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The Relationship between Parks, Health, Income, and Education in Albuquerque, New Mexico

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by

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ABSTRACT

As resources are becoming scarcer, Southwestern cities are looking for ways to expend less water and money, leading to removal of green spaces. This is happening alongside the current health crisis occurring throughout the United States, which is unfortunate since urban green spaces have been found to improve human health. The purpose of this study, focusing on Albuquerque, New Mexico, is to determine: (1) if those benefits appear to exist in a desert city, and (2) how additional variables, such as income and education, compare with parks regarding impact on community health. A GIS analysis was conducted using park, health, income and education data. The results indicate that while income and education do strongly correlate with certain health indicators, parks also demonstrate a small beneficial relationship with health in relation to chronic obstructive pulmonary disease (COPD), heart disease, and chronic disease.

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CHAPTER 1 – INTRODUCTION

Cities in the Southwestern United States are facing tough decisions as they struggle with drought, climate change, and recovery from the economic recession. As water becomes more scarce and budgets continue to suffer, cities are working to find compromises that offer their populaces the best living environment with existing resources.

At the same time, the United States, and New Mexico in particular, are facing a health crisis. It will be important for municipalities to continue to find innovative ways to encourage and develop a healthier population. Literature from Europe and large American cities suggests that the creation and maintenance of green spaces is one way to improve human health, alleviate issues with climate change, and contribute to economic integrity (de Vries, 2013; Maas, 2006; Harvey, 2011; Mitchell, 2008; Lovasi, 2013; Department for Environment, Food and Rural Affairs (DEFRA), 2011; Jakubowski, 2010; City Parks Alliance, 2015; Mathey, 2011).

Green spaces are areas of land that are mostly or completely vegetated with grass, trees, shrubs, flowers and other vegetation. Urban green spaces are those areas that are located within or along the boundary of an urban environment (i.e., towns and cities). Examples of green spaces include parks, playgrounds, community gardens, public plazas, cemeteries, riversides, farms, mountains and forests, and wetlands (EPA, 2014). Green spaces bolster health through a number of mechanisms including: encouraging physical activity, improving mental state, removing air pollution, removing water pollution, and allowing for water infiltration (Heinze, 2011). Additionally, parks help municipalities save money on both health care and infrastructure costs (Jakubowski, 2010; Harvey, 2011; City Parks Alliance, 2015). It seems reasonable that these benefits would not be exclusive to Europe and/or large cities such as New York City, but would also be found in less densely populated desert cities, such as Albuquerque.

The Issue

The Southwestern United States is experiencing a prolonged period of drought (Rocha, 2014). As water resources become more scarce, cities and towns are looking for ways to conserve water. Unfortunately, this is leading to the alteration of many current green spaces through removal of large amounts of vegetation, such as residential lawns and streetscaping (Lovett, 2013; City of Rocklin, California, 2014; City of Santa Cruz, 2014; City of Corona, 2014), and replacing it with gravel and other non-living features. The Albuquerque Bernalillo Water Utility Authority (ABCWUA) offers a rebate to homeowners who remove “high water use” landscaping and replace it with “xeriscape for a desert-friendly yard” (Albuquerque Bernalillo Water Utility Authority (ABCWUA), 2015). While this move seems to make some sense for water conservation, it may not bode well for the health of residents in these places. Increased impervious surfaces, such as concrete sidewalks and asphalt roads, and reduced vegetation in cities, are associated with the urban heat island effect. The urban heat island effect is a situation in which urban areas “experience elevated temperatures compared to their outlying rural surroundings" Additionally, as cities get hotter due to urbanization and climate change, residents and businesses use more air conditioning to create a comfortable environment. Unfortunately, use of air conditioners themselves further increases the outdoor temperature as cold air is blown inside a building and the hot air produced by the air conditioner is blown outside (EPA, 2015).

Large-scale removal of vegetation will increase the urban heat island effect. In spite of the xeriscaping rebate encouraging removal of lawns, the ABCWUA does recognize this problem. The ABCWUA offers a rebate to homeowners and businesses that care for trees on their property in an attempt to maintain an urban forest (Baca's Trees, 2015). However, this seems to contradict the xeriscaping movement, and many trees may still be removed by citizens in an effort to save water. As lawns, residential vegetation, and vegetated streetscapes are removed and replaced with non-living landscaping or hard surfaces, urban parks will take on an increasingly larger role in providing physical, mental, economic and environmental benefits.

Who Benefits from Urban Green Spaces?

The simple answer is that everyone who lives, works and spends time in an urban setting benefits from urban green spaces. According to Maas (2006), the greatest benefit is gained by people who spend the most time near to an urban green space. People who live, work or spend time within sight of a park gain mental health benefits from close proximity, including stress relief, improved mood, and faster healing times as well as reduced need to pain medication in hospital patients (Maas, 2006; Haq, 2011). Physical health benefits are gained by parks encouraging people to participate in physical activity which decreases the risk of several diseases (de Vries, 2013; Heinze, 2011). Everyone within the urban environment gains from beneficial economic and environmental effects through reduced infrastructure costs, reduced health and welfare costs to both individuals and government, and improved air and water quality (Jakubowski, 2010; Harvey, 2011; City Parks Alliance, 2015; Heinze, 2011). The literature reveals that more vulnerable populations, such as the young, elderly, and low-income groups, benefit the greatest from living near to, and having access to, urban green spaces, as discussed in Chapter 2.

Planning for the Future

Water use will be a key issue for Southwestern regions in the coming years. Past water use policies and inaccurate assumptions led to unsustainable usage habits. This problem is further compounded by the current drought, which is expected to last for decades. Climate change further complicates the issue with an expected overall increase in annual temperature, and a decrease in winter snowpack (Lenart, 2013). Governments and residents are now forced to learn new ways to think about and use water.

Planning for water shortages and changes to climate will lead to conflict as different groups develop different, and possibly conflicting, priorities (U.S. Department of the Interior (DOI) Bureau of Reclamation, 2005). Municipalities will need to determine which resources and activities they believe warrant water usage, and which uses may be unrealistic to continue. The consideration of maintaining green spaces within urban parks is not simply one of wanting some grass and trees. The numerous services provided by these spaces impact people in beneficial ways they may not even realize. In future planning, it will be important to take these beneficial impacts into consideration when determining water allotment and financial budgeting. These services will be important for municipalities while planning for environmental concerns, such as water and air quality. They will also be important when a city is considering the overall health of its population and planning for ways to improve it.

Why this Study Matters to Me

I came across this topic by accident having thought little about the issue. However, once I began to think about it, I was reminded of certain events in places I have lived, which I believe to be a foreshadowing of the potential water wars to come in the desert Southwest during this drought. Over the last 15 years, there have been an increasing number of incidents in New Mexico in which a city was at the receiving end of public outcry over planting new park grass. The public often sees planting of new grass or even the maintenance of existing grass fields as a waste of precious water. The public furor in these incidents is often compounded by municipal use of potable water for watering parks in conjunction with increasingly strict residential water restrictions. Golf courses often receive similar criticism as very public symbols of what many see as a waste of valuable water during times of drought. When I was in high school, the local newspaper covered a dispute between a city and a private subdivision in the county with golf courses over the use of potable water versus reuse water for the golf course turf.

I can sympathize with the angry public over what appears to be waste of an increasingly rare resource. However, I also see a potential problem if cities let parks die, stop watering vegetation, remove grass and shrubs, and install more gravel and hard surfaces in place of living plants. First, I feel that the appearance of cities would be considerably less attractive. Second, the urban heat island effect would worsen, and people would be less likely to spend time outdoors on the hot days, which are expected to increase in number with climate change (Lenart, 2013). Further, If park vegetation and residential vegetated landscaping are removed, the environmental and economic benefits provided by urban green spaces would effectively disappear. What we would be left with are hot, dry, unappealing desert cities with an unhappy populace who is reluctant to leave the comfort of air conditioning. This is not the future I want to see for our desert cities. Instead, I want governments and residents alike to understand and appreciate the value we get from our urban green spaces so that we can work together to sustainably manage and protect these resources in what may be a difficult water future.

Study Objectives

This study examines the relationship between parks, health, income and education in Albuquerque, New Mexico to inform recommendations for desert communities about public health. Using existing data, the study analyzes whether a correlation between parks and health indicators exists, and identifies opportunities for improvement to better the lives of residents. The purpose of this thesis is to determine if urban parks have a measurable effect on human health in Albuquerque given the city's distinctive location and layout with an adjacent mountain range, the bosque, and extensive open space, or whether other variables such as income and education have a greater impact. It is important for the city to understand that many variables impact resident health.

CHAPTER 2 – LITERATURE REVIEW

Health Crisis in the United States and New Mexico

The United States is facing a national health crisis. The general health of Americans is considered poor and seems to be getting worse. This can be seen in several risk factors. According to the Centers for Disease Control (CDC, 2014a), 6.9 percent of Americans were diagnosed with diabetes in 2011. That number is almost triple the 2.5 percent of Americans diagnosed in 1980. That means more than one out of every 10 adults in American has diabetes. Every age group has seen an increase in the incidence of diabetes from 1980-2011. This increase is occurring in both men and women, all race categories, and for people of all educations levels (CDC, 2014a).

A similar national trend can be seen when looking at heart disease. In 2011, 3.2 percent of Americans had a heart attack and 4.8 percent of Americans had coronary heart disease. In addition, 2.0 percent of people had heart failure in 2009-2010 (most recent data available) and 2.7 percent of people had a stroke in 2011 (CDC, 2014b). Other major risk factors for health problems such as diabetes and heart disease include obesity and lack of physical activity. According to the CDC (2014b), 35.7 percent of adults were obese in the 2009-2010 time frame. This is an increase from a rate of 30.2 percent just ten years earlier. Interestingly, 29.6 percent of adults were "inactive" in 2011, which is a decrease from 35.1 percent in 2002.

Similar health trends can be seen in New Mexico. The state saw an increase in the prevalence of diabetes in adults from 5.3 percent in 1994 to 9.4

percent in 2011, which is above the national average. In 2009, 3.6 percent of New Mexicans had a heart attack, and 3.3 percent had coronary heart disease; while 26.1 percent of New Mexico adults were obese, and 22.5 percent were inactive (CDC, 2014b).

America's Health Rankings (2014) provides reports on health data by state including statistics as well as qualitative information regarding issues that impact health. The site ranked New Mexico as number 32 out of the 50 US states in overall health. They listed "low levels of air pollution, high per capita public health funding, and a low rate of cancer deaths" as strengths. The aspects that the site identified as negatively impacting health in New Mexico were "low high school graduation rate, high percentage of children in poverty, and a high percentage of uninsured population." The site also indicated that the "overall healthiness" of New Mexicans is likely to decrease in the future since New Mexico "ranks lower for determinants than outcomes," suggesting a high number of risk factors that have not yet resulted in diagnosed diseases. All of these factors suggest that Americans in general and New Mexicans in particular are suffering from the burden of poor health. Poor health is not just an unfortunate circumstance; it shortens a person's life-span, decreases quality of life, and increases medical costs both for the patient and the public (Surgeon General, 2013).

Besides the health outcomes discussed above (diabetes, heart disease, and obesity), there are health outcomes and risk factors associated with the environment. One of these factors is poor air quality, which can lead to an increase in asthma (Heinze, 2011). The prevalence of asthma in children in New Mexico for the period 2003-2012 was approximately 8 percent, similar to that of the United States. The prevalence of asthma in adults was also around 8 percent for both New Mexico and the United States for the period 2000-2012. However, there does appear to be a slightly increasing trend of asthma during that time period (New Mexico's Indicator-Based Information System (NM-IBIS), 2014a; NM-IBIS, 2014b).

Parks and Health

The benefits of urban green spaces can be fairly obvious in promoting improved physical and mental health (Jakubowski, 2010). First, these spaces encourage people to spend more time outdoors. In particular, they encourage maintenance or an increase in the amount of outdoor physical activity as people use these spaces for exercise and sports (Sugiyama, 2013). The importance of exercise to health is well documented; it reduces obesity and the incidence of diseases, such as diabetes and heart disease. The presence of green spaces has also been linked to less obvious health benefits including better birth outcomes (Donovan, 2011).

Children, as a vulnerable population, particularly benefit from green spaces. Parks and other inviting green spaces encourage children to play outside and be active rather than staying indoors and being inactive. Rising childhood obesity is an especially concerning trend in America today and many communities and programs are working to improve childhood health. A study in

New York City found that along with neighborhood safety, increased density of trees along the street is associated with a lower incidence of childhood obesity (Lovasi, 2013).

A study in England found that proximity to green spaces reduces the overall mortality risk of people of all income levels. This was found to be true for all diseases, but in particular, for circulatory diseases. The study also noted that the more green spaces present, the lower the health inequality between income levels. When the amount of green space decreases, the health inequality gap increases, negatively affecting the health of low-income populations at a proportionally greater rate (Mitchell, 2008).

Green spaces also improve mental well-being. Vegetated areas are calming, lift people's spirits and provide overall stress relief. Studies in the Netherlands found that the amount of green space people are exposed to in their living environment strongly correlates with their perceived quality of health (de Vries, 2013; Maas, 2006). The correlation was most apparent in young people, the elderly, housewives, and low-income groups. Maas also found that green spaces positively affect mental health for people of all education levels.

Further, studies found that the presence of green spaces within three kilometers or less correlated with improved actual and perceived health, as well as more consistent participation in physical activity (Maas, 2006; de Vries, 2013; Sugiyama, 2013). The correlation between health and distance from homes to green spaces was more important in more urbanized areas. In intensely urban areas, the greatest health benefits occur where green spaces are within a half mile of homes (Maas, 2006). Maas and de Vries also noted that both increased quantity and quality of green spaces within a reasonable proximity to residences correlates with better perceived physical and mental health.

Community gardens and farms provide dual purpose health benefits as general green spaces, as well as sources of fresh food (Jakubowski, 2010). Poor nutrition and obesity are serious problems affecting the health of Americans today. The Southwest is no exception to this situation. Improving access to fresh food is one of the most important initiatives to combat obesity (Jakubowski, 2010). Farms and gardens are also incredibly important to areas that are designated as “food deserts” in which affordable, healthy food is difficult to obtain. Low-income communities may be at risk of being designated a food desert, and are noted for having poorer overall health (US Department of Agriculture (USDA), 2015). Farms and community gardens not only encourage people to spend time outside working and enjoying green space, but also provide access to fresh, healthy produce that may not otherwise be readily available (Jakubowski, 2010).

Parks and Economics

Urban green spaces provide economic benefits as well. One of the more immediate benefits is related to transportation. Green spaces encourage people to use alternative modes of travel rather than driving personal vehicles. This saves, firstly, on expenses of gas and maintenance associated with vehicular wear and tear. It also lessens wear and tear of public roadways as fewer vehicles travel the road, saving communities some maintenance expenses (Jakubowski, 2010).

Another economic benefit is associated with health and welfare. A study in the United Kingdom (UK) concluded that simply living in a place with a view of green spaces is worth £300 (approximately $467) per person per year in health and welfare benefits from decreased health care costs resulting from improved physical and mental health. Overall, the study concluded that care of the UK's existing natural assets would be worth an additional £30 billion ($46.7 billion) per year in health and welfare benefits in the UK (Harvey, 2011; Department for Environment, Food and Rural Affairs (DEFRA), 2011).

These and other economic savings have been documented by the City Parks Alliance (2015). The City Parks Alliance states that health savings associated with urban parks in the United States' 85 most populous cities totaled $3.08 billion. A 2008 report suggested that Philadelphia saves $16 million annually in storm water and air pollution management as a result of urban parks. The City Parks Alliance also suggests that urban parks contribute to a city's economy through incidental benefits, including: increased tourism, increased property values, and supplemental tax receipts. The beneficial impact to property values is particularly poignant as adjacent parks can increase a property's value by approximately 20 percent (Crompton, 2005).

In one paper (Harnik, 2014), Harnik and Crompton describe "the economic value of 12 benefits associated with urban parks." The first value is that of direct spending by park users, in which park users spend money in the local community buying food, gas, and other goods and services; as well as people paying admission for access to areas such as botanical gardens. They then list five indirect sources of value: gains in property values, environmental services in the form of storm water management and air pollution control, reduced health spending, and social benefits. Five additional sources of economic value identified are: availability value in which people are willing to pay for the costs associated with a park, parks' contribution to economic development, stimulation of recreation equipment sales, alleviating deviant behavior among youth, and reducing energy costs by mitigating the urban heat island effect.

Parks and the Environment

Urban green spaces are also known to provide environmental benefits in the form of air and water quality improvement. Polluted air and water have been linked to a variety of diseases, including asthma and various cancers. This is especially troublesome as children are particularly susceptible to diseases associated with air pollution (Natural Resources Defense Council (NRDC), 1997). Green spaces have also been shown to help fight "heat island" effects. This is a phenomenon in which the air temperature of an urban area is higher than surrounding rural and developed lands due to human activity. The heat island effect increases as the amount of paved and impervious surfaces increases. Green spaces combat this by breaking up the amount of impervious surfaces to help create a more temperate and comfortable climate (EPA, 2015). Vegetation also traps air pollutants and sequesters carbon, improving air quality. This is particularly important both for local air quality and climate change (Heinze, 2011).

