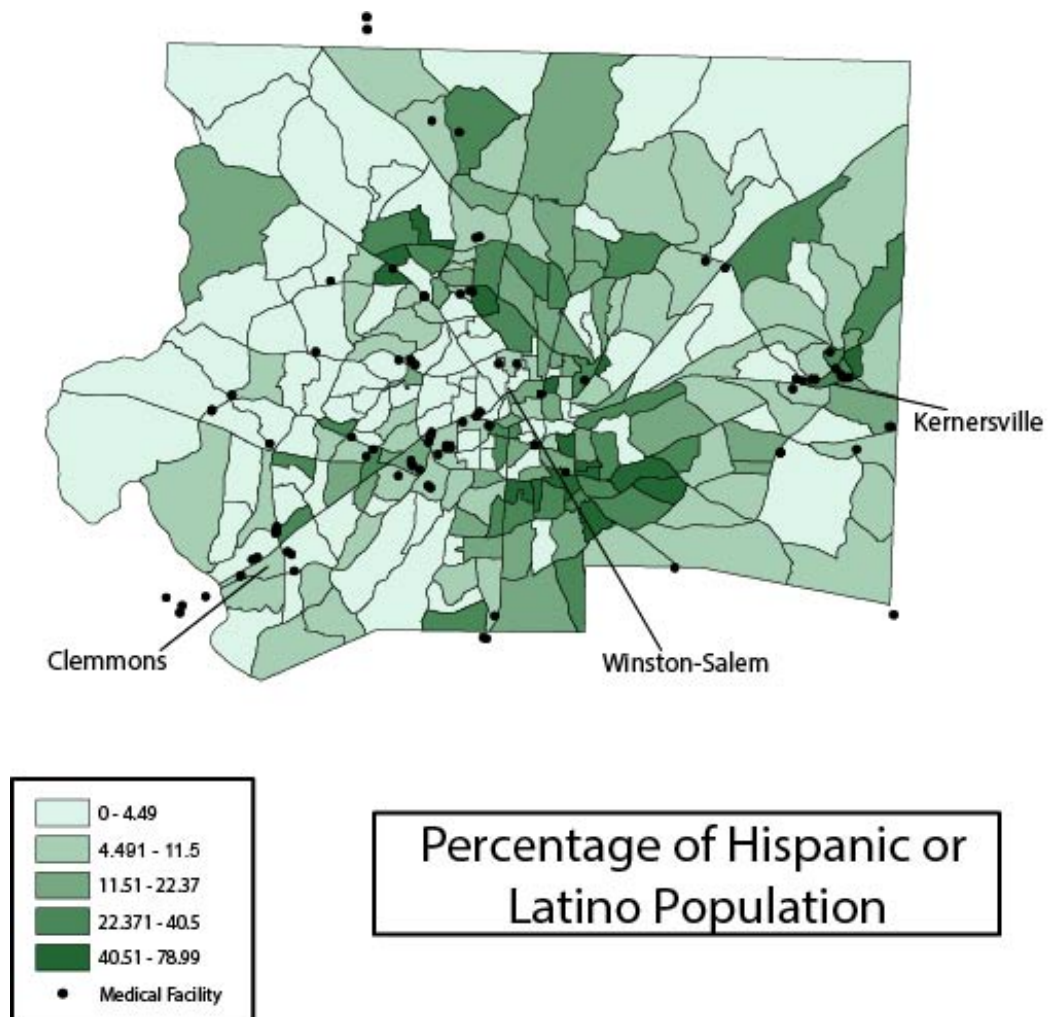


Figure 16 Percentage of Hispanic or Latino population by block group

The median age the percentage of the population under the age of 18 and the percentage of the population over the age of 65 did not appear to be explanatory factors

in determining the nearness to facilities (Figures 17, 18 & 19). The block groups with the lowest median age were located less than one mile away from a facility. The only exception was the block group that contained Wake Forest University, which was located around one mile away from a facility. Since most residents living in this area are students, they may have access to medical facilities on campus. The block groups that had the highest share of children under 18 largely overlapped with those with the lowest median age. The distances ranged from less than a mile to over a mile and a half. On the other end of the spectrum, with the oldest median age in the county, the distances ranged from around half a mile to over two miles. For the block groups that had the greatest share of population over 65, the distances ranged from less than half a mile to nearly a mile and a half. Overall, the location of the youngest and oldest population does not appear to make a difference as to where facilities are located. It should be noted that some block groups have their median age and percentage over 65 skewed due to several factors. Some block groups have an overwhelming number of young or old people in them, due to their proximity to a university or to nursing homes and other such facilities. As such, these areas likely have their own medical facilities for student or resident usage. Special circumstances such as these skew distances for certain populations.

