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Spatial Distribution of High Obesity Rates in South Carolina

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Spatial Distribution of High Obesity Rates in South Carolina

Tom Bennett, Introduction to Geographic Information Systems (GIS), Fall 2016

Introduction

In 2015, the rate of adult obesity in South Carolina was nearly 32%, which places South Carolina as the 13th worst state when it comes to the prevalence of adult obesity[1]. Along with overall rates of adult obesity, South Carolina has the 8th highest high school student obesity rate with 16.3% of high school students being obese. These statistics are troubling because obesity is a primary cause of Type II Diabetes, high blood pressure, and many other negative health effects. These health care issues then affect supply and demand for health care, advertising, physical exercise, and many other market segments, making the obesity epidemic an overarching problem in the state of South Carolina and the United States[2]. What, then, is causing these alarming rates of obesity in South Carolina? To answer this important public health question, the relationship between density of fast food locations, physical inactivity, median income, and access to healthy food retailers will be analyzed to find the economic and geographic conditions that lead to high obesity rates in South Carolina. This study will use GIS practices to visually map obesity, physical inactivity, income, distance to healthy food retailers, and fast food location data to find the source of South Carolina's obesity epidemic.

Figure 1: Median Income Per County

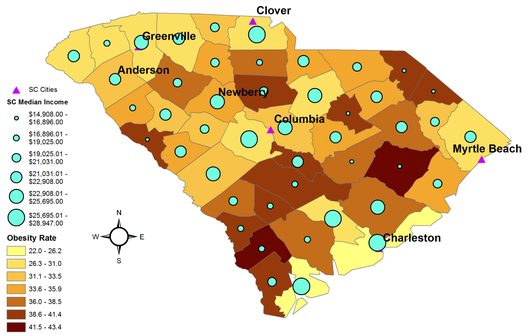


Figure 2: Distance to Healthy Food Retailer

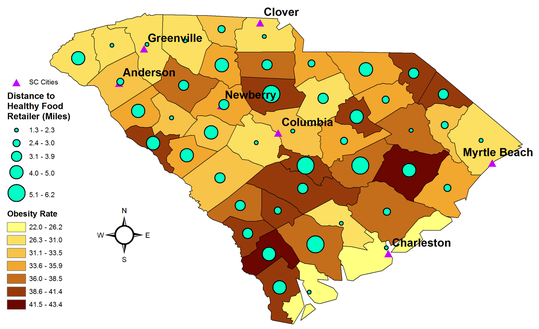


Figure 3: Fast Food Locations Per 1000 People

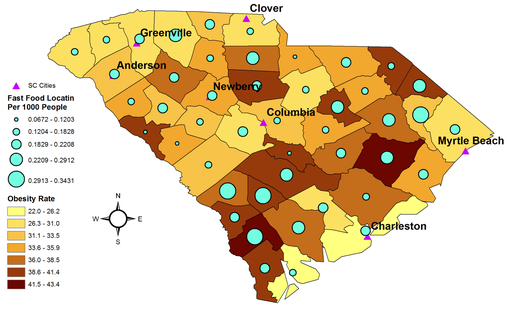


Figure 4: Leisure Time Inactivity Rate

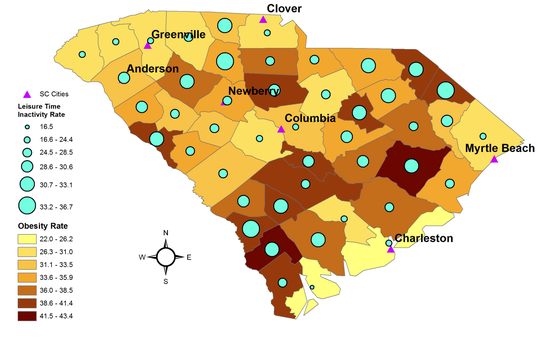


Figure 5: Intersection of All Variables

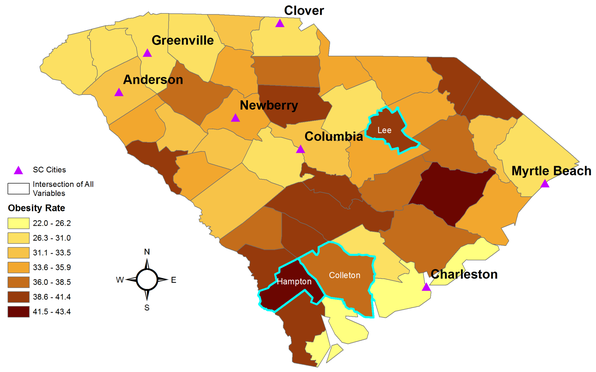


Figure 6: Top 5 Highest Obesity Rates in SC

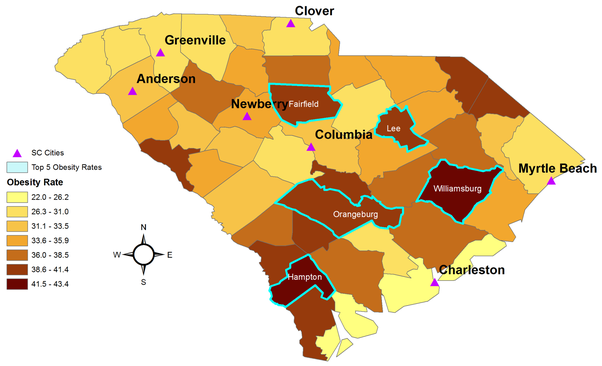


Figure 7: Union of All Variables

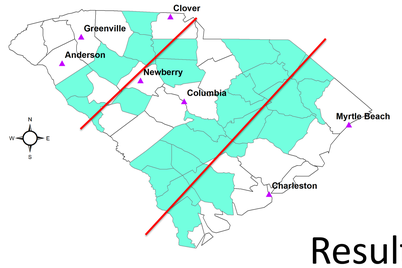
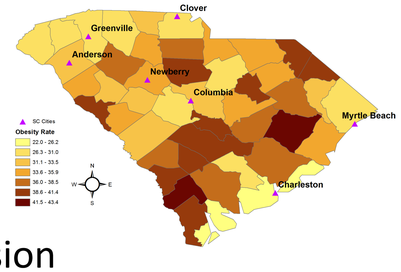


Figure 8: SC Obesity Rates



Results & Discussion

This study begins by examining the relationships between the four independent variables and obesity rates. It is important to note, however, that this is not an empirical study, and that all conclusions are not supported by extensive data analysis. With that in mind, figure 1 shows an inverse relationship between income and obesity rates. This conclusion is consistent with the findings from the 2014 paper that explores relationships between poverty and first-incidence obesity[3]. Continuing with figure 2, there is an apparent positive relationship between distance to a healthy food retailer and obesity rates. The further a household is on average from a healthy eating option, the higher the obesity rates that are observed. Areas with a high distance from a healthy food retailer also tend to have lower median house hold incomes, suggesting that a link between economic hardship and an unfavorable retail food environment is present[4]. Building on these trends of unfavorable retail food environments in less affluent areas, figure 3 shows that fast food locations per capita appears to be higher in relatively poorer areas. Finally, in reference to figure 4, it appears that leisure time inactivity and high obesity rates are positively related. On average, the more time one spends sedentary, the higher the obesity rates will be[5]. It also appears that leisure time inactivity and median income are inversely related. One potential explanation for this is that physically active leisure time activities are generally more money and time intensive, thus discouraging poorer individuals from being physically active.