Vegetated parks also provide benefits associated with water issues. Vegetation absorbs water, allows for infiltration, and removes pollutants, improving water quality. Further, vegetated areas stabilize soils (Heinze, 2011). Parks and urban green spaces provide opportunities to reduce flooding through the direction of storm water through the vegetated spaces. The vegetated areas will slow the storm water, and allow for infiltration while improving the water quality as discussed above. This process can also help protect drinking water. Parks will improve the water quality of storm water before that water continues into surface drinking water supplies. Ground water drinking water supplies are also protected and replenished as water infiltrates the ground in vegetated areas, and vegetation and soils remove many pollutants (Crompton, 2008).

Income, Education, and Health

It is well documented that increased income and educational attainment correlate with improved health. These findings have been found to exist at the individual or household level. It has also been found that the distribution of income in a society affects individual health. In societies with greater income inequality, the quality of health decreases. Studies suggest that the impacts of income inequality can be mitigated by investment in social goods, and “more equitable distribution of public and private resources” (Lynch, 2000; Kawachi, 1999).

The association between educational attainment and health has been studied as well. One study (Ross, 1999) found that an increase in education was correlated with improved health. College selectivity and degree credential did not appear to have strong associations with health. Another study concluded that a mother's educational attainment is positively associated with improved child health and nutrition (Cochrane, 1980).

Albuquerque Parks

Recent research highlighting parks as beneficial urban resources has shown that Albuquerque ranks high for multiple variables. One study found that nearly 23% of Albuquerque's land area was park land. Not only did that study rank Albuquerque in the top 20 cities in the United States with the largest park systems, but it also ranked Albuquerque 12th for cities with easy walking access to parks (81% of Albuquerque residents are within a 10-minute walk) (Benepe, 2014). Another study calculated city park land per square foot per person for 24 cities in the United States. Albuquerque ranked at the top of the list with significantly more parkland per capita (2,933 square feet per person) than the other cities (de Chant, 2011). The Parkscore index (2015) delves more deeply into Albuquerque's park system. Parkscore ranks Albuquerque as number 15 out of 60 for the 60 largest cities in the country, and gives Albuquerque an overall score 63.5 points out of a possible 100. These rankings are based on the City having: a large amount of park land as a percent of city area, relatively small median park size, small amount of park spending per resident, "middling" number of playgrounds per 10,000 residents, and a high percentage of the population living within a 10-minute walk (0.5 mile) of a park.

CHAPTER 3 – DATA AND METHODS

Framing this Research Study

As indicated by the literature described above, strong correlations have been found to exist between parks and human health. However, most of the studies were very large-scale, sometimes covering large portions of a country or an entire nation. Also, most of the studies were conducted in much wetter and greener environments than the desert Southwest and often in more densely populated cities, such as New York City. This study aims to determine if a desert Southwest city – with low density development, city-wide landscape views, and nearby access to outdoor recreational opportunities in Federal public lands – possesses similar relationships between urban green spaces and health. Albuquerque was chosen because of its documented large amount of open space along with its unique landscape, which includes mesas on the west side, the Sandia Mountains on the east side, and the Rio Grande and bosque through the center of the city..

The primary question guiding this research study is: how do parks within the City of Albuquerque affect the health of residents? In order to answer this question, the following more specific questions were developed for analysis:

- Where are parks in Albuquerque located and how are they distributed?
- How accessible are the parks for residents?
- How do the number of parks and acreage of park space in Albuquerque correlate with the health of residents, using certain diseases as indicators of health?

- Do income and educational attainment appear to impact health, and if so, how does the relationship compare to the relationship between parks and health?

These questions will help me answer the overarching research question by allowing me to categorize the data and analysis into potential relationships between health and parks, health and income and education; and parks, income and education. These categories will also help me to identify areas in which the city's parks are having a positive effect as well as potential areas for improvement.

Data Sources

This study was conducted using existing secondary data. Geographic Information Systems (GIS) data were used for all of the analyses. The GIS data sources used were:

- New Mexico Resource Geographic Information System (Resource Geographic Information System (RGIS), 2014) – New Mexico *cities and towns* layer that was used to obtain a City of Albuquerque boundary
- City of Albuquerque (2013) – *Parks* layer, *land use* layer, *bike paths* layer, *streets* layer
- ArcGIS (Gingerich, 2014) – New Mexico health data by small area for the period 2005 to 2009. "New Mexico Small Areas are 109 geographic areas across the state with population sizes that are just large enough to calculate rates for selected health events. New Mexico small areas were

based on population size, not land area." (NM-IBIS, 2015a). The death data available in this database are for: chronic disease, cancer, diabetes, heart disease, and chronic obstructive pulmonary disease (COPD). These diseases were included in this study because the data are readily available, and these diseases are consistent with those discussed in related literature as indicators of population health. These GIS data were developed by Andrew Gingerich, Srini Vasan, and Tom Scharmen at the New Mexico Community Data Collaborative. The source data for the health information used to create the GIS layers are from the New Mexico Department of Health's IBIS website.

- NM-IBIS (NM-IBIS, 2015b)
    - Economic data – American Community Survey (ACS) economic indicator data by New Mexico Small Area. Specifically, median income for the 5-year period of 2008 to 2012 was used as these were the only income data available by Small Area.
    - Educational attainment data – ACS social indicator data by New Mexico Small Area. Educational attainment for the 5-year period of 2008 to 2012 was used as this was the only education data available by Small Area. The data were broken into two categories: population over 25 years of age with no high school diploma, and population over 25 years of age with a bachelor's degree or higher.

Methods

The data were prepared and analyzed using ArcGIS and Microsoft Excel. To begin, the Albuquerque city boundary was extracted from the towns and cities layer, and all other GIS layers used for this study were “clipped” to that boundary using the ArcGIS function. This provided a consistent area for analysis.

Working with the parks data was the next step. The city parks layer identifies 307 parks owned and maintained by the City. However, this layer did not include all of the other private parks and recreational areas that could be viewed as parks that are present within Albuquerque. It also omits the open space areas. The Albuquerque Major Public Open Space are lands primarily owned and maintained by the city that provide outdoor recreational opportunities but are treated more like natural areas than manicured parks (Open Space Alliance, 2015). The bosque along the Rio Grande is an example of open space. The City land use layer was used to incorporate the other parks and open space areas omitted from the parks layer. All parcels within the land use layer are given a land use category, one of which is parks/recreation. For this study, all of the parks/recreation parcels were extracted from the land use layer, and that information was merged with the parks layer. Duplicates were then deleted. In cases where the duplicates were different sizes, the attribute that was largest and fully encompassed the smaller attribute was kept. It is assumed that all park/recreation areas in this layer are publicly available recreation facilities that incorporate at least some vegetation. Only one parcel was deleted because, while it was attributed as an “urban courtyard/plaza”, it was actually a small asphalt parking lot and concrete sidewalk. The resulting GIS layer and attribute information is the basis of the “parks” information used for all of the analysis in this study.

The literature suggests that parks have the strongest influence on residents who live near them. A simple GIS analysis was performed to determine how Albuquerque is doing in that regard; specifically, I looked at the number of residences that were encompassed by certain distances from parks. Initially, the parks layer was buffered for 0.25 mile radius and overlayed with the land use layer showing residential parcels. The same analysis was then done for a 0.5 mile buffer.

To compare Small Areas by park space, an intersect analysis was performed in ArcGIS with one of the Small Area health datasets. The intersect analysis created a count of the number of parks and acreage of park space within each Small Area. It should be noted that a result of the intersect analysis was that parks that crossed a Small Area boundary were split into two parks along the boundary (Figure 1). This makes the total number of parks artificially high since the parks located along those boundaries were double-counted. However, I used this information for the analysis because it eliminated the issue of either double-counting park acreages that appear in separate Small Areas, or having to develop a threshold to determine in which Small Area those parks should be counted. I felt that it was important to account for park area that was near residents in any Small Area, and some park access would not be counted if parks could not be split along Small Area boundary lines. With this analysis, the total number of parks increased from the original 953 to 1,030. The park counts and acreages were used for comparison with the Small Areas health data as well as the income and education information.

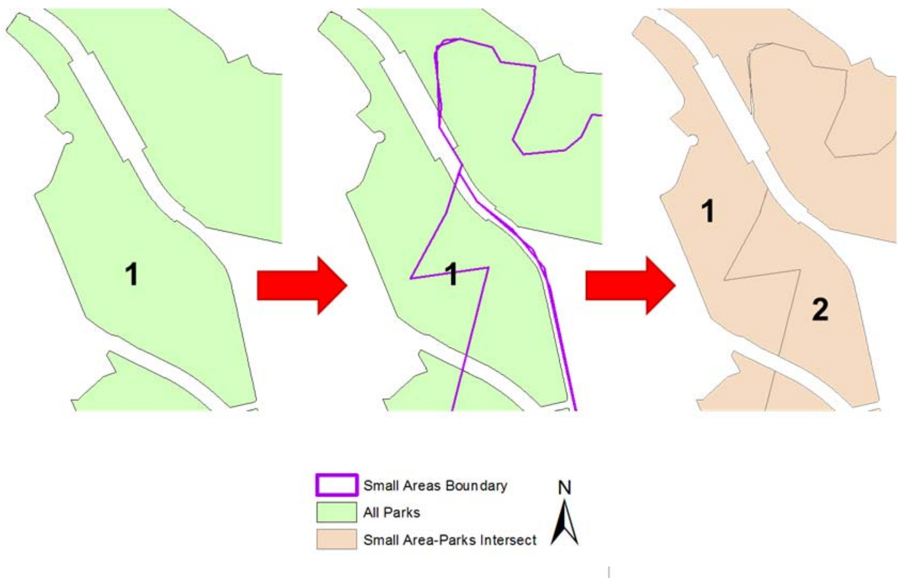

Figure 1 - Example of the Parks/Small Area Intersect Analysis

The park counts and acreages were compared with the Small Areas health data in Excel. As mentioned above, the counts and acreages were determined from the intersect analysis. Those numbers were entered into an Excel spreadsheet by Small Area number (every Small Area in the state has an identification number from 1 to 109; the Small Areas included in this study are numbers 1 to 34, and 89). The health data were then entered into the same spreadsheet by Small Area number. For each of the five health/disease categories, the death rates per 100,000 people under 65 years of age and under

75 years of age were used as the health indicators. Using this data, graphs were prepared for each disease comparing the number of parks to the death rate and the park acreage to the death rate by Small Area (Appendix A). Deaths for people under 65 years of age, and under 75 years of age were symbolized differently on the same graph. So, two graphs (one for park count and one for acreage) were created for each disease. A trendline for each age category was placed on all of the graphs for better visualization, and R-squared values were calculated.

The income and education information was compared with the health data in a manner similar to that described above for the parks-health comparisons. R-squared values were calculated by Excel for all graph trendlines to determine the strength of correlations for comparison. Finally, parks data were compared with the income and education data in a similar fashion as with the health data.

Limitations

There are several limitations with the data used that could potentially impact the results of this study. The first limitation is that of the City boundary. As mentioned above, the City boundary was obtained from the RGIS *cities and towns* layer, and other data used for this study were clipped to that layer using ArcMap. The *City* layer used for this study excludes small portions of the city in the northeast corner, possibly the northwest corner, the center of the western edge, and the southwest corner. The reasons for this may be that areas that appear to be part of the city on the ground are not actually within the city limits or the GIS layer may be outdated. This potentially leads to small portions of the city being excluded from this study.

The Small Area data itself are limited. Due to the small size of the areas, and the fact that data are collected by survey rather than census, there is high potential for error. Small Area data were used in this thesis as the only available reporting of health information at the scale needed for this study. The use of the 5-year data does provide the strongest available health, income, and education information given the circumstances.

Another limitation concerns the income and education data. The ACS 5-year period (2008-2012) is different from the health data period (2005-2009). While ACS data are available for the 2005-2009 period, it is not readily available by Small Area since the Small Area is not a Census designation. The authors of this Small Area data compiled the information from ACS census tracts and apply it to population estimates by the University of New Mexico Bureau of Business and Economic Research (BBER), which also needed adjustment for accuracy (NM-IBIS, 2015b). Ideally, this analysis would use the 2005-2009 ACS data for Albuquerque, and compile the information and apply the appropriate estimates to obtain the Small Area information. In addition, it is not stated whether the median income reported for the Small Areas is “median individual income”, “median family income”, or “median household income”, which are all collected and reported by the ACS. Also, the education data misses the group of people over 25 years of age who have a high school diploma (or GED) and either no college degree or an associate’s degree.

Presentation of Data and Analysis

For this thesis and the accompanying defense, I will present a comparison of attributes that may contribute to the health of residents in Albuquerque and recommendations for the City to consider in its ongoing mission to better the lives of the populace. The relevant data will be presented in maps, tables, and graphs. The maps, tables, and graphs will be used to more easily communicate the potentially complex relationships being analyzed. I will examine the data in order to determine if any correlations exist, why some correlations may be present but not others, and to better understand the complexity of health in relation to green space for Albuquerque residents.

CHAPTER 4 – ANALYSIS AND RESULTS

Count and Acreage of Albuquerque Parks

As explained in the methods section, the parks in this analysis include a combination of city parks, private parks, and open space. All parks are shown in Figure 2. The City designates 26 categories for parks and recreation parcels. An additional category was added - city parks not otherwise designated - to account for the parks present in the *City parks* GIS layer that did not have corresponding duplicates in the land use layer. Table 1 shows the number and acreage of parks by category.

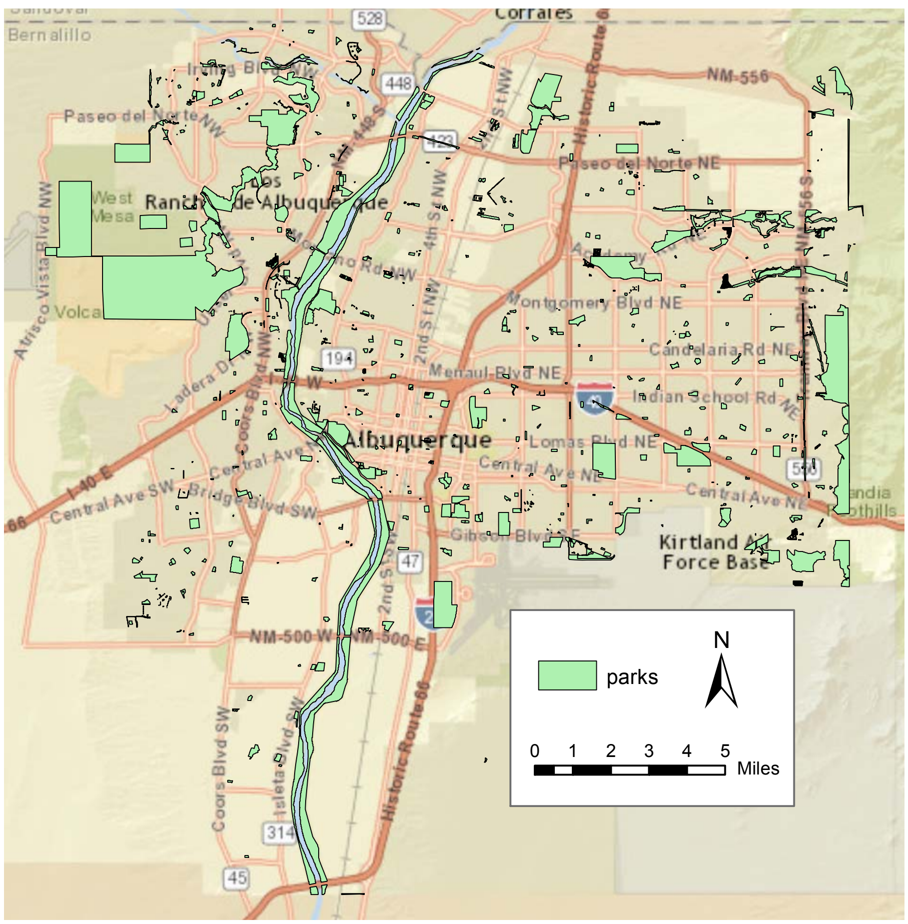

Figure 2 - Albuquerque Parks

Table 1 - Albuquerque Parks

Category	Count	Acreage
Public Recreation and Open Space	6	37
Public Outdoor Sports and Recreation – All Other	3	45
Public Stadium or Athletic Field	6	156
Public Fairgrounds or Race Track	1	216
Public Sports Court	1	9
Public Outdoor Swimming Pool	1	2
Public Golf Course (including private)	7	1109
Private Golf Course	9	361
Open Space and Recreation Areas	57	1644
Parks – All Other	12	217
Neighborhood Park	141	407
Community Park	62	348
Regional Park	2	49
Biological Park	3	66
Park/Landscaping not Maintained by City or County	426	425
County Park	26	172
Rio Grande State Park	21	2624
Urban Open Space – All Other	12	109
Urban Pedestrian Mall	2	1
Streetscape	28	8
Urban Trail	13	76
National Monuments	10	4000
Cibola National Forest	3	154
Vacant Park	1	2
Commercial Outdoor Facilities	1	1
Commercial Recreation	1	1
City Park not Otherwise Designated	98	1372
Total	*953*	*13612*

As can be seen from Table 1, the categories with the greatest number of parks are: Park/Landscaping Not Maintained by City or County, Neighborhood Park, and City Park Not Otherwise Designated. The categories with the greatest amount of acreage are: National Monuments, Rio Grande State Park, Open Space and Recreation Areas, City Park Not Otherwise Designated, and Public Golf Course (including private). This suggests that City Parks and other smaller, more traditional parks are the most common type, while City Parks and Open Space dominate by area. This also suggests that potentially, the most easily accessible green spaces (residential parks and open spaces) are also the most common.