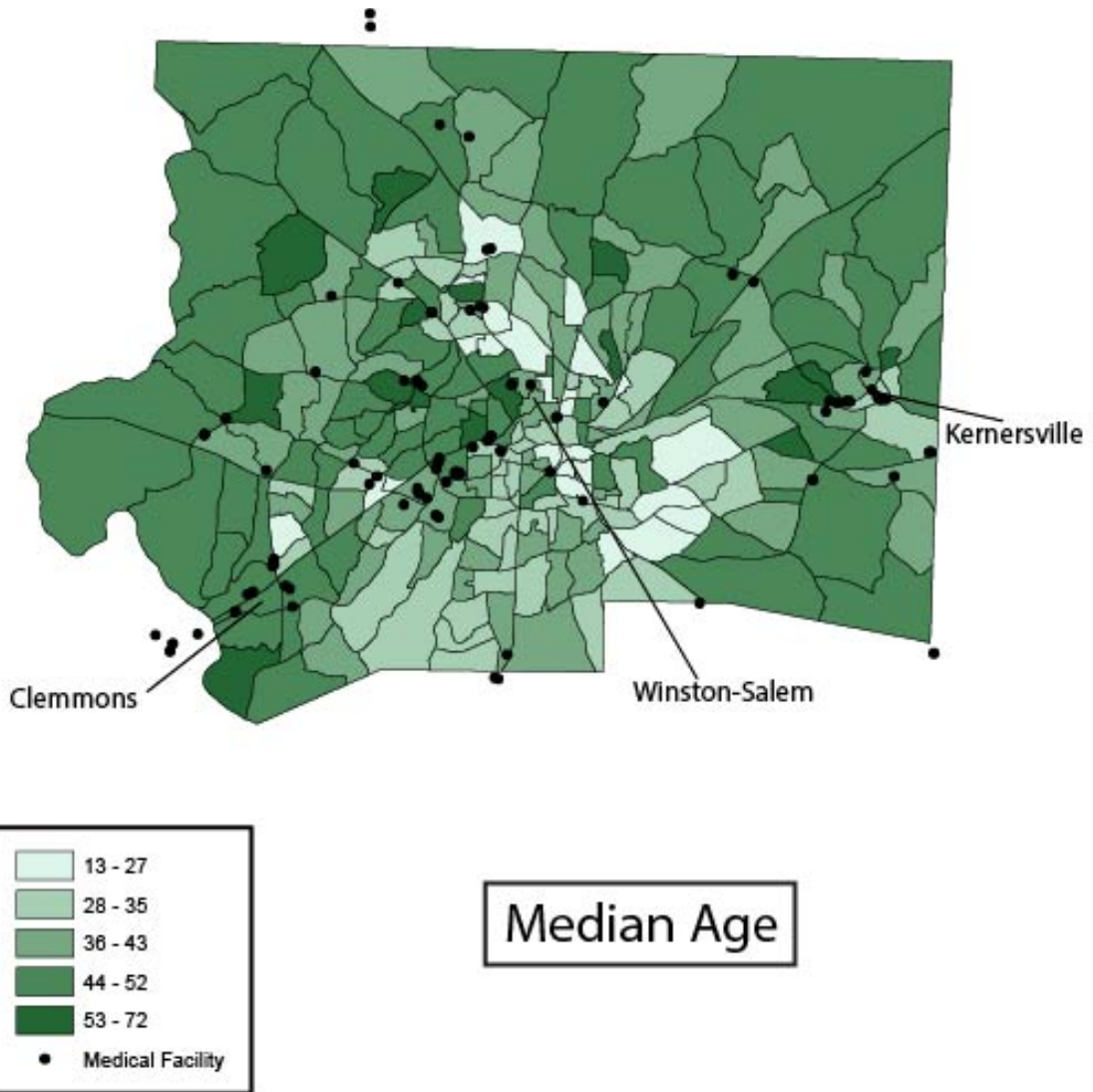


Figure 17 Median age by block group

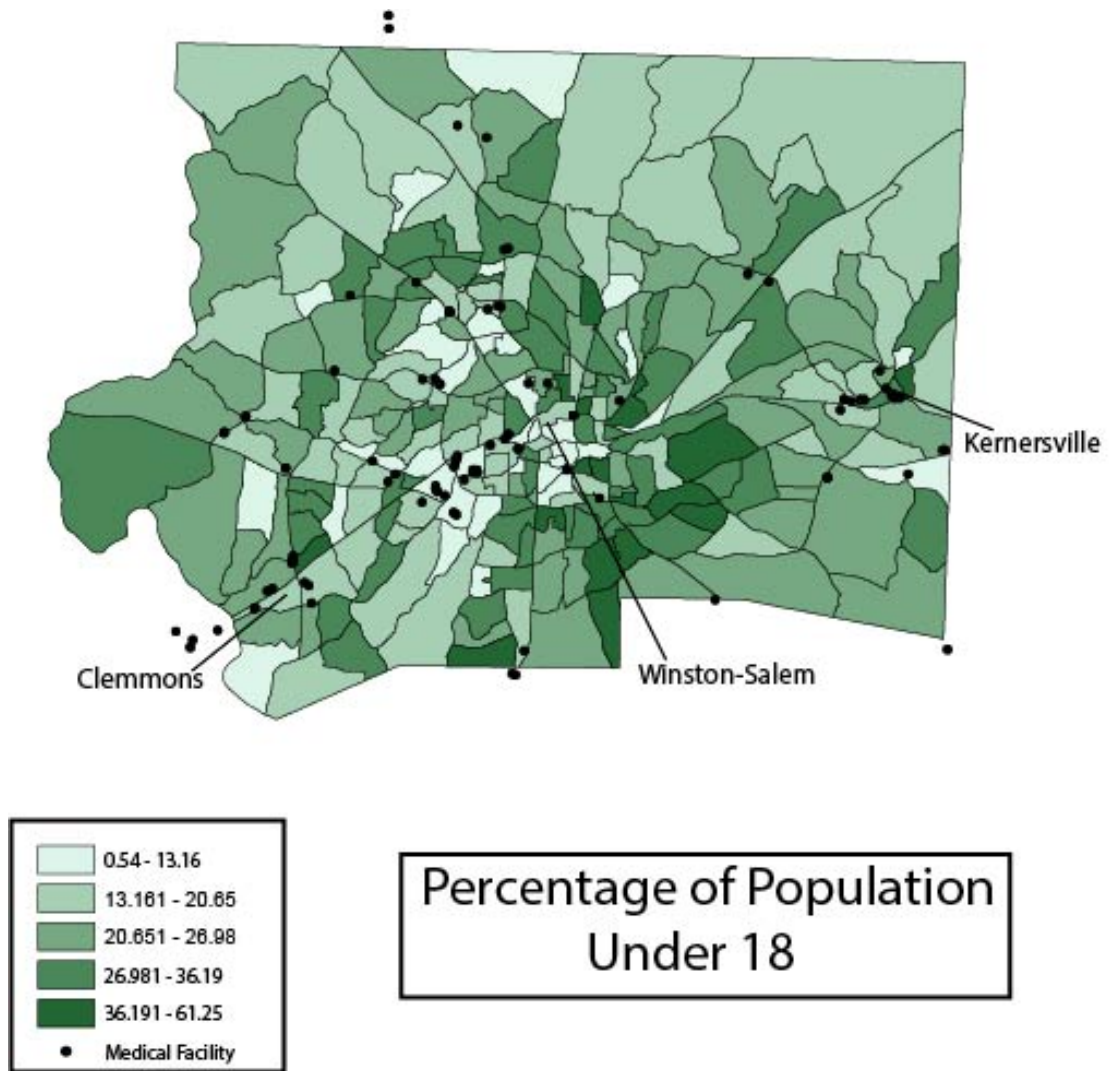


Figure 18 Percentage of population under the age 18 by block group

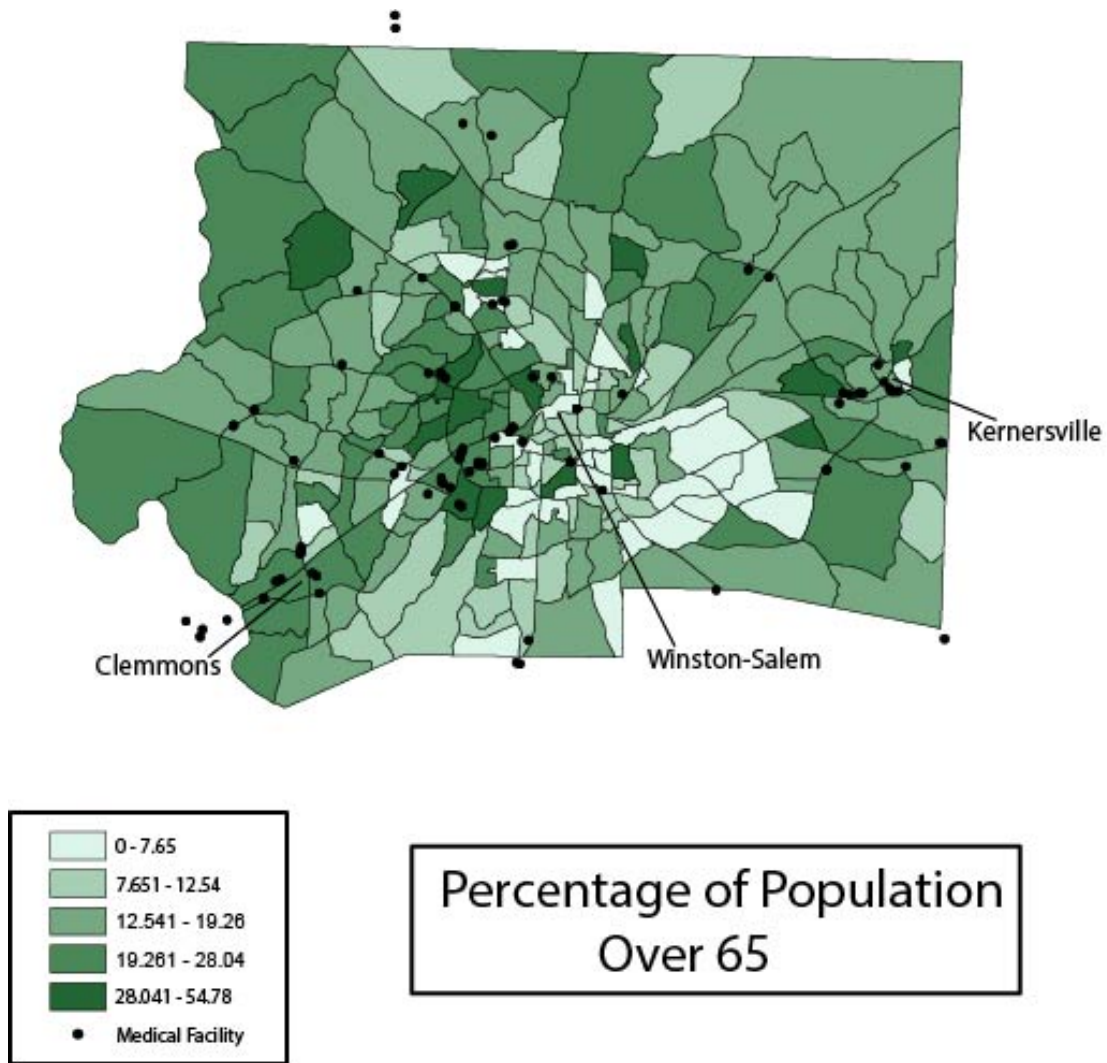


Figure 19 Percentage of population over the age 65 by block group

The distances to the closest facilities by median income are interesting (Figure 20). Some of the poorest block groups, primarily located close to the center of Winston-Salem, had some of the shortest distances to facilities -- all less than a mile. For the richest block groups, the distances varied more, ranging from half a mile to around a mile and a half. Several of these block groups were either located just outside to the west of

Winston-Salem or located in the most exclusive areas in the city near Forsyth County Club. Income levels are not quite perfect indicators as to where medical facilities are located at, as some richer areas were closer to medical facilities than some poorer ones. However, income can be used to make predictions. For instance, areas with higher incomes may oppose commercial zoning anywhere near their neighborhood, which would also include medical facilities. Even so, it really depends on the community and what they would allow to be built in their vicinity. Areas with less income are often located in areas that already have commercial areas and are closer to the middle of the city. These facilities are closer to those that do not have vehicle access, which could be a significant aid to the population living there. Even though this is the case for Forsyth, this may not hold true for other areas. Some poorer areas in other cities may be several miles away from the nearest facility while the richer areas may be less than half a mile from a facility. Distance from rich and poor areas depend on the city and its zoning practices. Again, not perfect indicators, just predictors.

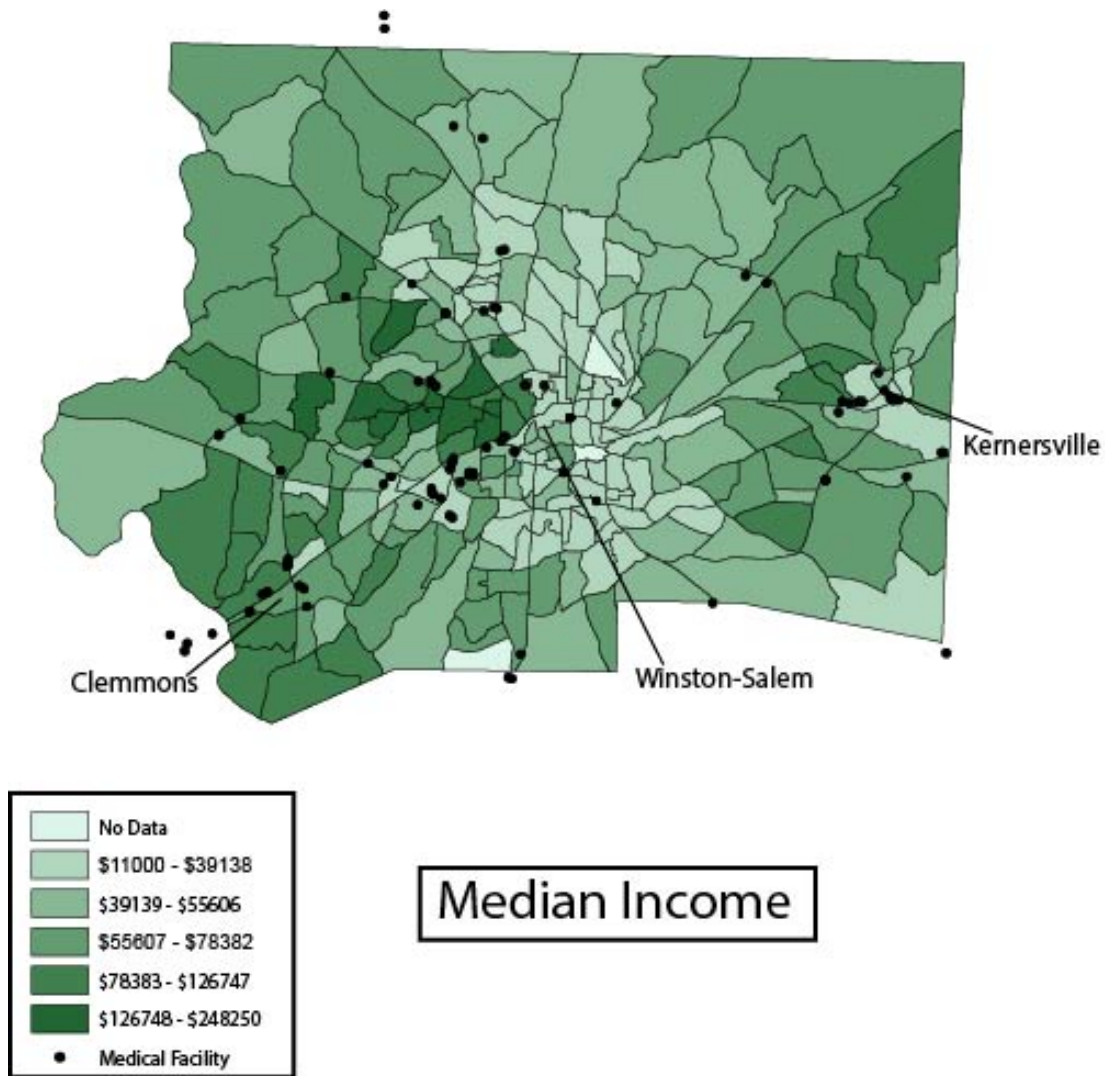


Figure 20 Median income by block group

Overall, there really is not a common factor for indicating where the nearest facility is located at. Rich and poor areas have facilities located close by. The young and old both live near facilities. Some areas that have the highest percentage of households without vehicle access are some of the closest to facilities. It should be important to note that distance is not everything and that communities close to facilities face other

challenges. Even if an area is close to a facility, it may be the only facility for miles around and does not have enough resources to serve the nearby community. Some neighborhood facilities may be of low quality and residents might opt to travel to facilities further away. There are many factors that go into who receives adequate healthcare and distance to facilities is just one of them.