Park Access

Park access was determined in two ways for this study. The first method used a buffer analysis of distance from parks in ArcGIS. The buffer distances were based on the Maas (2006) and Sugiyama (2013) articles, as well as the ParkScore index (2015). Therefore, the first buffer was chosen to be 0.25 mile from parks as that distance is considered a standard easy walking distance for planning purposes in the United States (Yang, 2012). The second buffer was chosen for a distance of 0.5 mile. Sugiyama suggests that physical activity benefits from parks are most greatly obtained by residents who live within 1.6 kilometers (~1.0 mile) of a park, and Maas generally found a 3 kilometers (~1.8 mile) proximity to be sufficient to achieve benefits from green spaces. However, Maas also found a stronger correlation in which the elderly and young benefit at 1 kilometer (~0.6 mile), and ParkScore used 0.5 mile as its access radius. Therefore, a 0.5 mile buffer was chosen as a reasonable distance. Figures 3 and 4 show the buffer analyses.

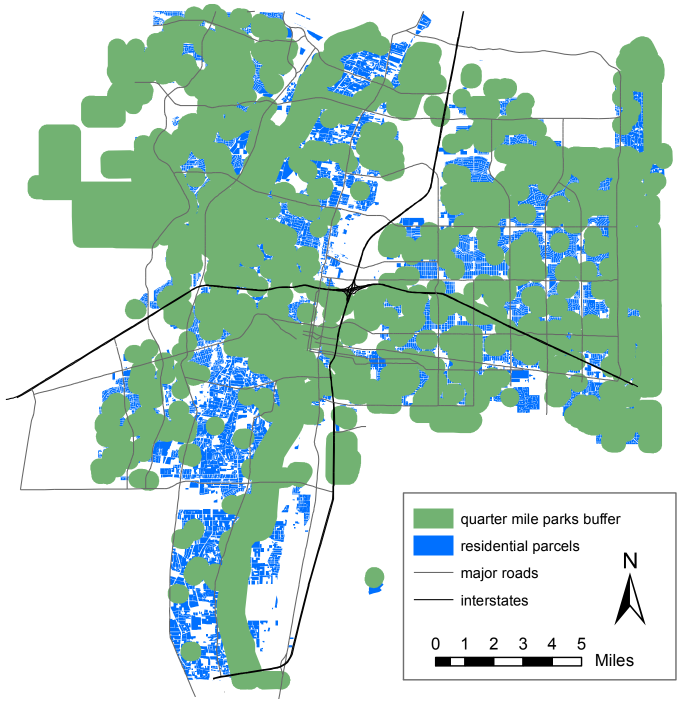

Figure 3 - Quarter-mile Parks Buffer

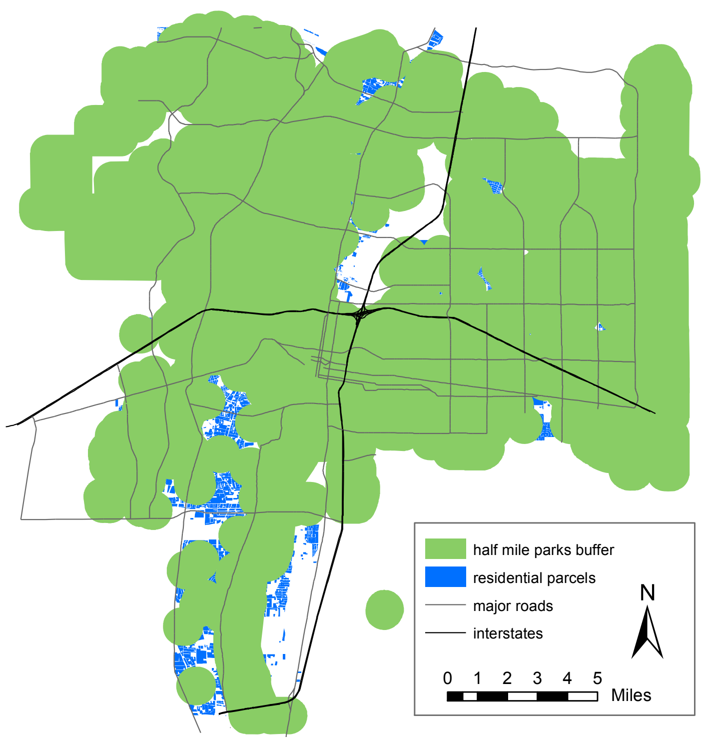

Figure 4 - Half-mile Parks Buffer

As Figure 3 shows, more than half of Albuquerque residences are within 0.25 mile of a park. However, the amount of blue showing indicates there are many residential parcels throughout the city that are farther than the 0.25 mile buffer. With the 0.5 mile buffer shown in Figure 4, much more of the city is covered. This indicates that the majority of Albuquerque residents live within 0.5 mile of a park. There are a still a few portions of the city that are not covered by even the 0.5 mile buffer. The large majority of those residences are in Albuquerque's South Valley, the southwestern quadrant.

The second method of analysis for access involves bicycle access. The actual analysis was simply a visual examination of a map (Figure 5) showing the city's bicycle trails and parks.

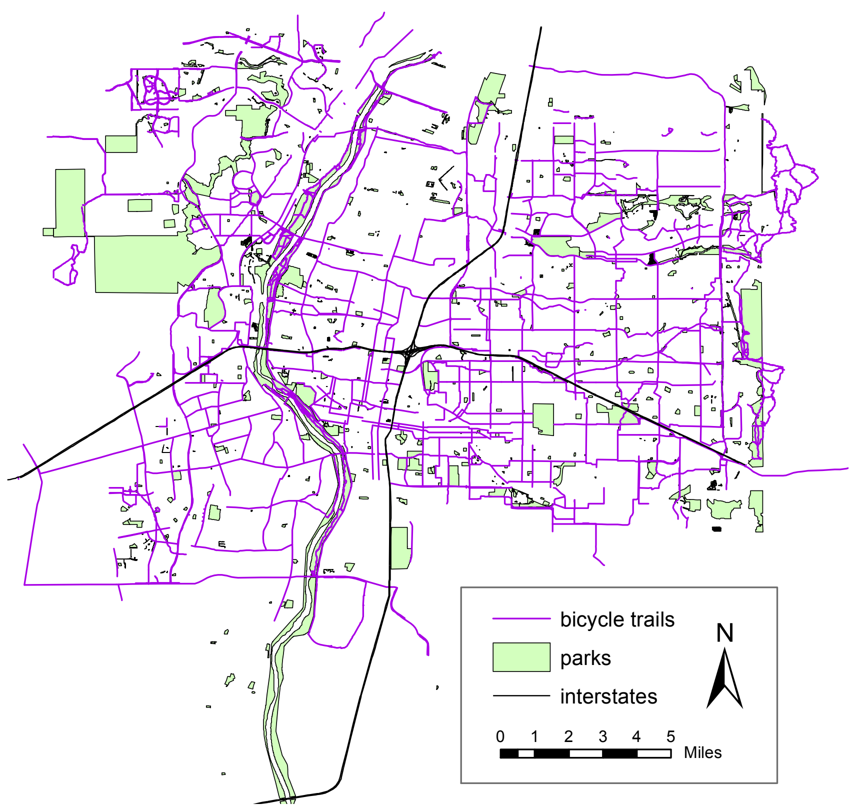

Figure 5 - Bicycle Trails in Albuquerque

Bicycle trails enable easy access to parks by residents, particularly when coupled with relatively short distances to travel to parks, which the literature demonstrates is important for encouraging physical activity. As seen in Figure 5, the city has an extensive network of bicycle trails, many of which connect to or even through parks. In general, it appears that most parks are connected to a designated bicycle trail. The situations in which bicycle trails are least likely to connect to parks are in cases where the parks are small. Also, similar to the finding of the buffer analysis, several of the parks not connected to a bicycle trail are located in the South Valley and the north-central portion of the city.

Parks and Health

To assess how parks relate to health in Albuquerque, five health indicators were chosen: diabetes, heart disease, COPD, cancer, and chronic disease. In this case, cancer is defined as malignant neoplasm. COPD is a breathing related disease similar to asthma. Previous literature has indicated that poor air quality increases the incidence of asthma in people of all ages, and particularly children and the elderly who are especially susceptible (Natural Resources Defense Council (NRDC), 1997). The reason parks are beneficial for breathing related disorders is due to the way living vegetation improves air quality. This is especially important in urban environments where more air quality pollutants, such as automotive emissions may exist, and less vegetation is present to sequester carbon and other pollutants (EPA, 2015; Heinze, 2011).

These indicators were chosen for two reasons: 1) the literature suggests that parks can reduce the incidence of these and other diseases, and 2) the data pertaining to these indicators were available by Small Area rather than simply by county, the form in which most health data are made publicly available. The health indicators were measured in terms of death rate per 100,000 people under the age of 65 years and under the age of 75 years, and the data were available by Small Area. These indicators were compared with the number and acreage of parks within the Small Area. For the acreage comparisons, Small Area 13 was excluded as an outlier. Small Area 13 has 3,303 acres of park land because it includes the majority of the Petroglyph National Monument. This is compared with the Small Area 3 located along the eastern edge of the city, which has the next largest amount of park acreage at 1,340 acres due the Sandia Mountains foothills open space areas. Graphs showing the comparisons between the health indicators and parks by count and acreage are located in Appendix A. Figures 6 and 7 are examples of the graphs using diabetes deaths.

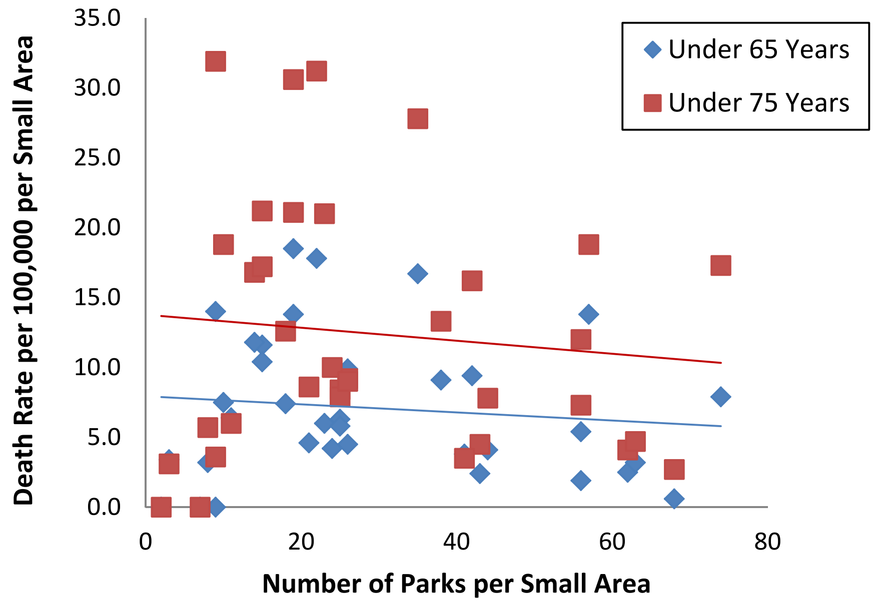

Figure 6 - Diabetes Mellitus Deaths and Number of Parks by Small Area

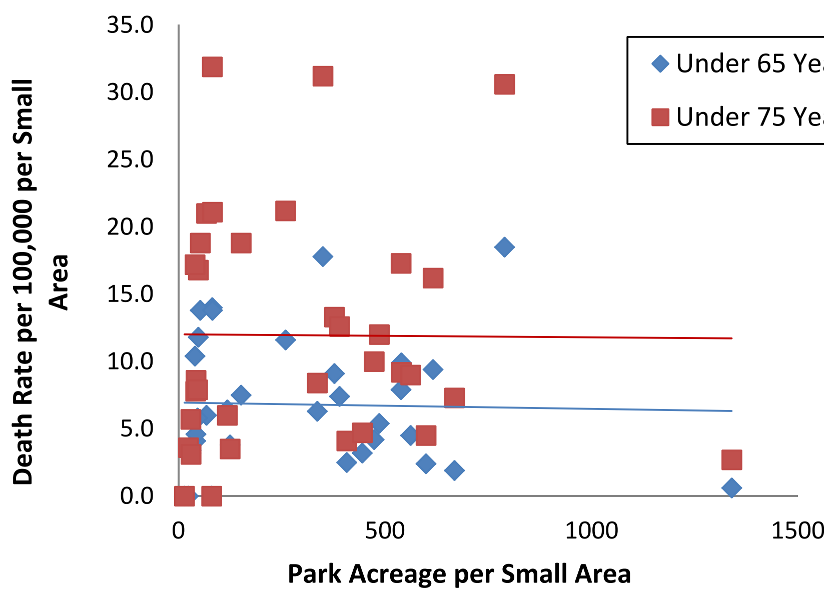

Figure 7 - Diabetes Mellitus Deaths and Park Acreage by Small Area

In Figure 6, each individual data point represents the number of parks compared with the diabetes death rate per 100,000 in a single Small Area. Figure 7 shows the same information for amount of park acreage versus diabetes deaths per 100,000 in each Small Area. A trendline has been added to better visualize the strength of the correlation. The trends indicated by the graphs can also be seen by looking at the R-squared values for each trendline (Table 2).

Table 2 - R-squared Values for Health Indicators Compared with Parks

	Diabetes		**Heart Disease**		**COPD**		**Cancer**		**Chronic Disease**	
	Under 65	**Under 75**	**Under 65**	**Under 75**	**Under 65**	**Under 75**	**Under 65**	**Under 75**	**Under 65**	**Under 75**
Park Count	0.0128	0.0109	0.0498	0.0289	0.0109	0.1411	0.0069	0.0005	0.0198	0.0223
Park Acreage	0.0008	0.0000	0.0064	0.0153	0.0014	0.0419	0.0045	0.0025	0.0019	0.0054

From the values indicated in Table 2, there does not appear to be a strong correlation between parks and any of the health indicators; however, some indicators show a slightly stronger relationship than others. For this section, discussion of relationships is confined to negative relationships – those in which an increase in the number of parks correlates with a decrease in the disease death rate.

In all cases, except cancer deaths for people under age 75, the R-squared value is noticeably higher for park count than park acreage. The park count value tends to be close to or more than double the value for park acreage. Though the relationships are weak, this data suggests that proximity to one or more parks of any size is more important to health than the amount of park space.

The three health indicators that have the strongest relationships with parks are COPD, heart disease, and chronic disease. COPD shows the strongest overall correlation for number of parks for both age categories, and the strongest correlation with park acreage with the under 75 value. It would make sense that a correlation would exist between parks and COPD. In this case, the correlation between greater number of parks and fewer deaths from COPD increases with the age bracket. Like children, older people are more susceptible to breathing conditions (Natural Resources Defense Council (NRDC), 1997). Also, the time period between 65 and 75 years of age is the period in which many Americans retire and begin spending more time at home (Brandon, 2013) and more time outdoors (National Recreation and Park Association, 2014). As indicated in the literature, the benefits from living near a park increase for those who spend the most time at home, such as the elderly. This more vulnerable population may benefit more greatly from the localized, improved air quality created by park vegetation than younger generations who spend more time away from home and are less susceptible to breathing conditions.

The other two health indicators with potentially beneficial correlations, heart disease and chronic disease, may similarly make sense. It has been demonstrated that the presence and ability to access a nearby park encourages people to spend more time outdoors in general, and more time exercising specifically. In many cases, heart disease and chronic disease can be prevented or improved through regular physical activity. While chronic disease shows a stronger correlation with the higher age group, similar to that seen with COPD, heart disease shows the opposite.

When talking about increased physical activity, one would expect to also find a correlation with diabetes death rates. However, there was effectively no correlation between diabetes death rates and parks, either by count or acreage. This suggests that other variables may have a much stronger impact on diabetes rates, overriding any benefit gained from proximity to parks. The same appears to be true of cancer deaths.

Income, Education, and Health

An analysis similar to that described above was completed in order to compare income and education information with health outcomes (see graphs in Appendix B). Figures 8, 9, and 10 are examples of the graphs using diabetes deaths. The income data used are median income for the period 2008-2012 compiled by Small Area. The educational data are for the same time period and also compiled by Small Area. The education information is broken into two categories: over 25 years of age with no high school diploma, and over 25 years of age with a bachelor's degree or higher. As with the section above, R-squared values were calculated for comparison using Excel (Table 3).

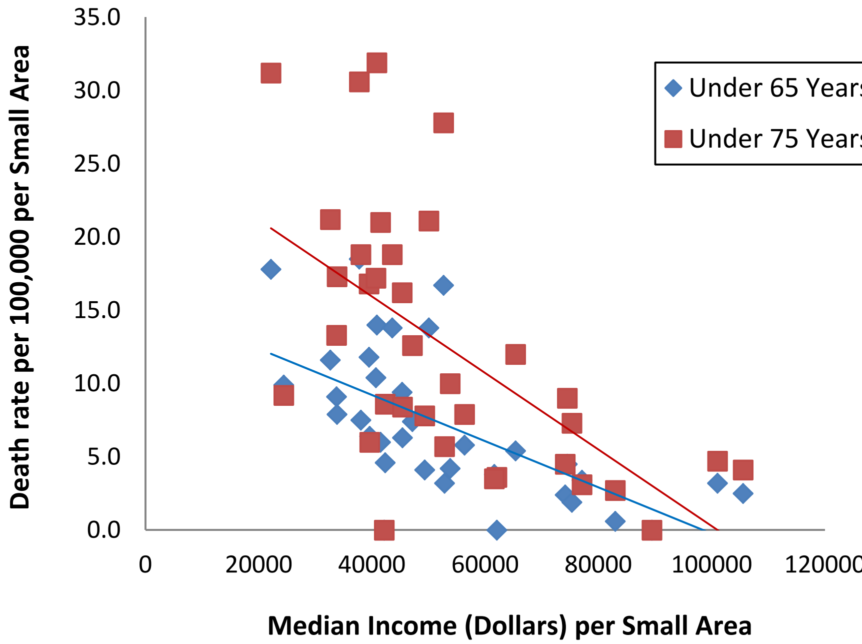

Figure 8 - Median Income and Diabetes Deaths by Small Area

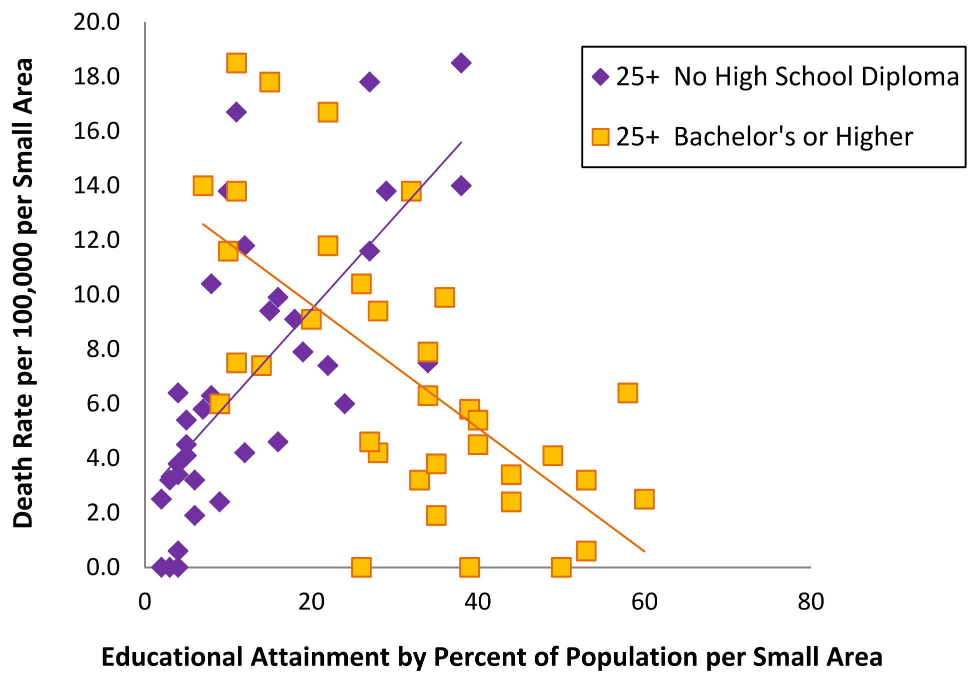

Figure 9 - Education and Diabetes Deaths for People Under 65 Years by Small Area

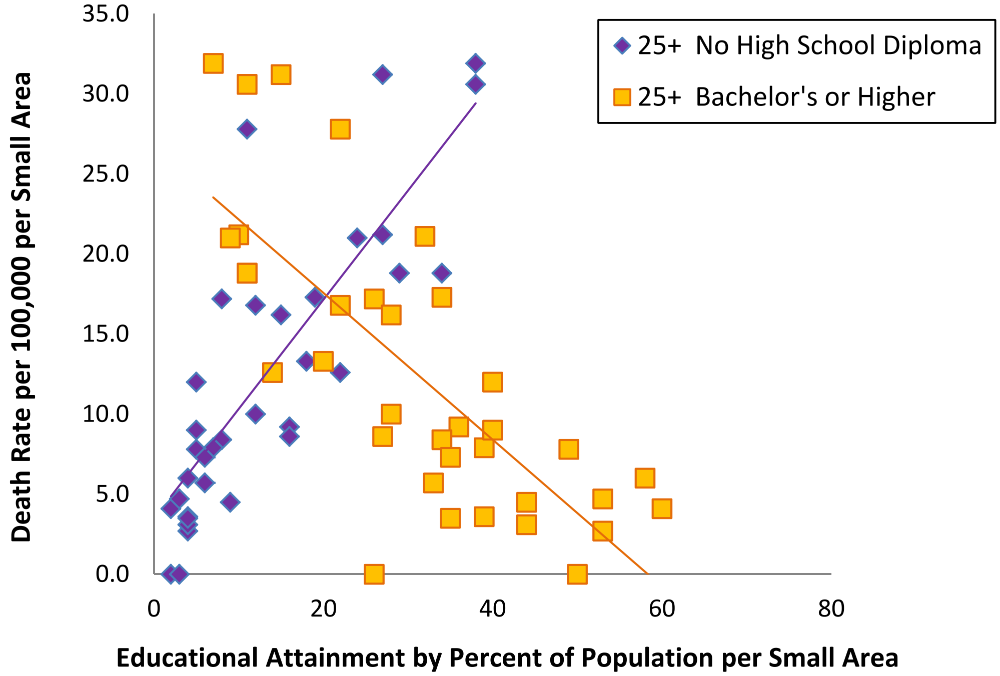

Figure 10 - Education and Diabetes Deaths for People Under 65 Years by Small Area

Table 3 - R-squared Values for Health Indicators Compared with Income and Education

	Diabetes		Heart Disease		COPD		Cancer		Chronic Disease	
	65	**75**	**65**	**75**	**65**	**75**	**65**	**75**	**65**	**75**
Income	0.3935	0.3549	0.5544	0.5615	0.2690	0.3217	0.1939	0.2011	0.5753	0.5535
No High School	0.5003	0.6584	0.2184	0.2844	0.1697	0.1164	0.5912	0.6560	0.6073	0.6485
Bachelors	0.4293	0.5789	0.3113	0.4483	0.2009	0.2583	0.3635	0.4751	0.5644	0.6710

From the R-squared values, it is clear that both income and education are more strongly correlated with these five health outcomes than parks. For all five diseases, the income and education trends are the same. A negative correlation is shown for income, in which the rate of disease deaths decreases as income increases (Figure 8). Education demonstrates two related trends, one for each category. As the percentage of the population with no high school diploma increases, the rate of disease deaths also increases (Figures 9 and 10). Correspondingly, as the percentage of the population with at least a bachelor's degree increases, the rate of disease deaths decreases (Figures 9 and 10). These trends are true for both age categories.

Income and educational attainment both appear to be strongly correlated with chronic disease for both age categories. This suggests that financial access to resources and education make an impact on chronic disease outcomes. Heart disease is similarly strongly correlated with income, while diabetes and cancer are more strongly correlated with education. This would suggest that financial access to resources is more important for heart disease, while education makes more of a difference in life choices affecting diabetes and cancer death rates. Interestingly, COPD has some of the weakest correlations for both income and education.

Income, Education, and Parks

Finally, a comparison was made between income and parks, and education and parks. The purpose of this comparison was not to look for causal relationships as with the previous analyses, but instead to determine if some overlap and/or disparities exist with these resources that may help explain other relationships noted in this study. Based on the results, a comparison was also made between income and education to determine if a causal relationship between those variables may be affecting the appearance of a relationship between these variables and parks. The graphs used for this analysis are located in Appendix C. Tables 4 and 5 display the R-squared values for the trendlines.

Table 4 - R-squared Values for Income and Education Compared with Parks

	Park Count	Park Acreage
Income	0.1233	0.0248
No High School Diploma	0.1045	0.0013
Bachelor's Degree or Higher	0.0261	0.0120

Table 5 - R-squared Values for Income Compared with Education

	No High School Diploma	Bachelor's Degree or Higher
Income	0.3825	0.4902

From Table 4, it is clear that a stronger relationship exists for income and education when compared with the number of parks versus the acreage of park space. While the relationships are not strong, there does appear to be a correlation between income and number of parks. This suggests that more parks are constructed in wealthier areas in Albuquerque, or wealthier people can afford more desirable homes, and parks are considered a desirable feature which can increase a home's sale price (Lutzenhiser, 2001). It is difficult to determine a reason the parks/education correlations would exist, which may suggest a correlation influenced by other factors. Finally, a correlation also exists between income and education as seen in Table 5. This suggests that people with higher income levels have also obtained a higher level of education. It is possible that a higher education level leads to higher income, and higher income leads to people living in more desirable areas which also contain more parks.

CHAPTER 5 – RECOMMENDATIONS AND CONCLUSIONS

In spite of being a desert city, Albuquerque contains both a large number of parks and a large amount of area of publicly available park space. This has been documented in the literature and corroborated by this study. Park space is not concentrated in one area of the city, but rather is distributed around the city. Figures 4 and 4 show that the majority of city residents live within 0.5 mile of a park, and many live within 0.25 mile of a park. When coupled with the extensive bicycle trail system throughout the city, those relatively short distances enable easy access to parks by residents, which the literature demonstrates is important for encouraging physical activity.

Based on the gaps indicated in the buffer analysis, the City should consider expanding the park system in the areas of the City, particularly the South Valley, in which many residences are not covered by the 0.5 mile buffer. Similarly the City should consider extending the bicycle network to connect to all park areas in the City. However, before taking action to extend the park and bicycle networks into the those areas, .the City should holding meetings with community members in those areas to determine if there is a desire to have the park and bicycle systems extended to fill those gaps. An open dialogue should be held with residents and business owners in the affected communities to determine the desires and priorities of residents and business owners. If the City were to move forward with extending the park and bicycle networks in those areas and fill in the gaps seen in Figures 4 and 5, it would be ensuring more equitable access for all residents.

From the health comparisons in this study, it is clear that there are many factors affecting the health of Albuquerque residents. The presence of parks in Albuquerque does appear to reduce death rates associated with COPD, heart disease, and chronic disease. Parks may have a positive impact on heart disease and possibly chronic disease by encouraging physical activity. However, the strongest correlation is with COPD. If a relationship between COPD and parks does truly exist, it is likely associated with the positive air quality benefits of green spaces. This argues that not only do parks make a positive difference in terms of encouraging people to spend more time outdoors and increase physical activity levels, but it also demonstrates the importance of having vegetated parks that can provide ecosystem services, such as improved air quality. Elderly people who are more susceptible to breathing problems and may struggle to spend a great deal of time outdoors can still benefit from living near parks due to the improved air quality.

While a moderate to weak correlation between parks and health exists for some of the five health indicators, a much stronger correlation between median income and health exists for all of the health indicators. In all cases, it is clear that median income plays an important role in health outcomes. Similarly, education clearly affects health, with lower educational attainment being associated with poorer health outcomes, and higher educational attainment associated with better health outcomes. The correlations were both stronger and more consistent than for those of parks.

Interestingly, the number of parks in Albuquerque also appears to be correlated with median income. As income increases, so does the number of parks within close proximity of a residence. There are several possible reasons for this, not the least of which being that increased wealth allows people to purchase more desirable homes, which may be located in close proximity to parks. For this study, the correlation suggests a possible relationship between all three factors of income, parks, and health. A positive correlation between parks and health, income and health, and income and parks could suggest that both income and parks are working together to improve health. This may create a situation of inequality like that suggested by the Albuquerque data in which wealthier citizens live in areas with parks in close proximity to homes, and experience even more improved health outcomes.

If this correlation is real, then the presence of parks in low-income communities would seem to be especially important. Some of the literature suggests that health outcomes related to income inequality can be overcome through investment in public goods and other non-monetary resources. Even if parks only make a slight to moderate improvement in health, they are still a public good that can have a positive impact. Investment in parks in low-income communities would be a relatively inexpensive investment on the part of a city to improve both the real and perceived health of at-risk community members, while increasing property values and adding ecosystem services. In the case of Albuquerque, the buffer analysis demonstrated that residents in the South Valley have disproportionately poor access to parks in terms of distance. The South

Valley also happens to be one of Albuquerque's lowest income areas. The city should consider investing in parks in this area, not just for the sake of improving access, but for the potential health benefits as well.

Overall, the data make clear that in cases where relationships exist, the presence of parks is more important than the amount of park space. In almost all of the comparisons in this study, park acreage was weakly correlated with other variables, or no correlation existed even in cases in which a correlation existed with the number of parks. This is not say that Albuquerque or other cities should only build small parks, but it does suggest that having a greater number of small parks spread around a city makes a greater difference than just a few large parks.

As Albuquerque and other Southwestern cities continue to deal with water scarcity and climate change, green spaces within the city will become more important. The ecosystem services associated with improved air quality, heat island mitigation, improved water quality, and water infiltration will become increasingly important for the comfort and benefit of citizens. Urban parks in particular will become increasingly important as private citizens replace residential lawns and vegetation with gravel and other non-living features. When coupled with the current health crisis that the United States is facing, the potential benefits to human health, and associated health care savings to both individuals and governments, provided by green parks suggest that park vegetation is one amenity into which we should invest precious time, energy, water and money for the good of the populace.