The original goal of this research was to find the nearest primary care facility for Forsyth County residents. While would-be patients may live close to a facility, they may not choose to use its services even if the location is convenient. As noted before, health care access is not entirely dependent on geography and factors such as cost or accommodation can influence whether or not an individual seeks care. Unfortunately, there has been very little research into the relation between residents and the nearest primary care facility.

The perception of the quality of care can be a factor whether or not residents use their nearest facilities for healthcare. Hawthorne and Kwan mention that accessibility studies using GIS often miss this point, equating accessibility with distance (as this paper does). Some residents may have a negative view of their nearest facilities and instead go to a facility farther away. Even if a facility is the most accessible, some residents will not use their closest facility if they perceive the facility offers too low quality of care. If that is the case, then there is more to accessibility than distance. In order to get a clearer picture, they suggest studies using mixed methodologies, not just GIS, to better measure accessibility. Ricketts (2003) wrote that GIS does not always make clear the relationship

between public health and space but does help us understand the issues surrounding healthcare and geography better.

There has been some research for other medical facilities. One study conducted by Alford-Teaster et al (2016) on mammography facilities found that women that passed-by the closest facility usually lived in an urban core, lived in a higher income neighborhood, and had longer travel times to work. They also found that women who did not use the nearest facility used one that was within five minutes away from the nearest facility. Little research has been done to determine how much farther these individuals are willing to travel beyond the nearest facility to receive what they consider better care.

An important factor an individual considers when deciding whether to seek health care is cost. Health care costs for many people are covered by health insurance but not always. Some costs are not covered by insurance and must be paid by the patient. Even when an individual is employed their employer may not offer insurance and are not eligible for Medicaid and must pay medical costs out of pocket. For those on tight budgets, medical attention may have to be weighed against other financial demands. Some may forego medical care in order to pay for necessities such as food and housing. In addition, some individuals, such as those working either full time or working two part time jobs may not be able to afford to take off work and may choose not to seek medical attention, even if they are sick (Diamant et al, 2004). Even with insurance, some patients may still not be able to afford care due to high deductibles or co-pay. Particularly for those with public insurance, some offices may either not take their insurance or may not be taking any more patients (DeVoe et al, 2007).

Many facilities are only open during traditional work hours, 8am to 5 pm -closed for lunch- and closed on the weekend. These hours provide an additional burden to the working population. Urgent care centers usually have extended hours in the evenings and on the weekends, but urgent care is typically used for minor emergencies and complaints as an alternative to the emergency room. Urgent care is not recommended as a substitute to a regular primary care doctor (SolvHealth; Loxterkamp, 2015).

Another important factor for those wanting to visit a doctor is transportation. Of the locations that have the longest trip to a facility, many had access to a vehicle, so it is less likely that transportation is an issue. Those locations that had no access to a vehicle but is close to facilities, walking is an option when there is no other option available. However, Winston-Salem is not particularly walkable nor bikeable so it may not be the safest option. Even for those who were half a mile away from the nearest facility, some people may not want to walk the distance, especially those who are sick or have other medical conditions. The next best option is public transportation, such as the bus system, which covers Winston-Salem, but it does not go far outside of the city limits. In addition, busses are sometimes not the most time efficient way to get to Point A to Point B, which may be a problem for those who need to get to an appointment. In one study (Wilkin, Cohen and Tannebaum, 2012) it was shown that some who used the emergency room as their source of primary care did not have reliable transportation, so they were not able to make appointments on time. To use emergency department services, patients do not need appointments so public transportation-dependent patients do not have to worry about arriving at a scheduled time.

For those who do not have access to a vehicle or live outside of the bus service area, Winston-Salem Transit Authority offers a bus service called Trans-AID. This service is available for those who need transportation to and from a medical facility. Those that are eligible for this service include people covered under the Americans with Disabilities Act (ADA), adults over 60, and Medicaid recipients. This can help fill in the gaps in the transportation situation for some of the population that need it.

Limitations and Future Studies

While knowing the distances between facilities and population is useful, it does not tell the whole story. This study has several limitations, as it does not account for behavior of the population. That is, it cannot answer the question whether residents are using nearby facilities and if not why. For example, while there may be several facilities to receive treatment close by it does not mean that nearby residents use those facilities. They may prefer to go to facilities across the county or outside the county. Some facilities may serve patients outside of the county as much as they serve nearby residents. Forsyth is surrounded by several rural counties that rely on Forsyth County for services. While there are facilities that serve residents living in them, these counties have much less access to health care and it is likely that many of those residents drive into Forsyth to receive care. In order to gauge where patients are coming from and why, interviews and questionnaires-based methodologies should be used.

The size of Forsyth itself proves to be a limitation as well. The county does not cover much land area, resulting in a short distance away from the nearest facility from any part of the county. Since the longest distance was six miles away from the nearest

facility, health care is potentially just a short car drive away. Distance itself is not a real problem in smaller areas, providing that residents have access to a vehicle. However, what may be a short distance for those with a vehicle could a considerable distance for those without vehicle access. Even if a person lives near a facility, actually getting there could present problems. If catching a bus, both the frequency of bus service and the number of intervening stops the bus makes may prevent a person from getting to their appointment on time. Answering the question of how difficult people perceive it is to get to their nearest facility is another question that should be addressed in a future study. The results of this study indicate that future studies in Forsyth County should pay special attention to areas in which over 50 percent of the households had no vehicle access.

Even though this study has limitations, it does provide valuable spatial data and a foundation for future studies dealing with healthcare access in Forsyth County. The following section outlines a few directions that future studies could go in, either covering the limitations of this study or by covering topics that does not currently have much literature.

Further research studies should be conducted on spatial health care accessibility in smaller urban areas, especially at the county level. Studies of these small areas are important because they do not have as many services as larger urban areas. These areas also typically do not have comprehensive public transportation, which makes them more car-dependent. While Winston-Salem does have bus service, it does not have regular stops outside of the city limits, which is limiting for other towns in the county. Since

these smaller urban areas are so different than both rural areas and large cities, more attention should be paid attention to them.

One topic that has very little written about it in healthcare access literature is the impact of healthcare companies on geography. In recent years, hospital networks have been merging with each other to form large chains of associated hospitals, primary and specialty doctors' offices, and urgent care centers, in many cases for cost-cutting purposes. In this study, most facilities belong to either Novant or Wake Forest Baptist Health; very few facilities are independent. As these companies took over more facilities, they also built additional facilities as well—three of the five hospitals used in the study area did not even exist ten years ago.

Even if they offer an essential service such as healthcare, these networks are still businesses and like other businesses, they want as many customers as possible, preferably syphoning customers from their competitors. In some parts of the county, the two networks will have urgent care centers across the street from each other, as shown in Figure 21. The placement of these facilities was most likely not an accident. In their competition, the networks will build more facilities, thus changing the landscape of healthcare. How does the addition of more facilities change healthcare access? More facilities could mean more places for patients to choose from. As shown in this study, even with the rapid expansion of healthcare networks, not all areas are served equally. As stated before, all companies wish to be located in well-traveled areas near competitors surrounded by well-paying customers, healthcare companies included. Financial reasons determine why Novant and Wake Forest Baptist built close to each other and why

facilities are located in commercial areas and in areas that are likely not to rely on public insurance. Now that many facilities are consolidated within a larger network, does that fact change where companies build facilities? If there is more money on hand to build, would companies place a facility where they previously would not, fearing profit loss? Or are healthcare companies still mostly staying in areas where there is the most profit?



Figure 21 Competition: Near the corner of Lewisville-Clemmons Rd. and Peacehaven Rd. in Clemmons

As more facilities are consolidated into larger networks, where and how patients use healthcare can dramatically change. If a patient's usual source of care is within a certain network, their information is stored within the system, which makes going to

other facilities within the same network much easier. For example, the patient's regular doctor may work at a facility close to where they live, but might go to an urgent care center near their work if, for instance, they get sick during a workday and can go during their lunchbreak. The patient can get diagnosed and treated without even seeing their regular doctor. Most spatial accessibility studies measure how accessible facilities are to where people live, but what of situations when other facilities are more convenient? The consolidation of medical facilities has surely changed the geography of care, but by how much? Previous healthcare accessibility studies have not addressed the impact of large healthcare networks on the geography of access. Future studies could address the effects of healthcare networks on spatial accessibility, especially in areas where there are two or more companies dominating the local healthcare market.

CHAPTER V

CONCLUSIONS

Primary healthcare accessibility is an important topic which impacts everyone's quality of life. Access to healthcare helps individuals get the care they need when facing immediate health issues and can also minimize or prevent medical issues before they become a problem in the future. If people cannot get the healthcare they need, current medical issues may get worse and they may leave themselves vulnerable to future severe health concerns. There are several barriers to receiving healthcare, both spatial and aspatial. This study focused on the spatial barriers to healthcare which are the barriers most directly connected to geography. Some places have more access to healthcare facilities. Urban areas typically have the most facilities, however, not all urban areas are the same, many smaller urban areas tend to have fewer facilities and public transportation for individuals is less frequent and may serve a smaller geographic area. This study focused on Forsyth County, North Carolina, a relatively small urban area in terms of both population and geographic area with a less-comprehensive public transportation system. Forsyth County is certainly not unique, this class of smaller urban counties is clearly different than large urban or more rural areas, yet researchers have to a large extent overlooked them in their studies.