APPENDIX A

HEALTH AND PARKS GRAPHS

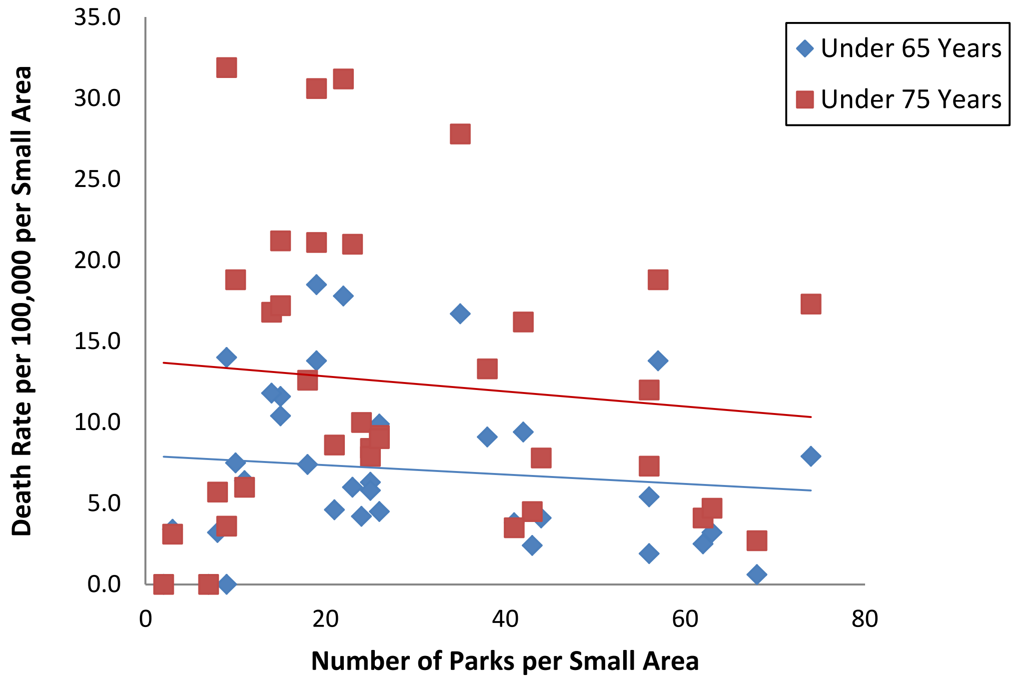

Figure 11 - Diabetes Mellitus Deaths and Number of Parks by Small Area

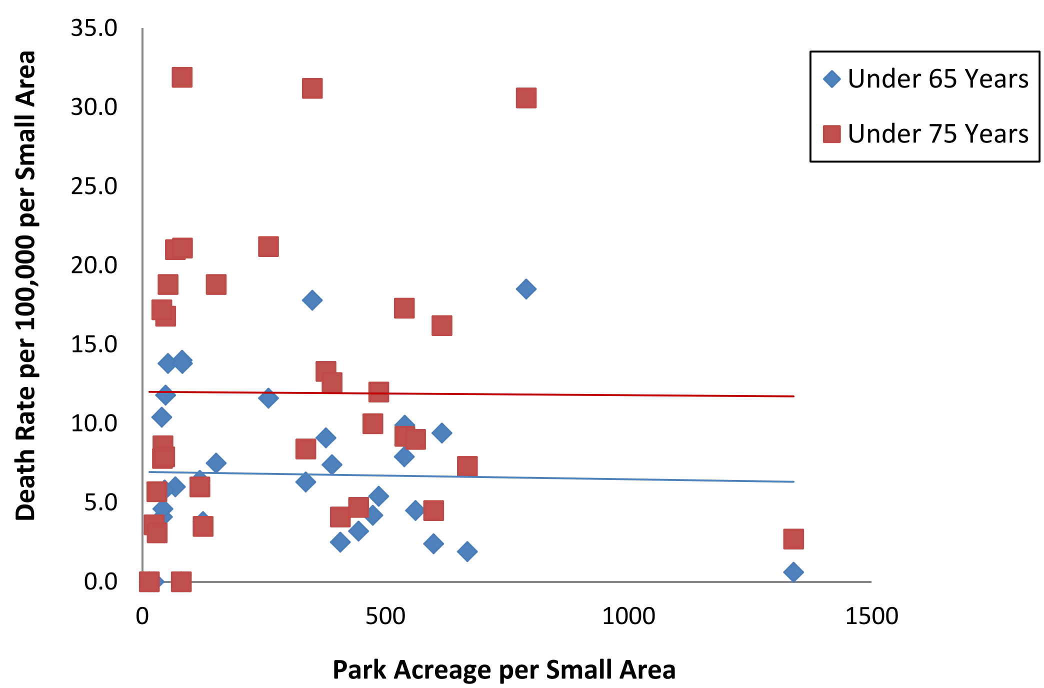

Figure 12 - Diabetes Mellitus Deaths and Park Acreage by Small Area

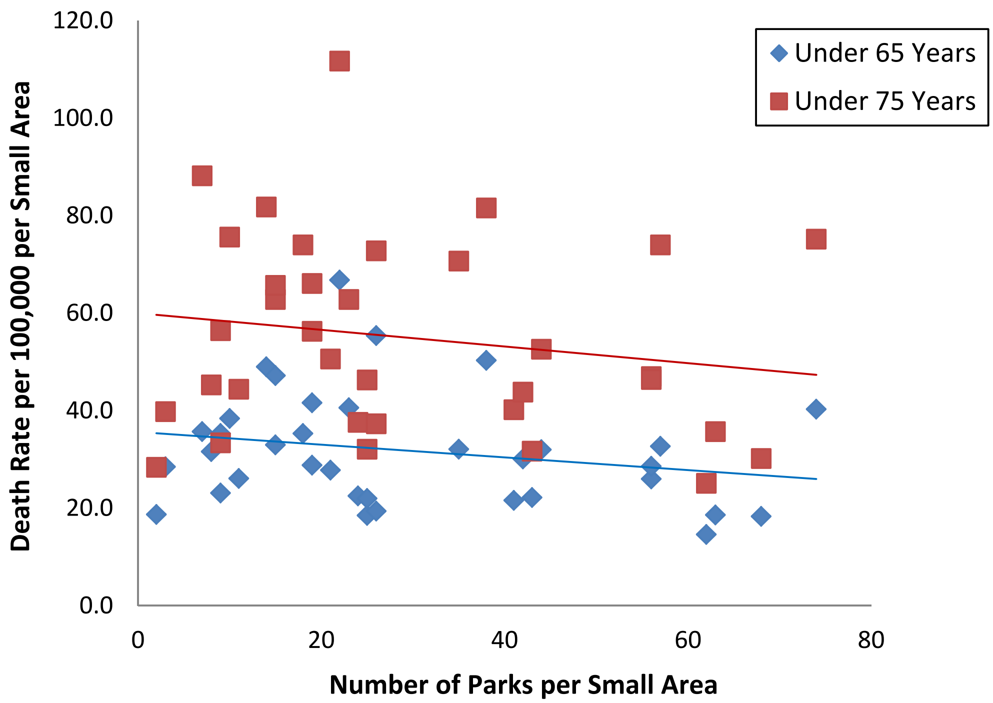

Figure 13 - Heart Disease Deaths and Number of Parks by Small Area

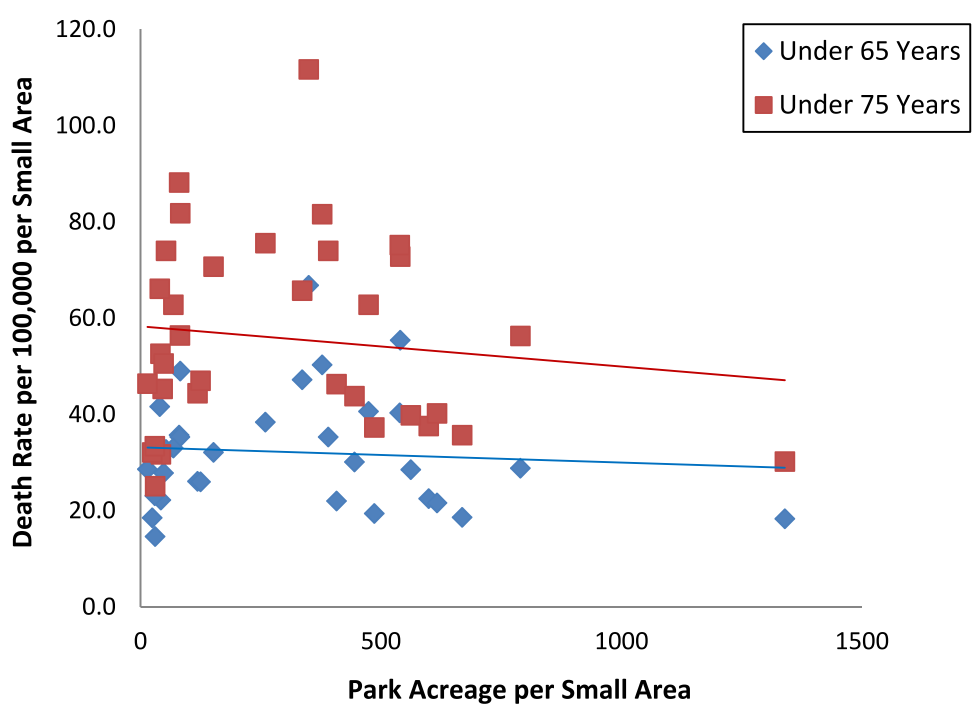

Figure 14 - Heart Disease Deaths and Park Acreage by Small Area

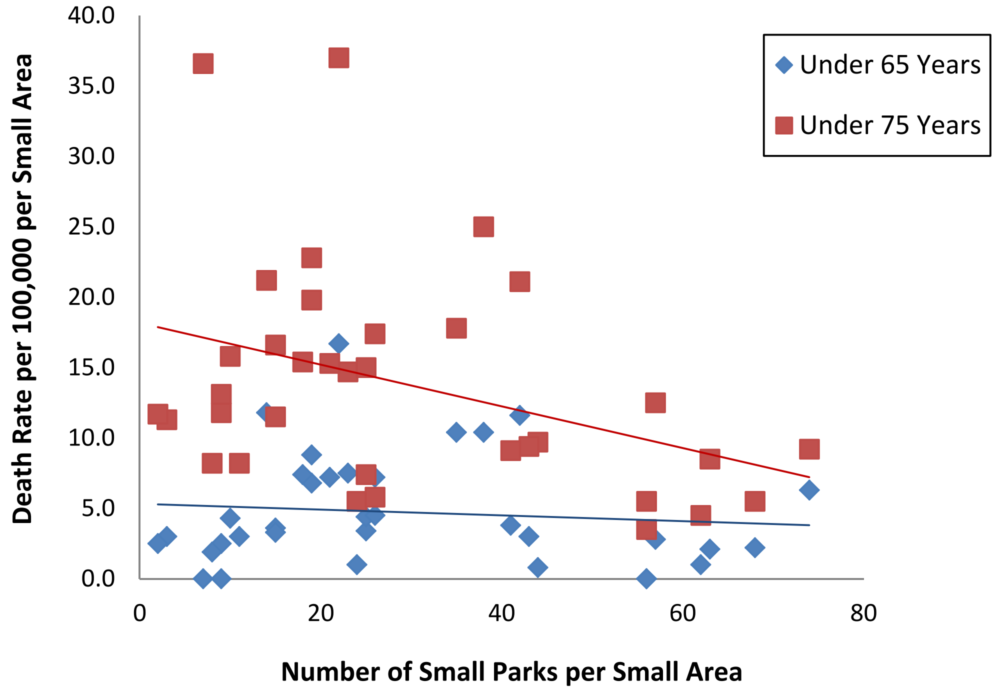

Figure 15 - COPD Deaths and Number of Parks by Small Area

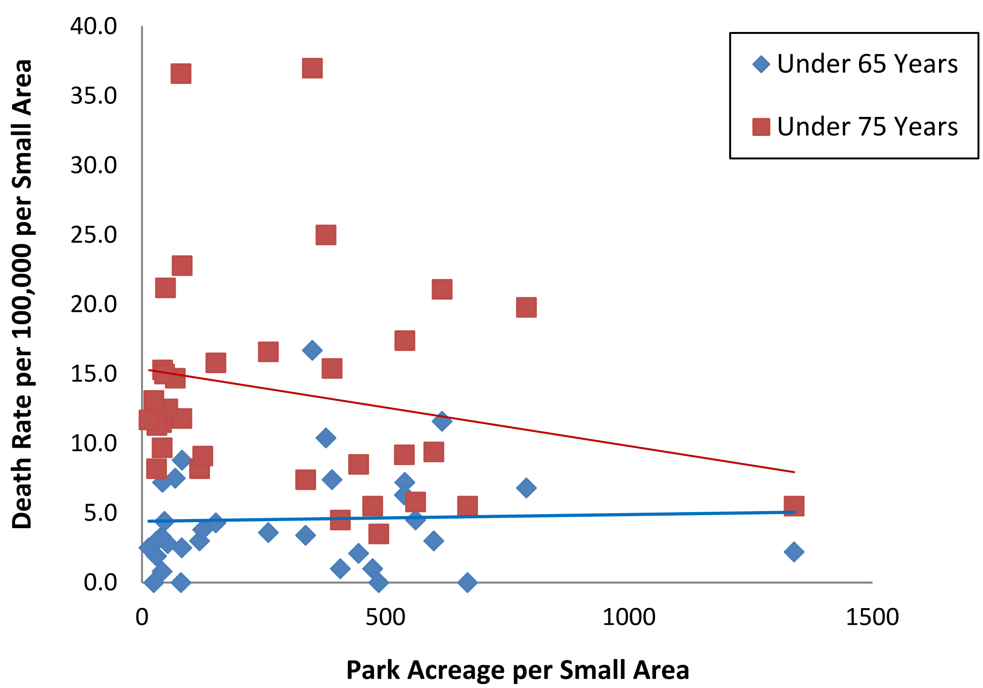

Figure 16 - COPD Deaths and Park Acreage by Small Area

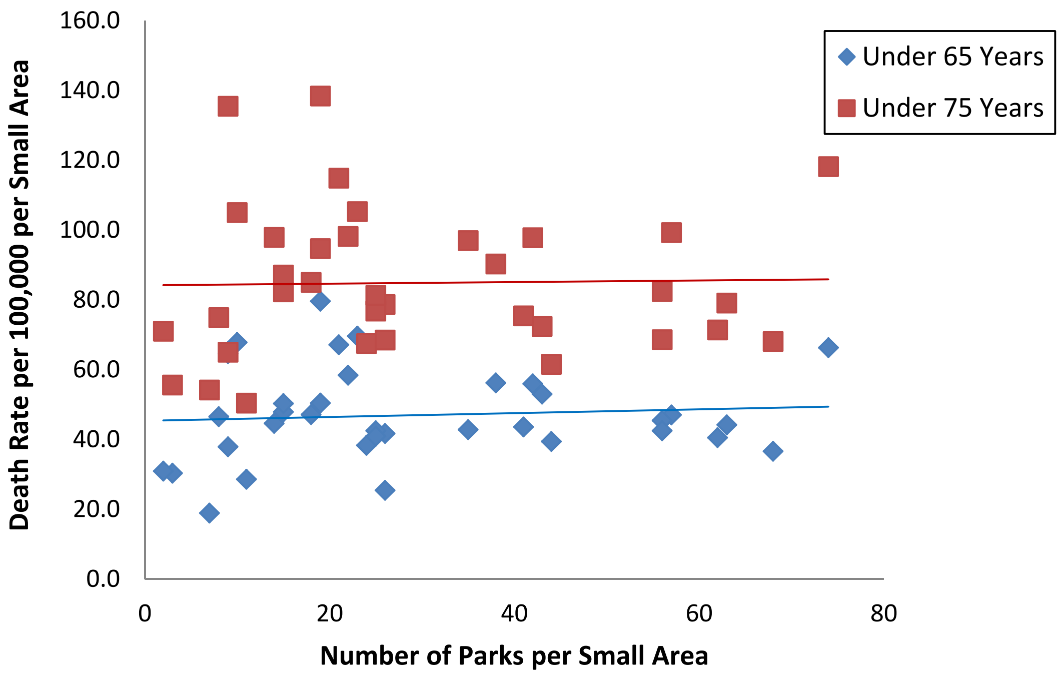

Figure 17 - Cancer (malignant neoplasm) Deaths and Number of Parks by Small Area

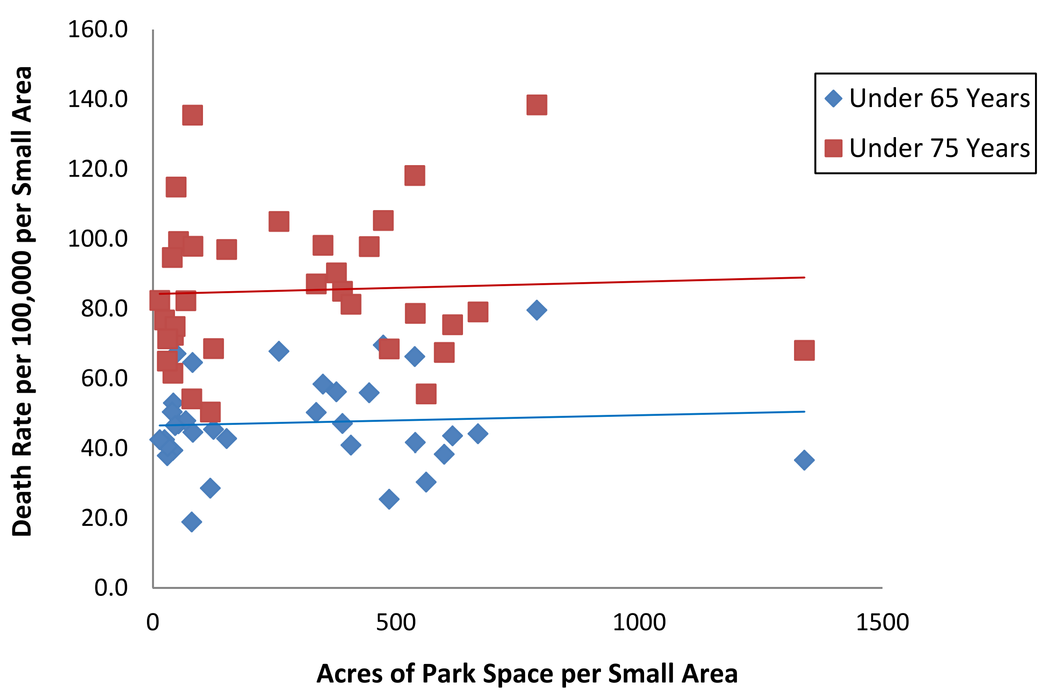

Figure 18 - Cancer (malignant neoplasm) Deaths and Park Acreage by Small Area