The method used to evaluate accessibility for this study was to measure the distance to the nearest primary healthcare facility from neighborhoods in the county, as

defined by Census block groups. Overall, this study showed that most people in the county are relatively close to a facility. Based on that metric alone, the county has good spatial access to healthcare. However, even if individuals have good spatial access, aspatial barriers, such as the lack of time or money, can affect whether individuals seek and receive healthcare. Facility usage in relation to the surrounding population is a topic not included in this study but is warrants further research.

This study offers several different ideas for future studies to address the shortcomings of this study and ideas for studies which existing literature does not address, notably the impact of healthcare company competition on spatial healthcare access. This study offers a starting point for future studies of spatial healthcare access in Forsyth County and other similar sized urban areas in the United States.

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Appendix A.

Tables

Table 1 Forsyth County medical facilities in study area

Name	Type	Number	Street	City	ZIP
Adult Medicine - Downtown Health Plaza	Primary Care	1200	N. Martin Luther King Jr. Drive	Winston-Salem	27101
Ardmore Family Practice PA	Family Medicine	2805	Lyndhurst Ave.	Winston-Salem	27103
Clemmons Urgent & Primary Care	Urgent Care	2245	Lewisville Clemmons Rd C	Clemmons	27012
Cone Health Med Center Kernersville	various	1635	NC 66 South	Kernersville	27284
Family Care of Winston Salem	Family Medicine	1365	Westgate Center Dr.	Winston-Salem	27103
Family Medicine - Laurel Creek	Family Medicine	900	Suite 222	Kernersville	27284
Family Medicine - Lewisville	Family Medicine	6630	Shallowford Road	Lewisville	27023
Family Medicine - National General	Family Medicine	5630	University Parkway	Winston-Salem	27105
Family Medicine – Peace Haven	Family Medicine	1930	North Peace Haven Road	Winston-Salem	27106
Family Medicine - Piedmont Plaza	Family Medicine	1920	West First Street	Winston-Salem	27104
Family Medicine – Reynolda	Family Medicine	3020	Bonbrook Drive	Winston-Salem	27106
Family Medicine - Westbrook Plaza	Family Medicine	1665	Westbrook Plaza Drive	Winston-Salem	27103
FastMed Urgent Care	Urgent Care	310	S Stratford Rd #120	Winston-Salem	27103
FastMed Urgent Care	Urgent Care	5701	University Parkway	Winston-Salem	27105
FastMed Urgent Care	Urgent Care	1024	S Main Street B	Kernersville	27284
House Of Life Family Practice, LLC.	Family Medicine	7781	North Point Blvd.	Winston-Salem	27106
Internal Medicine - Brookview Hills	Internal Medicine	3333	Brookview Hills Boulevard Suite 207	Winston-Salem	27103
Internal Medicine - Janeway Tower	Internal Medicine		Medical Center Boulevard	Winston-Salem	27157

Internal Medicine - Kernersville	Internal Medicine	861	Old Winston Road Suite 101	Kernersville	27284
Internal Medicine – Peace Haven	Internal Medicine	1930	North Peace Haven Road	Winston-Salem	27106
Kernersville Primary Care	Family Medicine	420	W. Mountain Street	Kernersville	27284
Lyndhurst Gynecologic Associates	OB/GYN	445	Pineview Drive	Kernersville	27284
Northern Family Medicine	Family Medicine	648	Almondridge Dr	Rural Hall	27045
Novant Health Adult Primary Care Harper Hill	Primary Care	4937	Old Country Club Road	Winston-Salem	27104
Novant Health Adult Primary Care Tanglewood	Adult Primary Care	4136	Clemmons Road Lyndhurst Ave., Suite 312	Clemmons Winston-Salem	27012 27103
Novant Health Arbor Pediatrics	Pediatrics	2927			
Novant Health Clemmons Family Medicine	Family Medicine	6301	Stadium Drive	Clemmons	27012
Novant Health Clemmons Medical Center	Hospital	6915	Village Medical Circle	Clemmons	27012
Novant Health Forsyth Family Medicine	Family Medicine	400	Jonestown Road	Winston-Salem	27104
Novant Health Forsyth Internal Medicine	Internal Medicine	1381	Westgate Center Dr.	Winston-Salem	27103
Novant Health Forsyth Medical Center	Hospital	3333	Silas Creek Parkway	Winston-Salem	27103
Novant Health Forsyth Pediatrics - Kernersville	Pediatrics	240	Broad Street	Kernersville	27284
Novant Health Forsyth Pediatrics - Union Cross	Pediatrics	1471	Jag Branch Blvd., Suite 101	Kernersville	27284
Novant Health Forsyth Pediatrics - Walkertown	Pediatrics	3431	Walkertown Commons Drive	Walkertown	27051
Novant Health Friedberg Family Medicine	Family Medicine	5010	Peters Creek Pkwy	Winston-Salem	27127
Novant Health Gateway Family Medicine	Family Medicine	390	Salem Ave.	Winston-Salem	27101
Novant Health GoHealth Urgent Care - Clemmons	Urgent Care	3163	Gammon Lane	Clemmons	27012
Novant Health GoHealth Urgent Care - Hanes Square	Urgent Care	105	Hanes Square Circle	Winston-Salem	27103
Novant Health GoHealth Urgent Care - Kernersville	Urgent Care	794	S Main Street B	Kernersville	27284
Novant Health GoHealth Urgent Care - North Point	Urgent Care	7811	North Point Blvd.	Winston-Salem	27106
Novant Health GoHealth Urgent Care - West Highland	Urgent Care	50	Miller Street, Suite C	Winston-Salem	27104

Novant Health Kernersville Family Medicine	Family Medicine	291	Broad Street	Kernersville	27284
Novant Health Kernersville Medical Center	Hospital	1750	Kernersville Medical Parkway	Kernersville	27284
Novant Health Lewisville Family Medicine	Family Medicine	1225	Lewisville Clemmons Road	Lewisville	27023
Novant Health Maplewood Family Medicine	Family Medicine	100	Robinhood Medical Plaza	Winston-Salem	27106
Novant Health Meadowlark Pediatrics	Pediatrics	5110	Robinhood Village Drive	Winston-Salem	27106
Novant Health Miller Street Family Medicine	Family Medicine	50	Miller Street, Suite G	Winston-Salem	27104
Novant Health North Point Medical Associates	Primary Care	1995	Bethabara Road	Winston-Salem	27106
Novant Health Pediatrics King	Pediatrics	167	Moore Road, Suite 201	King	27021
Novant Health Pfafftown Family Medicine	Family Medicine	4611	Yadkinville Road	Pfafftown	27040
Novant Health Pineview Family Medicine	Family Medicine	490	Pineview Drive	Kernersville	27284
Novant Health Robinhood Pediatrics & Adolescent Medicine	Pediatrics	1350	Whitaker Ridge Drive NW	Winston-Salem	27106
Novant Health Rural Hall Family Medicine	Family Medicine	290	West Wall Street	Rural Hall	27045
Novant Health Shallowford Family Medicine	Family Medicine	165	Lowes Foods Drive	Lewisville	27023
Novant Health Today's Pediatrics	Pediatrics	2001	Today's Woman Ave.	Winston-Salem	27105
Novant Health Today's Woman OB/GYN	OB/GYN	2001	Today's Woman Ave. NW	Winston-Salem	27105
Novant Health Triad OB/GYN	OB/GYN	2909	Maplewood Ave.	Winston-Salem	27103
Novant Health Union Cross Family Medicine	Family Medicine	1471	Jag Branch Blvd., Suite 103	Kernersville	27284
Novant Health Valaoras & Lewis OB/GYN	OB/GYN	245	Charlois Blvd.	Winston-Salem	27103
Novant Health Village Point Family Medicine	Family Medicine	7130	Village Medical Circle	Clemmons	27012
Novant Health Walkertown Family Medicine	Family Medicine	2800	Darrow Road	Walkertown	27051
Novant Health Wallburg Family Medicine	Family Medicine	10479	NC Highway 109, Suite 107-A	Winston-Salem	27107
Novant Health Waughtown Pediatrics	Pediatrics	648	E Monmouth Street	Winston-Salem	27107

Novant Health West Forsyth Internal Medicine and Pediatrics	Family Medicine	105	Stadium Oaks Drive	Clemmons	27012
Novant Health Winston-Salem Gynecology	OB/GYN	201	Executive Park Blvd.	Winston-Salem	27103
Novant Health WomanCare - Clemmons	OB/GYN	4130	Clemmons Road	Clemmons	27012
Novant Health WomanCare - Kernersville	OB/GYN	1730	Kernersville Medical Parkway, Suite 104	Kernersville	27284
Novant Health WomanCare - Winston-Salem	OB/GYN	114	Charlois Blvd.	Winston-Salem	27103
Novant Health-GoHealth Urgent Care - Highland Oaks	Urgent Care	600	Highland Oaks Dr	Winston-Salem	27103
Obstetrics and Gynecology - Clemmons	OB/GYN	2341	Lewisville- Clemmons Road	Clemmons	27012
Obstetrics and Gynecology - Downtown Health Plaza	OB/GYN	1200	N. Martin Luther King Jr. Drive	Winston-Salem	27101
Obstetrics and Gynecology - Shepherd	OB/GYN	500	Shepherd Street	Winston-Salem	27103
Old Town Immediate & Family Care	Family Medicine	3734	Reynolda Road	Winston-Salem	27106
Pediatrics - Clemmons	Pediatrics	2311	Lewisville- Clemmons Road	Clemmons	27012
Pediatrics - Downtown Health Plaza	Pediatrics	1200	N. Martin Luther King Jr. Drive	Winston-Salem	27101
Pediatrics - Ford, Simpson, Lively and Rice	Pediatrics	2933	Maplewood Avenue	Winston-Salem	27103
Pediatrics - Ford, Simpson, Lively and Rice - Kernersville	Pediatrics	100-A	Harmon Lane	Kernersville	27284
Pediatrics - Kernersville	Pediatrics	815	Old Winston Road	Kernersville	27284
Pediatrics - Westgate	Pediatrics	3746	Vest Mill Road	Winston-Salem	27103
Pediatrics - Winston East	Pediatrics	2295	E. 14th St.	Winston-Salem	27105
Salem Gynecology	OB/GYN	2830	Maplewood Ave	Winston-Salem	27103
Summer FamilyCare	Family Medicine	6614	Shallowford Road	Lewisville	27023
Twin City Pediatrics	Pediatrics	2821	Maplewood Ave	Winston-Salem	27103
Twin City Pediatrics	Pediatrics	5175	Clemmons Road	Clemmons	27012
University Internal Medicine - Clemmons	Internal Medicine	2311	Lewisville- Clemmons Road	Clemmons	27012
University Internal Medicine - Country Club	Internal Medicine	4614	Country Club Road	Winston-Salem	27104