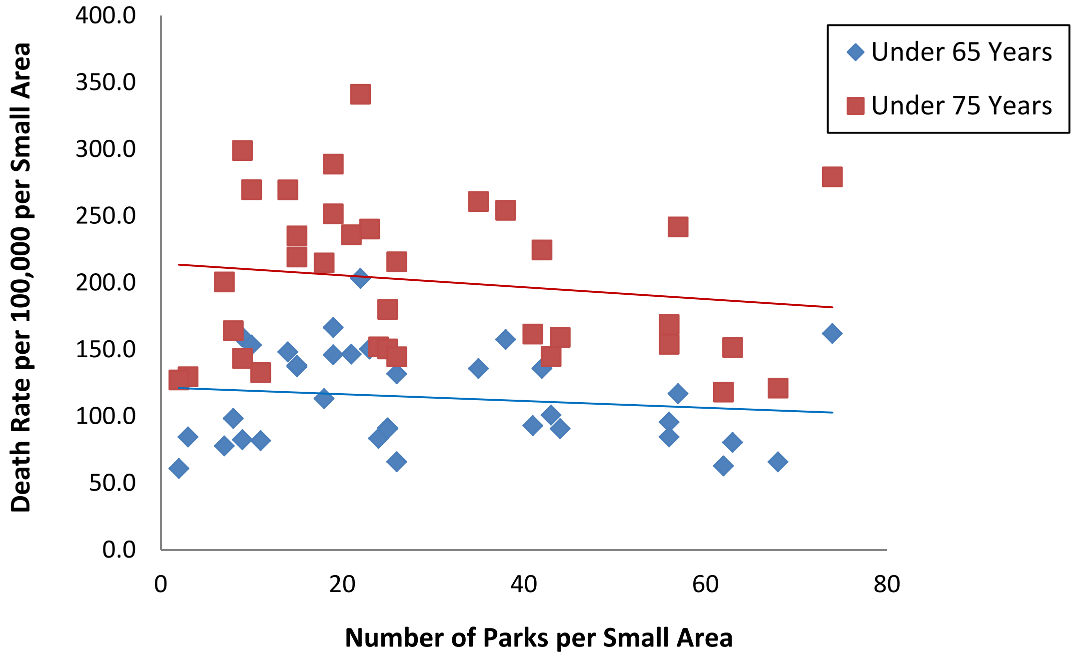

Figure 19 - Chronic Disease Deaths and Number of Parks by Small Area

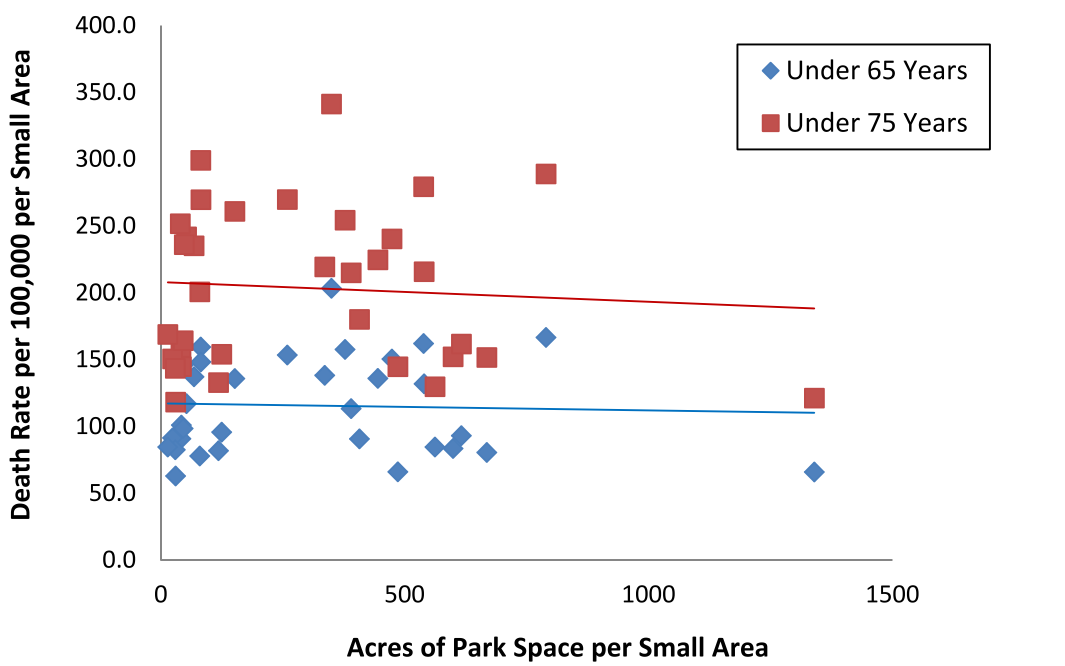

Figure 20 - Chronic Disease Deaths and Park Acreage by Small Area

APPENDIX B

INCOME, EDUCATION, AND HEALTH GRAPHS

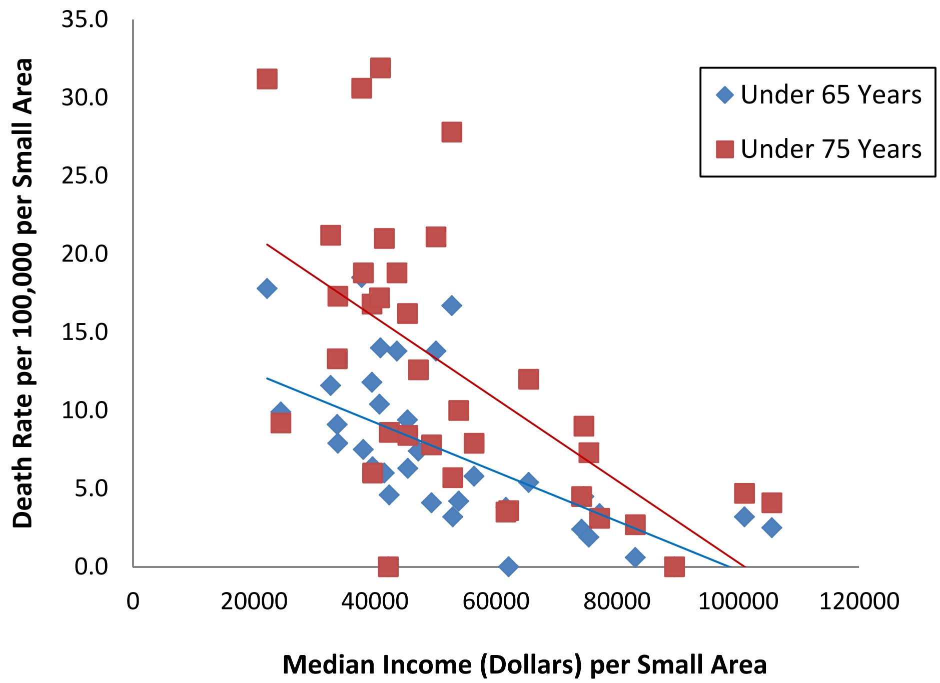

Figure 21 - Median Income and Diabetes Deaths by Small Area

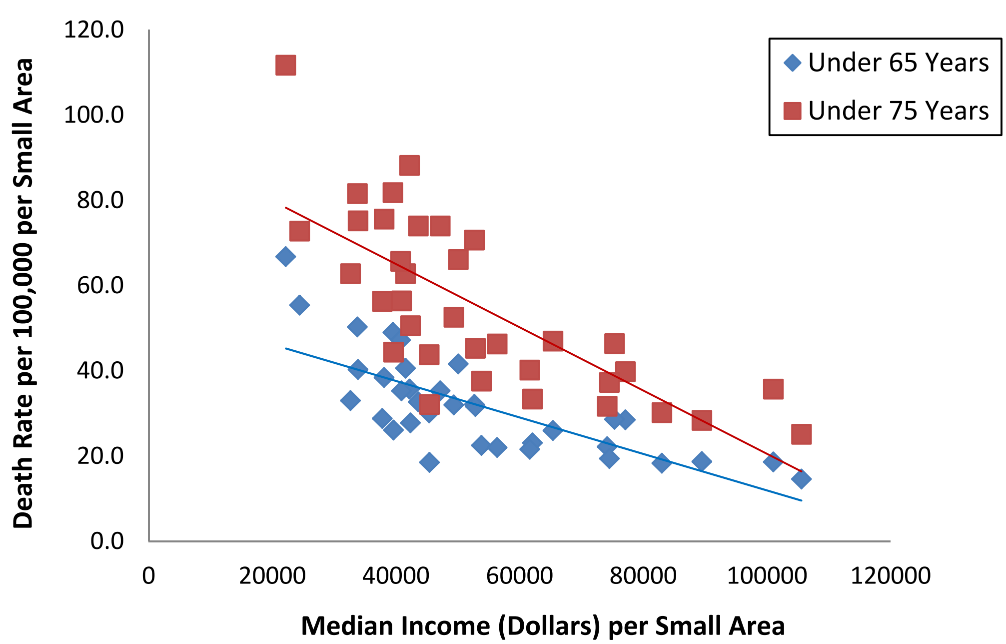

Figure 22 - Median Income and Heart Disease Deaths by Small Area

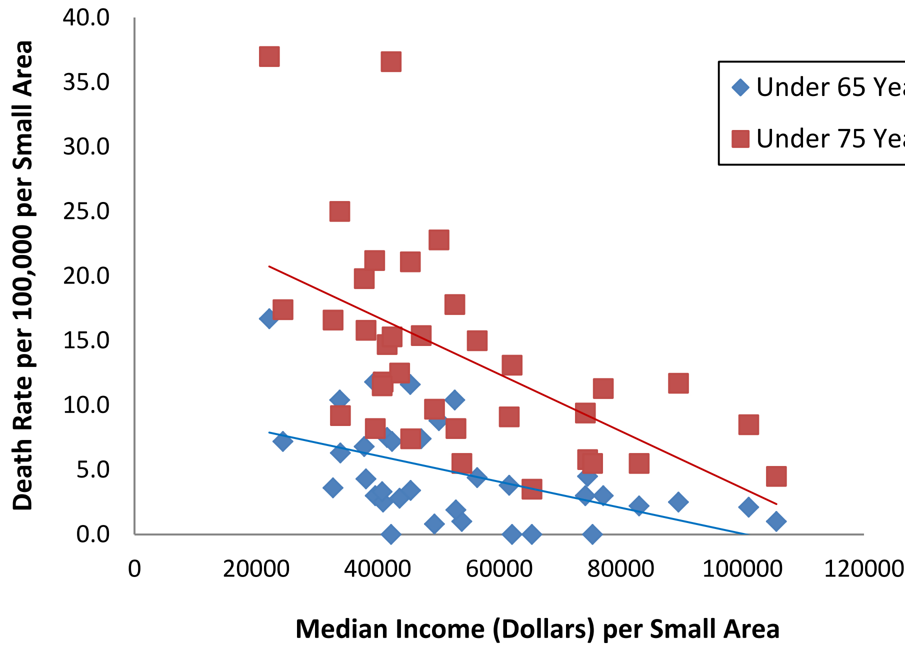

Figure 23 - Median Income and COPD Deaths by Small Area

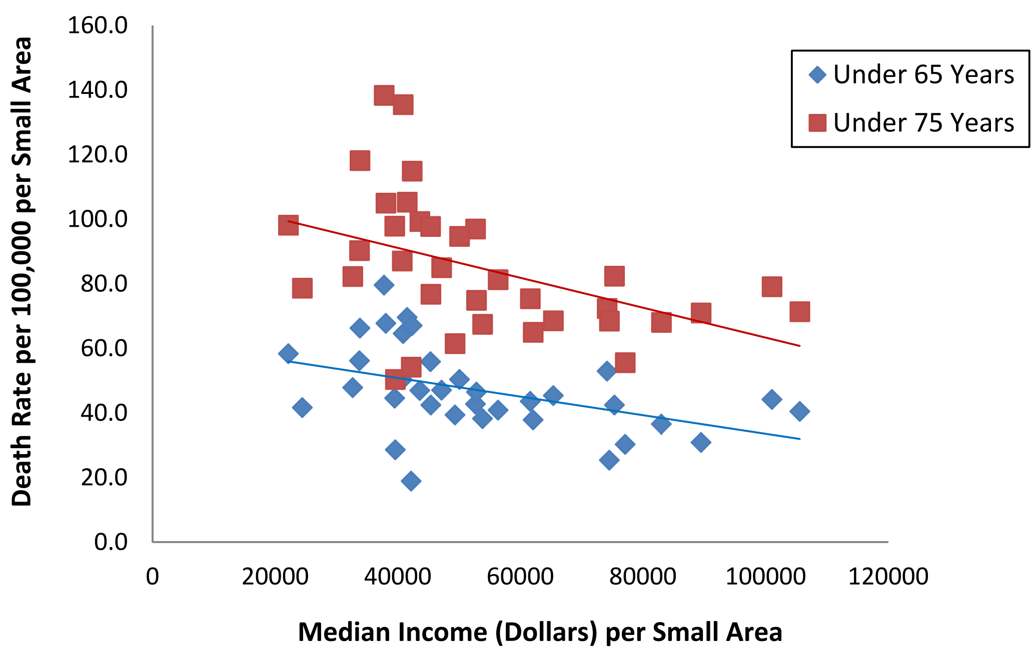

Figure 24 - Median Income and Cancer (malignant neoplasm) Deaths by Small Area

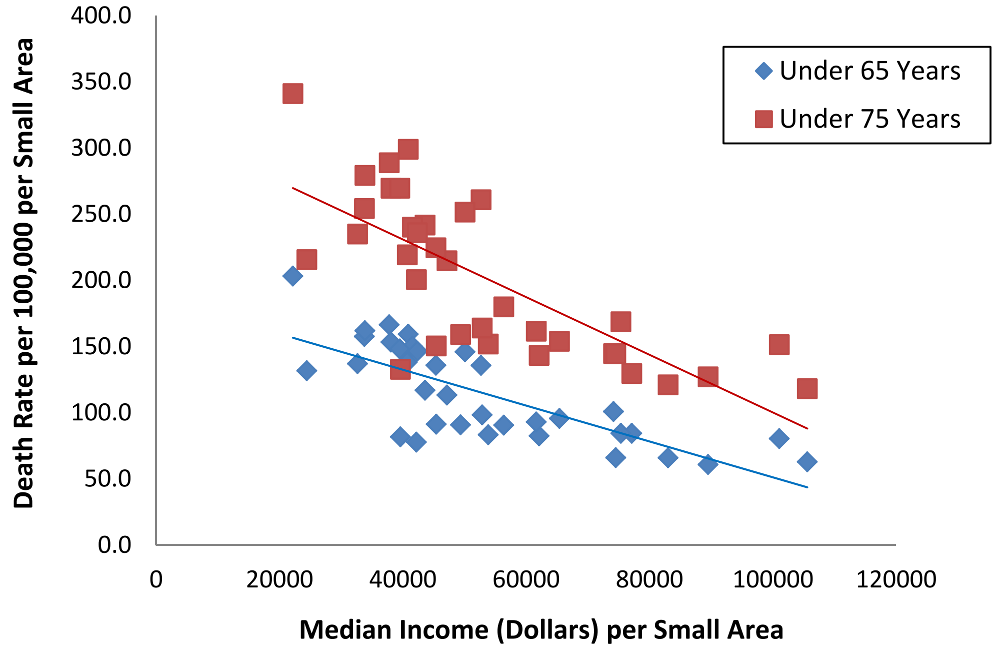

Figure 25 - Median Income and Chronic Disease Deaths by Small Area

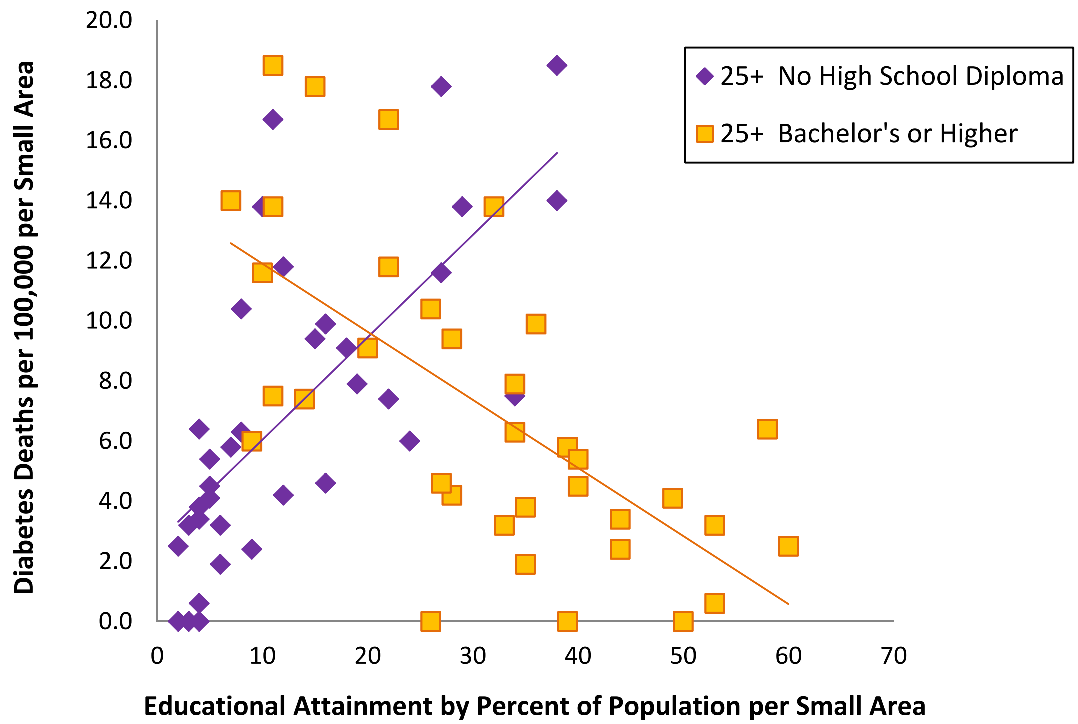

Figure 26 - Education and Diabetes Deaths for People Under 65 Years by Small Area

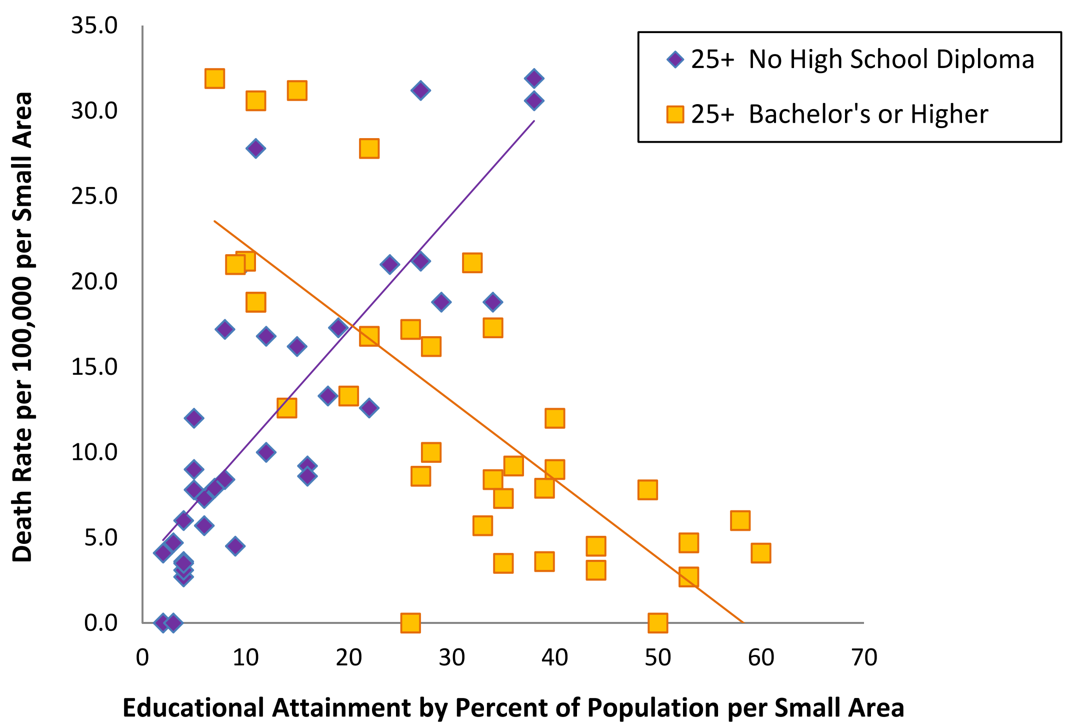

Figure 27 - Education and Diabetes Deaths for People Under 75 Years by Small Area

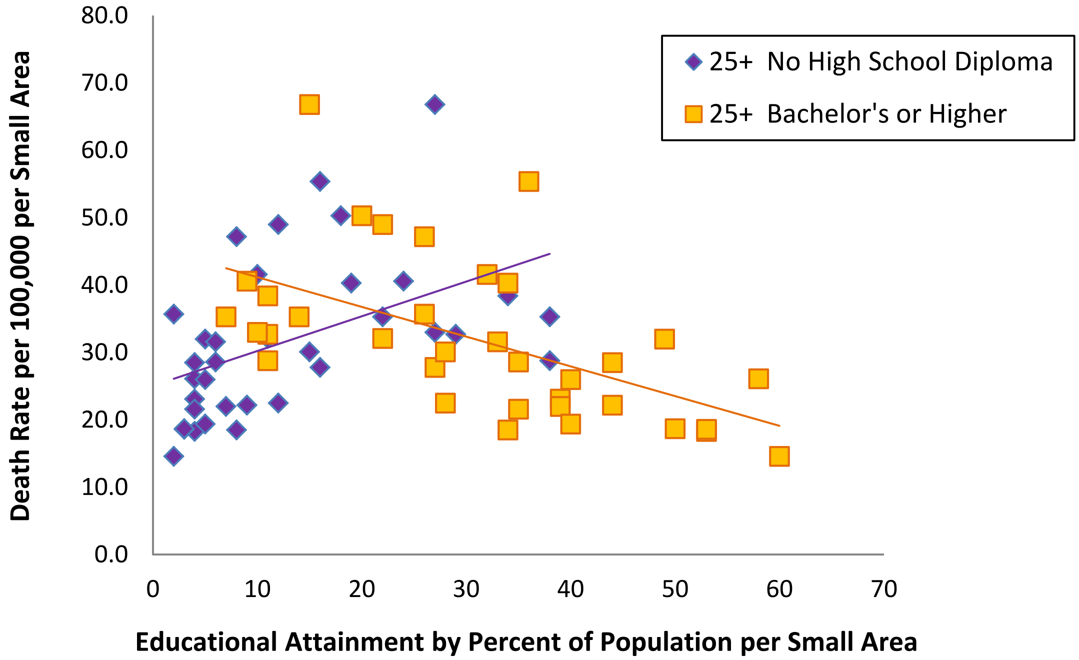

Figure 28 - Education and Heart Disease Deaths for People Under 65 Years by Small Area

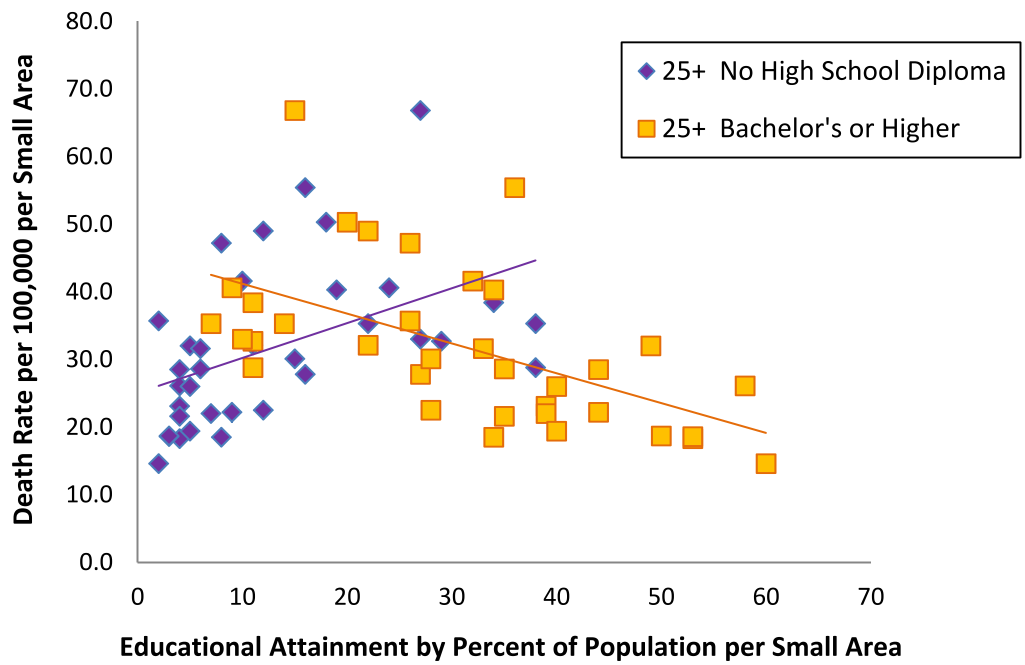

Figure 29 - Education and Heart Disease Deaths for People Under 75 Years by Small Area