Urgent Care – Clemmons	Urgent Care	2311	Lewisville- Clemmons Road	Clemmons	27103
Urgent Care - Piedmont Plaza	Urgent Care	1920	West First Street	Winston- Salem	27104
Wake Forest Baptist Medical Center	Hospital	1	Medical Center Boulevard	Winston- Salem	27157
Weekend Walk-In Services	Urgent Care	3020	Bonbrook Drive	Winston- Salem	27106
Winston Salem Pediatrics	Pediatrics	2808	Maplewood Ave	Winston- Salem	27103

Table 2 Outside county medical facilities in study area

Name	Type	Number	Street	City	ZIP
Family Medicine-Hillsdale	Family Medicine	147	Peachtree Ln.	Advance	27006
Novant Health Hillsdale Medical Associates	Family Medicine	121	Medical Dr.	Advance	27006
Novant Health Arcadia Family Medicine	Family Medicine	12208	NC-150	Winston Salem	27127
Novant Health Mountainview Medical	Family Medicine	216	Moore Road	King	27021
Novant Health North High Point Family Medicine	Family Medicine	6431	Old Plank Road	High Point	27265
Wake Forest Baptist Health - Davie Medical Center	Hospital	329	801 N	Bermuda Run	27006
Pediatrics-Advance	Pediatrics	114	Kinderton Blvd.	Advance	27006
MEDIQ Urgent Care	Urgent Care	12201	NC-150 Suite 11	Winston Salem	27127

Table 3 Distances to nearest medical facilities by block group

Block Group	Distance to nearest facility in Forsyth	Distance to nearest family care in Forsyth	Distance to nearest facility	Distance to nearest family care
3706700 01001	0.610	0.610	0.610	0.610
3706700 02001	0.480	0.480	0.480	0.480
3706700 03011	0.492	0.875	0.492	0.875

3706700				
03021	0.187	1.395	0.187	1.395
3706700				
04001	0.836	1.129	0.836	1.129
3706700				
04002	0.711	1.492	0.711	1.492
3706700				
04003	0.496	0.896	0.496	0.896
3706700				
05001	1.114	1.165	1.113	1.165
3706700				
05002	0.796	0.798	0.795	0.798
3706700				
05003	0.650	1.250	0.650	1.250
3706700				
06001	0.669	0.770	0.669	0.770
3706700				
06002	0.429	0.431	0.429	0.431
3706700				
07001	0.978	0.978	0.978	0.978
3706700				
07002	0.494	0.494	0.494	0.494
3706700				
08011	0.899	0.899	0.899	0.899
3706700				
08012	0.872	0.997	0.871	0.997
3706700				
08021	0.490	0.490	0.490	0.490
3706700				
08022	0.466	0.853	0.466	0.853
3706700				
09001	0.551	0.551	0.551	0.551
3706700				
09002	0.780	0.780	0.780	0.780
3706700				
09003	0.355	0.355	0.355	0.355
3706700				
09004	0.545	0.545	0.545	0.545
3706700				
10001	0.354	0.354	0.354	0.354
3706700				
10002	0.864	0.864	0.864	0.864
3706700				
10003	1.137	1.142	1.137	1.142

3706700				
10004	0.518	0.524	0.519	0.524
3706700				
11001	0.698	0.697	0.697	0.697
3706700				
11002	0.623	0.623	0.623	0.623
3706700				
11003	0.332	0.348	0.332	0.348
3706700				
12001	0.337	1.299	0.337	1.299
3706700				
12002	0.567	0.579	0.567	0.579
3706700				
13001	0.981	0.982	0.982	0.982
3706700				
13002	1.128	1.175	1.129	1.175
3706700				
13003	0.791	1.741	0.790	1.741
3706700				
14001	1.385	1.500	1.385	1.500
3706700				
14002	1.161	1.725	1.160	1.725
3706700				
15001	2.640	2.753	2.640	2.753
3706700				
15002	1.872	1.961	1.873	1.961
3706700				
15003	1.628	2.303	1.628	2.303
3706700				
16011	2.376	3.339	2.375	3.339
3706700				
16012	1.456	2.463	1.455	2.463
3706700				
16013	2.099	2.798	2.098	2.798
3706700				
16021	1.299	1.878	1.299	1.878
3706700				
16022	0.197	1.452	0.197	1.452
3706700				
17001	1.015	2.255	1.015	2.255
3706700				
17002	0.961	1.252	0.961	1.252
3706700				
17003	0.453	1.635	0.453	1.635

3706700				
17004	0.766	2.154	0.765	2.154
3706700				
17005	1.452	2.871	1.452	2.871
3706700				
18001	1.380	2.243	1.379	2.243
3706700				
18002	0.726	1.913	0.726	1.913
3706700				
18003	0.665	1.723	0.665	1.723
3706700				
18004	1.002	1.546	1.002	1.546
3706700				
19011	0.302	1.448	0.303	1.448
3706700				
19021	0.887	0.888	0.888	0.888
3706700				
19022	0.667	0.667	0.667	0.667
3706700				
20011	1.121	1.504	1.121	1.504
3706700				
20012	1.052	1.866	1.052	1.866
3706700				
20021	1.533	1.533	1.533	1.533
3706700				
20022	1.999	2.213	1.999	2.213
3706700				
21001	0.375	0.380	0.375	0.380
3706700				
21002	0.676	0.677	0.677	0.677
3706700				
22001	0.247	0.388	0.247	0.388
3706700				
22002	0.283	0.283	0.283	0.283
3706700				
22003	0.591	0.604	0.592	0.604
3706700				
25011	1.220	1.281	1.220	1.281
3706700				
25012	0.954	0.955	0.954	0.955
3706700				
25013	0.526	0.556	0.526	0.556
3706700				
25021	0.429	1.035	0.428	1.035

3706700	25022	1.084	1.279	1.084	1.279
3706700	26011	0.577	0.614	0.577	0.614
3706700	26012	1.118	1.239	1.118	1.239
3706700	26031	0.692	0.691	0.691	0.691
3706700	26032	1.011	1.011	1.011	1.011
3706700	26033	0.524	0.527	0.524	0.527
3706700	26034	0.483	0.483	0.483	0.483
3706700	26041	0.271	0.271	0.271	0.271
3706700	26042	0.952	0.952	0.952	0.952
3706700	26043	1.085	1.085	1.085	1.085
3706700	26044	1.296	1.297	1.297	1.297
3706700	27011	1.230	1.230	1.230	1.230
3706700	27012	0.409	0.408	0.408	0.408
3706700	27013	0.612	0.624	0.611	0.624
3706700	27021	0.923	0.939	0.923	0.939
3706700	27022	0.704	0.705	0.705	0.705
3706700	27023	0.852	0.852	0.852	0.852
3706700	27024	0.537	0.537	0.537	0.537
3706700	27031	0.430	0.539	0.431	0.539
3706700	27032	0.441	0.441	0.441	0.441
3706700	27033	0.496	0.497	0.496	0.497
3706700	27034	0.109	0.109	0.109	0.109

3706700	28011	6.469	6.469	4.493	4.493
3706700	28012	5.386	5.385	4.699	4.699
3706700	28013	3.495	3.495	3.495	3.495
3706700	28041	1.914	1.913	1.913	1.913
3706700	28042	1.575	1.574	1.574	1.574
3706700	28043	1.113	1.112	1.112	1.112
3706700	28061	0.404	0.422	0.404	0.422
3706700	28062	1.327	1.372	1.327	1.372
3706700	28071	1.609	1.609	1.609	1.609
3706700	28072	2.078	2.078	2.078	2.078
3706700	28073	0.560	0.560	0.560	0.560
3706700	28081	0.399	0.399	0.399	0.399
3706700	28082	1.987	1.987	1.581	1.581
3706700	28091	2.365	2.365	2.365	2.365
3706700	28092	2.195	2.195	2.195	2.195
3706700	29011	2.416	2.544	2.416	2.544
3706700	29012	3.459	3.459	3.459	3.459
3706700	29013	1.477	1.608	1.477	1.608
3706700	29031	3.267	3.596	3.266	3.596
3706700	29032	2.270	2.270	2.270	2.270
3706700	29033	3.462	3.584	3.462	3.584
3706700	29034	3.624	3.624	3.624	3.624

3706700				
29041	2.963	2.962	2.962	2.962
3706700				
29042	5.406	5.406	5.406	5.406
3706700				
30021	2.564	3.115	2.564	3.115
3706700				
30022	2.290	2.290	2.290	2.290
3706700				
30023	0.763	0.763	0.763	0.763
3706700				
30031	2.769	3.094	2.769	3.094
3706700				
30032	1.496	1.779	1.496	1.779
3706700				
30041	2.471	2.490	2.470	2.490
3706700				
30042	0.998	0.998	0.998	0.998
3706700				
31031	2.515	2.544	2.515	2.544
3706700				
31032	1.990	2.482	1.990	2.482
3706700				
31033	4.715	4.714	4.714	4.714
3706700				
31051	2.167	2.166	2.166	2.166
3706700				
31052	1.867	2.057	1.867	2.057
3706700				
31061	5.391	5.493	5.391	5.493
3706700				
31062	3.415	3.414	3.414	3.414
3706700				
31071	2.021	2.021	2.021	2.021
3706700				
31072	1.985	1.984	1.984	1.984
3706700				
31081	2.416	2.416	2.416	2.416
3706700				
31082	0.798	0.798	0.798	0.798
3706700				
32011	1.317	1.316	1.316	1.316
3706700				
32012	0.656	0.655	0.655	0.655