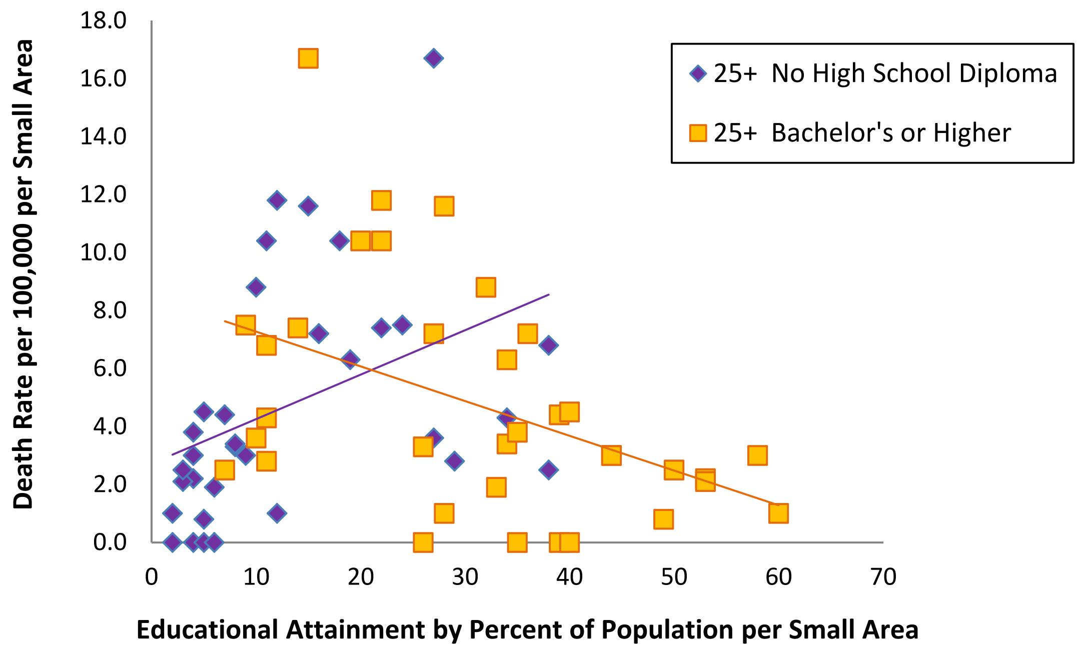

Figure 30 - Education and COPD Deaths for People Under 65 Years by Small Area

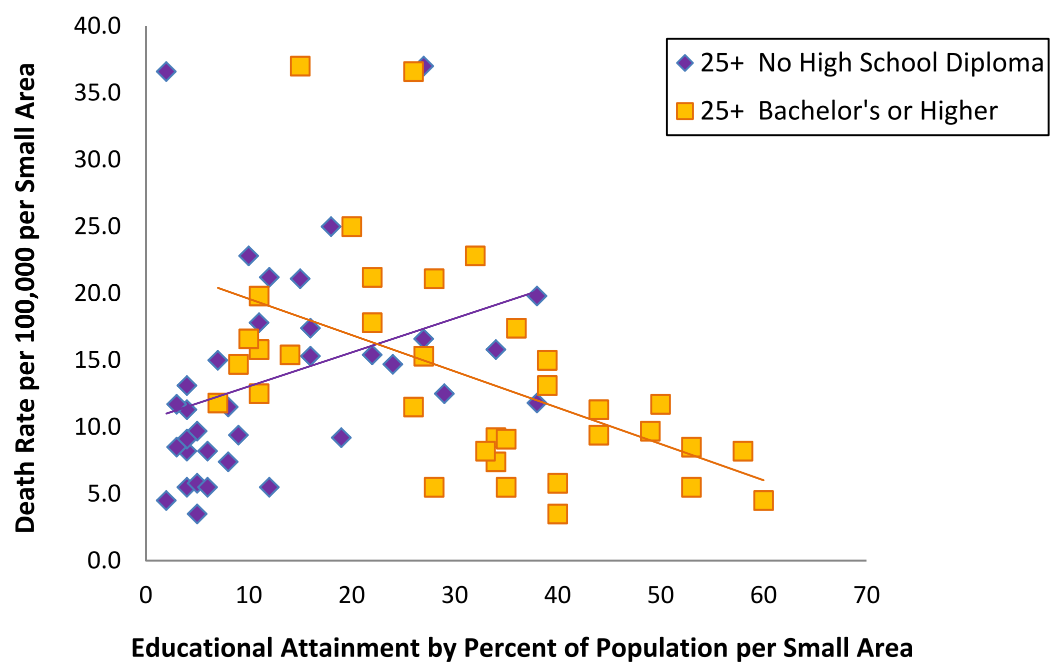

Figure 31 - Education and COPD Deaths for People Under 75 Years by Small Area

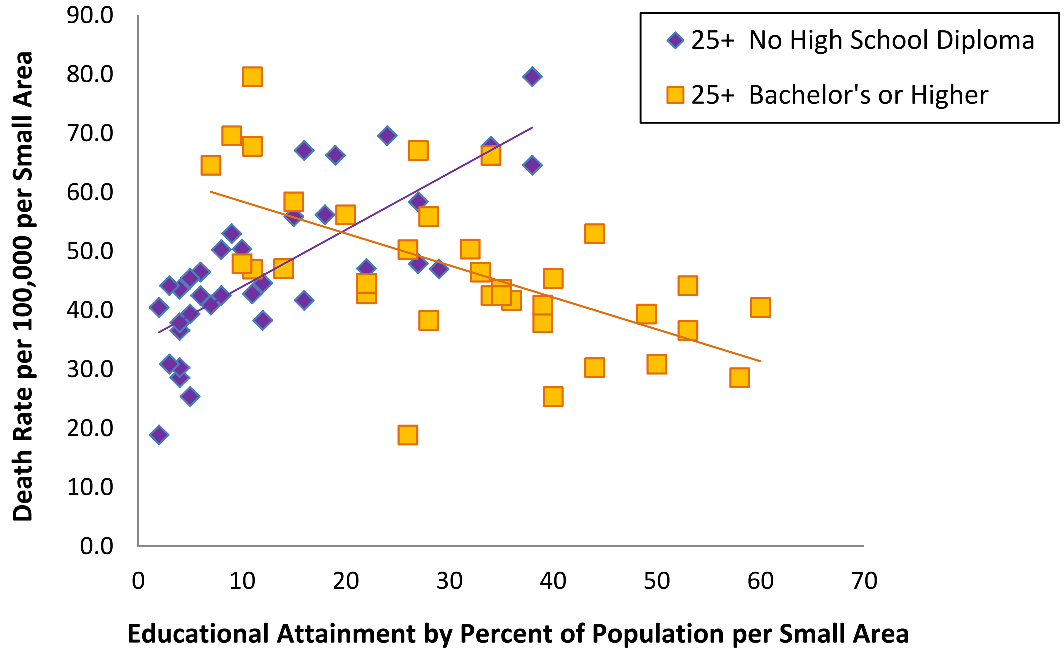

Figure 32 - Education and Cancer Deaths for People Under 65 Years by Small Area

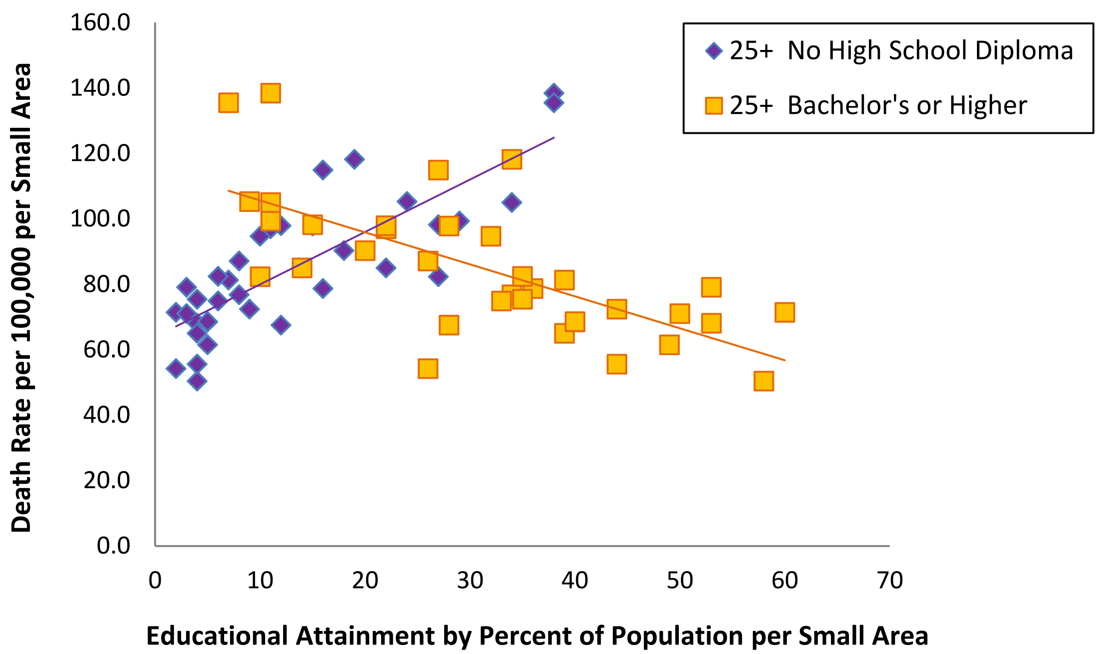

Figure 33 - Education and Cancer Deaths for People Under 75 Years by Small Area

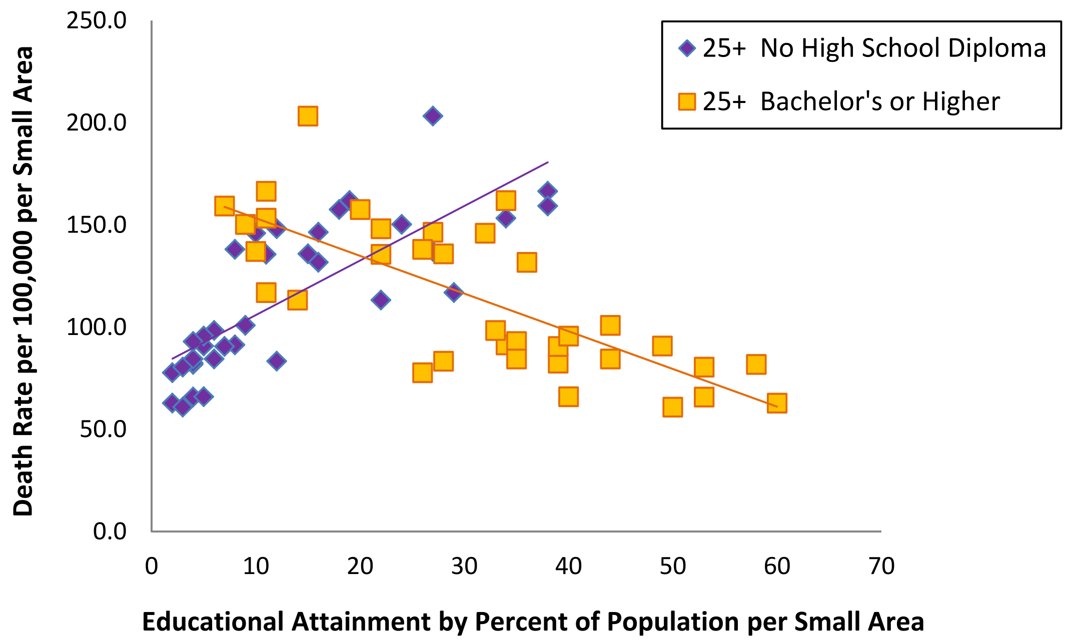

Figure 34 - Education and Chronic Disease Deaths for People Under 65 Years by Small Area

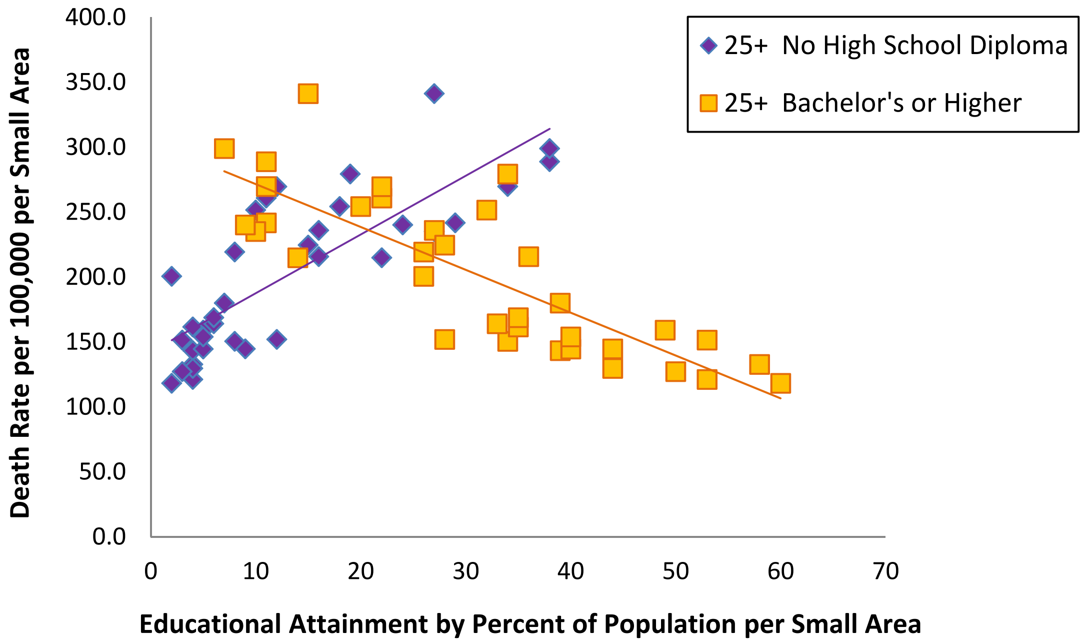

Figure 35 - Education and Chronic Disease Deaths for People Under 75 Years by Small Area

APPENDIX C

INCOME, EDUCATION, AND PARKS GRAPHS

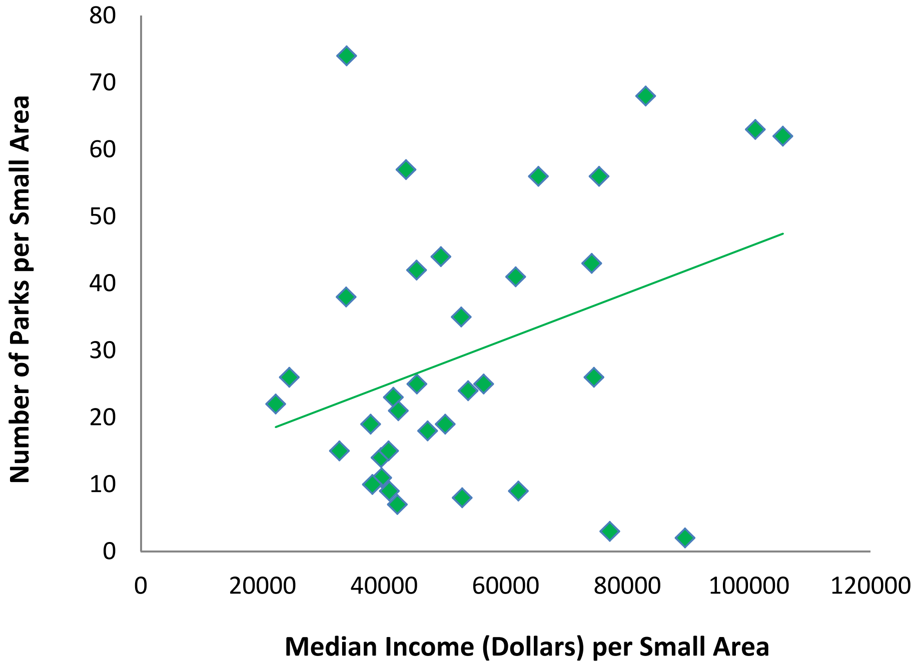

Figure 36 - Median Income and Number of Parks by Small Area

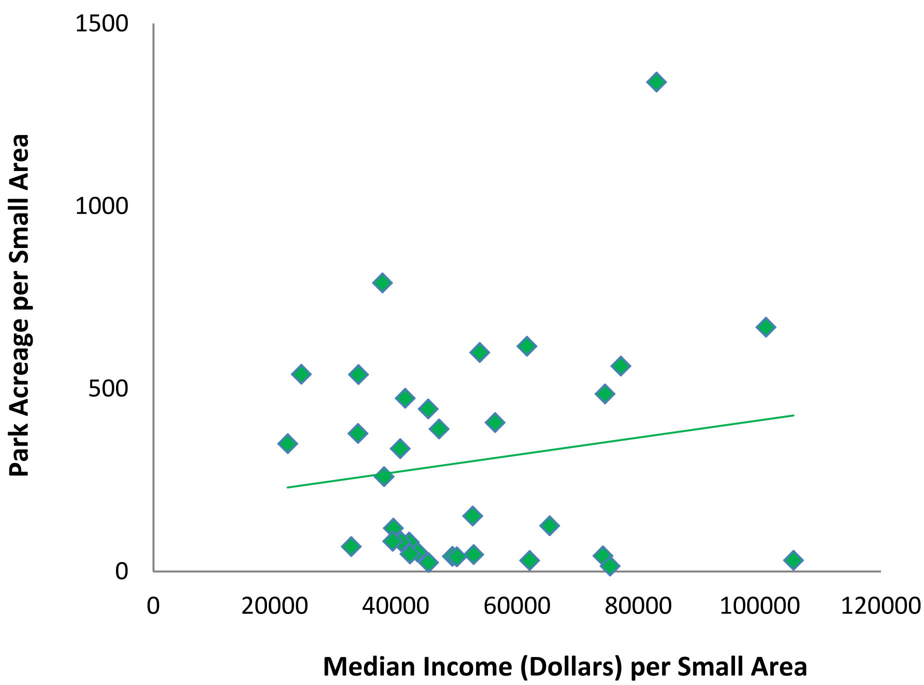

Figure 37 - Median Income and Park Acreage by Small Area

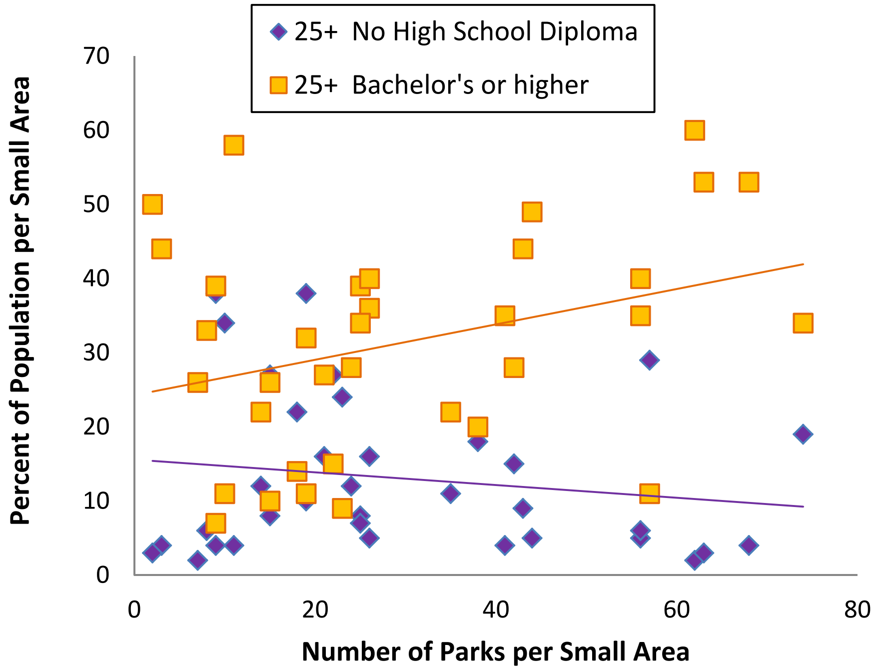

Figure 38 - Education and Number of Parks by Small Area

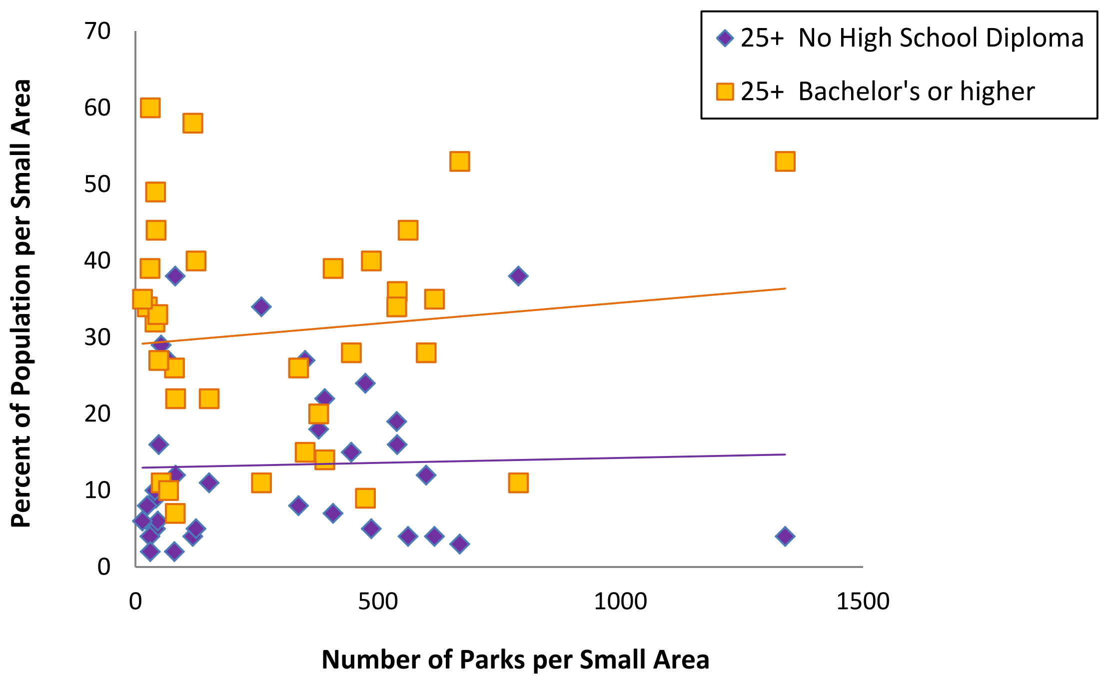

Figure 39 - Education and Park Acreage by Small Area

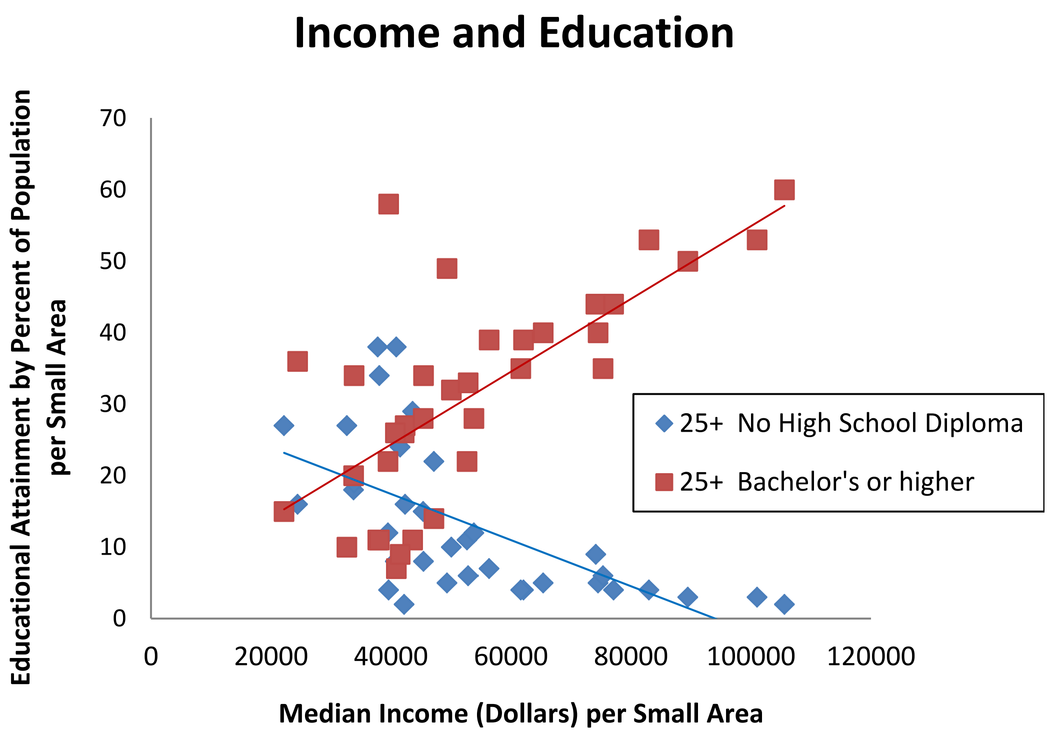

Figure 40 - Income and Education by Small Area

GLOSSARY OF TERMS AND ACRONYMS

Cancer	Malignant neoplasm
COPD	Chronic pulmonary obstructive disorder
GIS	Geographic Information System
Green space	Area of land that is mostly or completely vegetated with grass, trees, shrubs, flowers and other vegetation. Urban green spaces are those areas that are located within or along the boundary of an urban environment (i.e., towns and cities).
Open Space	The Albuquerque Major Public Open Space are lands primarily owned and maintained by the City that provide outdoor recreational opportunities, but are treated more like natural areas than manicured parks (Open Space Alliance, 2015).
Small Areas	"New Mexico Small Areas are 109 geographic areas across the state with population sizes that are just large enough to calculate rates for selected health events. New Mexico small areas were based on population size, not land area." (NM-IBIS, 2015a)

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