3706700				
32013	0.532	0.532	0.532	0.532
3706700				
32014	0.226	0.226	0.226	0.226
3706700				
32021	0.195	0.269	0.195	0.269
3706700				
32022	0.574	0.574	0.574	0.574
3706700				
32023	1.307	1.307	1.307	1.307
3706700				
33071	0.666	0.983	0.666	0.983
3706700				
33072	0.391	0.395	0.392	0.395
3706700				
33081	2.318	2.486	2.318	2.486
3706700				
33082	1.228	1.228	1.228	1.228
3706700				
33083	0.947	0.946	0.946	0.946
3706700				
33084	0.980	0.981	0.981	0.981
3706700				
33091	1.660	2.859	1.660	2.859
3706700				
33092	2.026	2.712	2.026	2.712
3706700				
33093	2.937	3.640	2.937	3.640
3706700				
33101	3.120	3.120	3.120	3.120
3706700				
33102	2.224	2.224	2.224	2.224
3706700				
33111	1.819	1.819	1.819	1.819
3706700				
33121	1.664	1.666	1.664	1.666
3706700				
33131	3.660	4.096	2.139	2.139
3706700				
33141	0.242	2.314	0.242	2.314
3706700				
33142	1.696	3.311	1.696	3.311
3706700				
33151	1.035	1.658	1.034	1.658

3706700				
33152	0.988	0.989	0.989	0.989
3706700				
34021	1.880	1.879	1.879	1.879
3706700				
34022	1.616	1.616	1.616	1.616
3706700				
34031	2.291	2.290	2.290	2.290
3706700				
34032	2.516	2.515	2.515	2.515
3706700				
34041	1.077	2.359	1.078	2.359
3706700				
34042	2.356	3.160	2.356	3.160
3706700				
35001	1.705	2.964	1.705	2.964
3706700				
35002	0.947	2.178	0.948	2.178
3706700				
35003	1.975	3.016	1.975	3.016
3706700				
35004	1.730	1.730	1.730	1.730
3706700				
35005	2.619	2.619	2.619	2.619
3706700				
36001	2.404	2.665	2.405	2.665
3706700				
36002	2.135	2.134	2.134	2.134
3706700				
36003	1.279	1.279	1.279	1.279
3706700				
37011	1.437	1.438	1.438	1.438
3706700				
37012	1.658	1.658	1.658	1.658
3706700				
37013	2.284	2.284	2.284	2.284
3706700				
37021	1.656	1.656	1.656	1.656
3706700				
37022	2.093	2.094	2.094	2.094
3706700				
37023	2.184	2.184	2.184	2.184
3706700				
37031	1.641	1.640	1.640	1.640

3706700				
3706700	37032	1.475	1.474	1.474
3706700	37033	1.164	1.164	0.994
3706700	37034	0.936	0.936	0.936
3706700	38031	0.807	0.807	0.807
3706700	38032	2.882	2.882	2.882
3706700	38041	0.208	0.244	0.208
3706700	38042	1.001	1.002	1.002
3706700	38043	2.601	2.677	2.601
3706700	38051	0.082	0.167	0.081
3706700	38052	0.282	0.808	0.282
3706700	38053	1.091	1.092	1.092
3706700	38054	1.131	1.583	1.131
3706700	38061	2.179	2.179	2.179
3706700	38062	1.779	1.778	1.778
3706700	39031	0.771	0.860	0.771
3706700	39032	0.491	0.491	0.491
3706700	39033	0.267	0.268	0.268
3706700	39041	0.794	0.794	0.794
3706700	39042	0.436	0.436	0.436
3706700	39043	1.074	1.074	1.074
3706700	39044	1.735	1.819	1.735
3706700	39051	0.408	0.408	0.408

3706700				
39052	1.130	1.241	1.129	1.241
3706700				
39061	1.001	1.070	1.001	1.070
3706700				
39062	0.500	0.585	0.501	0.585
3706700				
39063	1.047	1.047	1.047	1.047
3706700				
39081	0.454	0.454	0.454	0.454
3706700				
39082	1.493	1.493	1.493	1.493
3706700				
39091	1.260	1.260	1.260	1.260
3706700				
39092	0.527	0.527	0.527	0.527
3706700				
39093	0.925	0.925	0.925	0.925
3706700				
40051	0.363	0.396	0.363	0.396
3706700				
40052	0.711	0.718	0.711	0.718
3706700				
40053	1.856	1.856	1.680	1.856
3706700				
40071	3.294	3.294	3.294	3.294
3706700				
40072	2.728	2.728	2.728	2.728
3706700				
40073	1.235	1.235	1.235	1.235
3706700				
40074	1.175	1.174	1.174	1.174
3706700				
40091	2.058	2.057	2.057	2.057
3706700				
40092	1.326	1.325	1.325	1.325
3706700				
40101	1.115	1.832	1.116	1.832
3706700				
40102	1.095	1.095	1.095	1.095
3706700				
40103	1.004	2.124	1.005	2.124
3706700				
40111	0.798	0.797	0.797	0.797

3706700				
40112	0.893	0.894	0.894	0.894
3706700				
40113	0.972	0.972	0.972	0.972
3706700				
40121	0.803	0.912	0.803	0.912
3706700				
40122	0.880	0.977	0.880	0.977
3706700				
40123	0.979	0.980	0.980	0.980
3706700				
40124	1.240	1.241	1.241	1.241
3706700				
40131	0.563	0.600	0.563	0.600
3706700				
40132	0.245	0.244	0.244	0.244
3706700				
40141	0.496	0.496	0.496	0.496
3706700				
40142	0.797	1.326	0.798	1.326
3706700				
40151	0.755	1.177	0.756	1.177
3706700				
40152	1.915	2.389	1.916	2.389
3706700				
40153	2.383	2.705	2.384	2.705
3706700				
41021	3.915	3.914	3.914	3.914
3706700				
41022	2.901	2.901	2.901	2.901
3706700				
41031	1.013	1.249	1.012	1.249
3706700				
41032	1.377	2.297	1.376	2.297
3706700				
41041	0.766	0.765	0.765	0.765
3706700				
41042	1.713	1.712	1.712	1.712
3706700				
41043	1.102	1.102	1.102	1.102
Average				
Distance	1.356	1.557	1.336	1.536

Table 4 Select demographics by block group

Block group	Population	Median income	%without vehicle access	% white	% black	% Latino/Hispanic	Median Age	% under 18	% over 65	Number of facilities
370670001001	2253	53194	16.54	67.42	27.16	5.64	33	1.64	9.9	0
370670002001	1157	18352	37.81	50.73	43.39	12.53	40	14.52	3.98	3
370670003011	1860	16985	42.58	7.58	90.22	2.1	36	29.25	15.86	0
370670003021	1532	21394	31.21	7.9	84.6	11.29	41	22.65	18.15	1
370670004001	848	43050	16.25	14.5	61.79	18.4	41	18.4	8.96	0
370670004002	719	25189	38.28	0.28	77.33	0	49	21.14	23.92	0
370670004003	1859	25673	21.73	11.03	84.08	10.44	27	39.43	6.24	0
370670005001	499	16833	23.71	6.61	82.16	15.83	28	24.45	4.81	0
370670005002	690	15043	60.19	0.43	98.55	2.46	27	20.87	5.36	0
370670005003	1098	28185	23.13	19.22	75.05	17.3	29	31.6	11.57	0
370670006001	1420	14153	46.87	1.9	86.13	6.41	46	19.72	14.3	0
370670006002	814	24010	24.89	53.32	46.07	53.32	15	53.32	10.44	0
370670007001	785	16385	64.3	6.11	86.62	3.44	49	16.69	21.53	0
370670007002	1187	21859	34.78	35.05	60.91	12.97	32	30.92	11.46	0
370670008011	2601	N/A	N/A	16.03	75.01	2.92	20	0.54	0	0
370670008012	867	11000	41.88	17.99	47.4	44.06	13	61.25	3.34	0
370670008021	597	21284	6.43	11.73	79.56	7.04	17	53.94	0.67	0
370670008022	1786	11722	33.4	39.36	52.69	16.52	21	15.45	6.27	1
370670009001	774	11531	47.43	63.31	23	13.7	36	9.17	7.88	1
370670009002	891	16736	9.93	62.74	21.21	34.01	36	20.65	19.08	0
370670009003	540	34766	14.85	86.67	12.59	3.33	43	9.07	20.56	0

370670											
009004	1097	61058	1.99	65.82	22.24	2.19	23	2.83	11.12	0	
370670											
010001	835	31272	22.53	66.71	27.43	24.67	29	31.14	6.11	0	
370670											
010002	1752	33879	11.52	46.8	30.76	26.43	28	34.7	7.02	0	
370670											
010003	908	46202	3.61	69.27	26.76	1.32	30	26.43	8.7	0	
370670											
010004	605	63889	9.27	90.74	4.3	0	34	9.26	7.93	0	
370670											
011001	955	44688	18.74	78.64	15.6	3.56	35	9.53	10.79	0	
370670											
011002	763	51875	22.91	68.41	16.25	17.82	30	18.74	7.99	0	
370670											
011003	861	31719	28.19	65.97	32.29	4.3	51	4.18	23.34	2	
370670											
012001	513	98125	25.65	74.07	24.76	0	72	7.99	54.78	1	
370670											
012002	1454	110278	2.54	95.67	0.89	1.03	45	30.12	18.64	0	
370670											
013001	1235	41800	24	72.31	21.05	4.37	22	2.67	14.17	0	
370670											
013002	2635	156042	0	63.83	18.63	4.29	20	1.06	2.24	0	
370670											
013003	797	55147	8.11	66.75	30.49	3.26	47	26.98	23.09	0	
370670											
014001	2179	31994	5.88	20.74	76.96	14.27	33	34.28	14.09	0	
370670											
014002	1640	23125	13.51	45.73	36.83	24.76	27	28.48	8.23	0	
370670											
015001	2341	30938	7.89	26.48	57.84	32.34	25	39.21	7.22	0	
370670											
015002	1283	39000	6.59	42.95	47.31	33.13	36	26.03	14.96	0	
370670											
015003	950	25100	17.07	33.47	47.16	17.05	38	23.58	17.05	0	
370670											
016011	1553	46563	18.58	7.98	75.47	14.49	38	24.73	15.07	0	
370670											
016012	702	38765	17.46	0	100	0	61	4.27	41.6	0	
370670											
016013	873	35488	2.3	2.52	95.42	0	38	26.23	14.32	0	
370670											
016021	1458	N/A	42	22.84	75.72	15.09	25	29.7	4.05	0	
370670											
016022	1901	18143	30.81	24.36	75.64	23.62	41	26.2	13.83	1	

370670										
017001	584	37697	6.48	18.66	75.86	14.73	42	12.5	9.25	0
370670										
017002	749	12917	38.91	4.94	95.06	0	39	34.85	8.14	0
370670										
017003	1462	19835	35.12	9.3	88.71	9.3	29	37.07	15.87	0
370670										
017004	771	20625	30.51	26.59	62	49.29	25	43.19	2.46	0
370670										
017005	2261	61454	4.14	30.25	55.42	1.02	34	29.28	11.76	0
370670										
018001	2077	37832	17.16	34.71	63.65	27.59	31	29.75	11.56	0
370670										
018002	831	19640	14.36	33.09	27.8	64.38	28	38.75	7.22	0
370670										
018003	613	25667	0	30.18	56.77	44.7	39	32.63	9.46	0
370670										
018004	798	25341	11.44	17.79	82.21	21.55	52	24.69	35.59	0
370670										
019011	1606	22802	18.6	49.69	31.26	45.64	29	32.94	8.22	0
370670										
019021	1301	25125	7.92	60.57	25.06	22.37	32	18.22	7.23	0
370670										
019022	646	52589	0	91.64	6.35	3.87	45	13.16	30.19	0
370670										
020011	1100	33409	1.31	50.64	31.27	41.09	34	29.64	9.09	0
370670										
020012	1809	27411	7.42	44.72	45.49	25.21	39	29.3	15.81	0
370670										
020021	1790	29598	3.14	59.61	28.66	52.18	30	36.98	5.2	0
370670										
020022	1680	25693	9.45	70.54	26.55	38.21	37	24.46	16.67	0
370670										
021001	969	58150	6.78	85.66	12.07	9.18	42	17.75	26.21	1
370670										
021002	1211	52266	14.37	90.09	6.94	2.73	37	16.68	14.12	0
370670										
022001	624	41625	11.07	96.96	3.04	7.53	51	10.42	28.04	11
370670										
022002	1531	40168	11.71	71.33	14.04	8.88	33	16.46	7.58	5
370670										
022003	1520	75625	5.08	92.11	0.59	0.79	43	17.3	14.08	0
370670										
025011	753	92375	1.67	93.63	1.99	1.06	42	22.97	23.64	0
370670										
025012	573	177500	4.74	100	0	0	44	25.13	22.69	0

370670										
025013	1268	248250	1.83	95.11	2.44	3.79	53	19.4	25.24	0
370670										
025021	1416	84000	0	89.62	5.51	3.46	47	20.34	20.9	0
370670										
025022	1503	159429	4.2	91.75	2.66	0.67	51	22.82	29.01	0
370670										
026011	1642	63207	2.61	95.01	3.11	0	48	8.1	29.54	3
370670										
026012	1302	151083	0	86.87	13.13	0.54	45	24.19	20.81	0
370670										
026031	2348	44564	4.51	71.64	26.53	5.45	40	19.59	20.4	0
370670										
026032	1393	63688	3.55	74.52	12.28	9.83	48	10.55	20.75	0
370670										
026033	683	67321	0	82.72	0	5.27	58	7.61	20.5	0
370670										
026034	1278	49481	7.7	59.23	23.71	10.56	35	23.16	14.71	0
370670										
026041	832	19447	32.02	41.83	29.57	43.15	29	31.61	12.98	1
370670										
026042	1760	68657	5.63	80.85	15.28	9.89	45	21.48	15.85	0
370670										
026043	2114	114853	0	73.32	15.42	5.87	41	31.41	10.12	0
370670										
026044	1427	140104	0	84.02	7.57	0.63	49	25.02	17.8	0
370670										
027011	3705	33136	9.04	37.54	50.72	37.89	31	33.74	5.32	0
370670										
027012	2239	37361	6.14	79.63	17.87	43.37	30	28.18	9.29	0
370670										
027013	892	50664	11.26	67.94	27.58	4.48	47	16.26	24.89	2
370670										
027021	1324	52702	0	37.69	60.65	31.42	40	17.82	13.37	0
370670										
027022	757	29183	31.55	27.08	62.62	10.17	34	7.4	5.28	0
370670										
027023	2028	25755	19.42	38.81	59.66	9.81	25	36.19	2.51	0
370670										
027024	1865	29615	25.81	47.35	51.69	13.4	54	18.18	35.87	0
370670										
027031	1984	24779	11.44	45.77	30.85	41.08	23	30.09	9.07	1
370670										
027032	2077	41316	5.32	64.76	17.24	3.18	28	6.36	21.33	0
370670										
027033	1445	25530	27.79	68.51	28.17	13.63	30	15.09	5.12	0

370670										
027034	907	30702	19.5	36.38	63.62	4.96	38	19.18	3.64	2
370670										
028011	1252	68375	0.56	96.81	0	0.64	48	18.37	20.69	0
370670										
028012	722	40682	0	85.87	9.97	0	52	26.04	20.08	0
370670										
028013	2300	69539	0.11	83.83	13.09	2.35	46	18.22	17.74	0
370670										
028041	1246	50804	1.77	70.63	24.48	3.77	49	17.34	24.64	0
370670										
028042	1379	60052	6.18	64.97	23.93	42.06	39	30.6	16.9	0
370670										
028043	1600	36639	7.95	57.56	31.81	39.63	30	32.25	10.69	0
370670										
028061	755	30893	7.62	36.03	57.62	6.89	26	33.91	17.88	2
370670										
028062	2529	32305	9.72	52.63	37.76	16.41	39	21.31	18.15	0
370670										
028071	1796	54730	4.98	55.62	35.58	8.8	40	28.45	12.31	0
370670										
028072	1393	53239	7.05	66.48	24.62	0	51	8.69	27.64	0
370670										
028073	2238	49442	7.84	89.1	7.24	26.99	37	24.26	13.9	1
370670										
028081	1909	51844	2.26	86.85	11.63	7.86	47	16.82	18.18	1
370670										
028082	1924	71071	0	99.06	0.42	8.16	37	24.22	12.01	0
370670										
028091	1143	65662	4.75	74.89	18.46	1.66	59	12.07	35.26	0
370670										
028092	1237	67875	4.29	85.37	14.63	0.57	50	14.87	16.41	0
370670										
029011	1680	35917	9.62	66.37	23.27	21.85	44	20.3	14.4	0
370670										
029012	1377	39531	1.38	95.21	2.11	16.99	49	19.32	20.48	0
370670										
029013	1824	51726	0	39.53	54.39	7.68	39	23.68	13.54	0
370670										
029031	968	39750	0	48.35	46.18	15.39	46	11.67	23.45	0
370670										
029032	1901	39781	0	75.49	23.46	32.14	36	25.2	14.73	0
370670										
029033	433	21607	4.95	100	0	17.32	57	15.47	32.79	0
370670										
029034	737	46750	0	91.04	8.96	3.26	40	23.2	15.88	0

370670											
029041	1433	48958	2.44	95.12	4.12	6.77	47	16.12	20.87	0	
370670											
029042	711	70208	4.91	97.19	1.41	0	40	19.41	11.25	0	
370670											
030021	1830	54167	3.26	19.34	74.21	9.62	43	27.92	14.64	0	
370670											
030022	1470	49024	3.01	47.01	48.16	5.51	46	24.76	25.44	0	
370670											
030023	1382	53692	1.45	82.2	14.98	5.14	44	23.81	21.85	1	
370670											
030031	1275	41250	0	70.35	26.67	0	47	19.53	15.06	0	
370670											
030032	1981	58578	0	79.86	16.3	4.09	38	28.02	13.12	1	
370670											
030041	2085	42083	1.06	78.61	15.16	11.27	36	22.06	14.72	0	
370670											
030042	1750	88000	10.16	87.6	8.4	0.17	56	20.29	28.97	3	
370670											
031031	1749	82650	0	94.85	3.54	3.09	40	24.81	13.21	0	
370670											
031032	1706	58768	0	95.08	3.87	27.14	46	19.58	16.24	0	
370670											
031033	2063	94583	0	88.41	5.19	9.89	46	15.56	16.67	0	
370670											
031051	1749	40019	1.7	78.27	21.33	5.83	48	20.93	13.84	0	
370670											
031052	1881	73902	4.37	89.15	9.3	2.76	39	29.67	15.52	0	
370670											
031061	2052	68654	0.89	95.47	3.61	0.49	47	16.18	16.28	0	
370670											
031062	705	78382	0	90.92	9.08	0	43	18.72	14.75	0	
370670											
031071	1154	59432	3.58	91.68	6.33	8.32	45	25.56	14.82	0	
370670											
031072	3089	62375	0.63	84.04	8.35	9.91	47	16.57	18.87	0	
370670											
031081	3137	40735	1.82	82.24	7.01	38.22	37	31.08	14.89	0	
370670											
031082	761	42083	14.78	90.93	6.83	17.48	53	8.67	30.75	0	
370670											
032011	1401	90179	2.08	71.73	25.41	7.49	46	22.7	21.41	0	
370670											
032012	804	87132	0	88.06	8.08	3.48	56	17.91	27.24	0	
370670											
032013	1894	37250	4.26	60.56	18.64	6.39	42	17.74	17.05	2	

370670											
032014	791	39750	13.92	96.08	0.88	24.53	41	21.74	14.66	0	
370670											
032021	1745	31953	3.57	94.33	5.67	35.42	35	29.63	19.26	5	
370670											
032022	579	31389	7.2	90.5	9.5	47.67	33	38.34	6.22	0	
370670											
032023	1736	57120	8.67	80.13	10.83	10.31	46	16.82	24.37	0	
370670											
033071	2007	57188	0	69.26	28.95	5.18	44	24.96	19.68	0	
370670											
033072	1835	51645	7.56	74.28	11.28	11.12	42	17	13.19	1	
370670											
033081	2820	76441	1.91	78.48	19.68	7.91	36	26.13	11.7	0	
370670											
033082	726	86134	0	98.9	0	0	59	14.46	31.54	0	
370670											
033083	4331	72652	0	77.93	16.49	12.56	41	26.88	14.41	0	
370670											
033084	501	51429	15.09	90.22	6.39	21.36	46	21.36	13.77	0	
370670											
033091	498	37228	0	43.37	24.7	37.55	35	33.94	6.22	0	
370670											
033092	1569	39545	2.41	18.36	81.64	1.34	52	15.11	17.21	0	
370670											
033093	3353	44148	7.63	52.07	39.1	14.2	25	40.74	6.83	0	
370670											
033101	2282	63167	2.23	59.07	32.08	24.36	35	30.06	7.62	0	
370670											
033102	1978	68750	6.2	74.06	22.9	7.33	33	27.86	7.63	0	
370670											
033111	1969	91929	1.17	76.59	17.06	8.43	40	26.41	7.01	0	
370670											
033121	2938	61500	0.63	83.56	13.55	2.18	45	22.06	21.07	2	
370670											
033131	1582	38935	4.01	84.83	4.68	6.83	48	23.83	17.95	0	
370670											
033141	1259	42827	2.68	81.33	16.44	5.48	43	8.18	14.14	1	
370670											
033142	2122	68429	0	89.68	7.3	11.5	40	29.03	12.16	0	
370670											
033151	1465	76000	3.03	93.58	4.57	0.82	49	18.7	26.55	0	
370670											
033152	2075	34066	6.44	89.88	8.48	18.99	34	21.45	14.27	2	
370670											
034021	818	45956	0	88.63	5.62	8.07	51	17.24	25.55	0	

370670											
034022	1630	48750	5.98	86.87	4.66	9.14	44	21.53	16.2	0	
370670											
034031	2330	39600	4.37	48.63	37.77	38.2	25	33.65	6.01	0	
370670											
034032	947	24000	10.66	56.6	9.5	78.99	25	42.45	3.8	0	
370670											
034041	1744	28314	17.4	48.17	39.56	29.76	29	35.61	10.95	0	
370670											
034042	2380	26955	12.48	33.36	31.47	52.65	26	39.79	6.18	0	
370670											
035001	1419	26797	4.02	36.08	26.5	66.81	23	45.31	4.16	0	
370670											
035002	630	15720	22.15	52.86	41.9	29.37	40	30.95	12.54	0	
370670											
035003	1206	17311	10.52	36.48	47.84	15.92	41	37.65	18.74	0	
370670											
035004	2111	53021	1.93	70.49	25.15	9.95	34	22.36	16.44	1	
370670											
035005	1978	59423	0	48.69	47.42	40.5	28	38.57	7.18	0	
370670											
036001	1150	50855	0	50.7	41.65	0	36	24.78	15.65	0	
370670											
036002	3880	59427	2.04	69.07	18.43	22.11	33	26.11	8.81	0	
370670											
036003	1874	46318	0	66.49	11.85	17.08	41	25.03	16.97	0	
370670											
037011	900	21012	55.23	28.67	61.89	20	29	28.44	7.56	0	
370670											
037012	2174	38529	10.38	56.99	33.07	4.88	30	28.43	7.31	0	
370670											
037013	1724	31362	1.9	48.96	46.46	26.51	28	29.64	8.76	0	
370670											
037021	2743	44507	8.48	64.67	26.25	14.18	41	16.44	17.86	0	
370670											
037022	481	61100	5.56	93.35	4.78	1.87	43	13.1	23.08	0	
370670											
037023	1687	57132	3.55	47.84	44.87	12.33	29	34.44	4.03	0	
370670											
037031	2117	66806	0	65.52	30.85	8.46	34	29.33	11.34	0	
370670											
037032	1546	65439	0	72.25	20.05	1.62	35	22.12	8.67	0	
370670											
037033	1461	N/A	0	73.51	26.49	26.28	29	39.7	6.84	0	
370670											
037034	2675	59883	3.06	39.21	53.27	6.02	43	17.64	11.36	1	

370670										
038031	2412	61515	2.84	77.49	20.36	7.3	49	12.48	28.9	0
370670										
038032	2941	54947	2.29	59.03	37.81	3.74	34	20.23	8.87	0
370670										
038041	867	31607	2.44	64.94	22.72	5.07	40	10.03	30.1	2
370670										
038042	2336	56875	16.23	47.77	37.59	0.43	43	11.17	25.47	0
370670										
038043	1927	59176	0	65.18	29.11	1.14	33	18.73	11.05	0
370670										
038051	1293	21690	39.21	43.77	44.24	16.47	39	11.76	20.88	4
370670										
038052	1664	51719	0	52.58	44.35	8.35	42	16.23	14.96	1
370670										
038053	1654	46968	2.77	49.52	43.17	16.93	36	27.51	5.99	0
370670										
038054	1383	68571	0	65.51	13.81	1.01	32	19.23	13.09	0
370670										
038061	1650	90078	1.31	68.61	17.09	11.03	38	27.94	13.7	0
370670										
038062	1508	64605	1.29	74.2	20.29	0.86	47	17.11	22.35	0
370670										
039031	1521	45644	11.49	64.23	33.27	8.02	45	12.62	16.9	0
370670										
039032	1809	27368	11.9	36.98	55.44	12.27	26	28.69	8.68	0
370670										
039033	1066	33425	6.05	53.1	30.02	25.61	26	34.71	1.88	1
370670										
039041	2098	75427	0	65.82	12.63	5.39	47	18.49	25.93	0
370670										
039042	1688	40333	1.95	63.21	25.71	6.93	32	13.8	14.75	2
370670										
039043	1333	51101	1.7	82.15	8.63	16.05	41	18.68	15.68	0
370670										
039044	992	86927	0	74.6	17.94	0	50	12.3	19.56	0
370670										
039051	1568	43432	0.52	63.84	24.23	2.74	31	11.29	10.27	0
370670										
039052	1737	53056	5.54	82.44	9.04	5.07	51	13.93	32.3	0
370670										
039061	1186	148889	0	94.94	0	0	40	32.21	19.9	0
370670										
039062	482	138083	0	91.29	2.07	12.45	58	14.94	31.12	0
370670										
039063	1827	92056	2.49	88.34	3.61	0.55	48	20.96	20.42	0

370670										
039081	1627	106316	0	90.35	5.1	3.26	53	18.38	26.55	1
370670										
039082	1335	165521	0	94.31	4.04	1.65	46	24.34	15.66	0
370670										
039091	1454	146838	0	91.75	8.25	0	48	25.86	21.46	0
370670										
039092	1107	54604	0	85.37	5.6	33.79	42	11.92	21.05	0
370670										
039093	1694	81838	0	89.43	2.77	3.48	48	18.83	18.06	0
370670										
040051	1389	62292	2.35	95.82	0.94	5.62	48	18	24.84	2
370670										
040052	2633	98298	0	82.23	15.57	7.75	48	23.78	22.86	0
370670										
040053	973	89500	2.73	95.68	1.85	0	55	10.69	26.31	0
370670										
040071	2428	49740	0	96.95	0	0	44	29.9	21.13	0
370670										
040072	2587	104286	0	93.16	1.16	7.5	49	23.31	21.69	0
370670										
040073	916	109531	0	65.5	22.71	0	48	13.1	17.47	0
370670										
040074	1975	126747	0	82.18	5.57	2.23	47	26.33	8.81	0
370670										
040091	1770	70595	1.29	89.83	3.11	4.07	45	24.97	18.93	0
370670										
040092	2716	89417	0	97.09	1.88	2.39	46	21.98	18.48	0
370670										
040101	2149	78083	0.72	79.57	4.23	2.93	43	20.52	14.19	0
370670										
040102	785	63882	2.48	97.96	0	5.22	53	17.58	20.64	1
370670										
040103	856	211625	0	76.29	5.61	0	42	31.19	13.79	0
370670										
040111	2305	101583	0	94.27	2.65	3.08	41	25.03	15.14	1
370670										
040112	2273	47721	0	81.61	14.39	4.49	41	20.15	16.06	2
370670										
040113	1090	67143	2.85	91.1	6.33	0	45	18.53	17.8	0
370670										
040121	2066	83065	2.1	64.86	15.97	0.73	26	27.98	7.65	1
370670										
040122	1899	73141	2.14	77.2	10.37	8.85	44	26.54	13.32	0
370670										
040123	1059	37286	0	48.54	22.38	25.31	28	35.88	10.1	0

370670										
040124	1268	58958	0	84.23	6.55	0	41	29.18	24.05	0
370670										
040131	1899	39138	2.15	80.25	6.11	35.55	33	38.07	11.95	4
370670										
040132	1418	83333	11.87	93.16	2.96	2.19	47	21.09	23.06	3
370670										
040141	1918	64250	7.39	90.3	3.81	3.49	49	20.13	25.03	3
370670										
040142	890	67375	2.6	98.88	0.79	0	47	24.16	19.1	0
370670										
040151	1310	42011	1.87	78.47	6.64	6.79	36	28.47	15.73	0
370670										
040152	1638	90492	0	70.63	21.49	7.51	38	29.18	12.09	0
370670										
040153	1632	113977	0	93.44	0.43	8.82	47	16.79	13.6	0
370670										
041021	1363	62571	5.37	96.85	2.35	13.21	51	22.16	24.65	0
370670										
041022	2000	74167	5.8	85.55	10.75	0	50	17.75	23.25	0
370670										
041031	2762	77589	0	81.35	15.06	2.17	38	24.26	14.48	1
370670										
041032	1672	55606	0	88.46	9.33	0	43	26.79	17.7	0
370670										
041041	2521	103355	0.95	78.94	12.38	3.97	37	34.63	13.45	1
370670										
041042	851	68611	2.16	96	1.41	0	57	17.98	30.08	0
370670										
041043	717	51894	0	78.8	21.2	0	47	11.16	21.2	0