After analyzing the four main independent variables individually, this study focuses on illuminating how the variables affect obesity rates a whole. As shown above (Figure 5), when the variables of high inactivity, low median income, high distance to a health food retailer, and high fast food per capita are intersected, three counties stand out: Hampton, Colleton, and Lee. When these counties are compared to high obesity rates in South Carolina (Figure 6), two are in the top three most obese counties in the state. Hampton county maintains the highest obesity rate in South Carolina at 43.4%, and Lee county has the third highest obesity rate at 41.4%. At the nexus of high inactivity, low median income, high distance to a health food retailer, and high fast food per capita, obesity rates tend to be very high. This suggests that multiple variables act at in unison to influence obesity rates. These findings could help policy makers decide which geographic areas to focus on to help reduce South Carolina's obesity epidemic. In the future, utilizing regression analysis would be helpful to determine the magnitude and significance of each independent variable in this study.

Following up on the analysis of the intersection of the four major variables, this study aims to understand the broad trends surrounding obesity by completing a union of high inactivity, low median income, high distance to a health food retailer, and high fast food per capita. As seen above in figures 7, the union shows two clear bands across the state. These highlighted counties fit at least one of the criteria explained in the methods section. When compared to figure 8, high obesity rates mirror the two bands that go across the state. The primary band between the coast and the upstate carries the infamous name of 'The Corridor of Shame' because of its sub-par economic, health, and education conditions[6]. For future research, this study suggests conducting more specific research on economic and health conditions in this corridor by census block group. Clearly, these results show that multiple variables are acting in unison to influence obesity rates in South Carolina.

Methods

After generating a research question and conducting extensive research on obesity trends in the United States and South Carolina, it was time to gather and clean data for this analysis. Fast food restaurant location data was gathered from fastfoodmaps.com, where researchers compiled an extensive database of the addresses of McDonalds, Burger King, Wendy's, Taco Bell, Pizza Hut, Jack in the Box, Hardee's, and In-N-Out locations across the United States. Data on county level obesity rates and leisure time inactivity was gathered from the Centers for Disease Control and Prevention website . Data regarding household distance to healthy food retailers was found on the healthy insight web page. Data regarding median household income per county was generated from the NHGIS website.

Using a shapefile of South Carolina's county boundaries, fast food locations were geocoded by address on to the map. Geocoding entails transforming descriptions of locations into a physical locations on a map. From there, all other data was joined with the South Carolina county boundaries. Using a choropleth map, obesity rates were mapped with graduated colors to visually represent which counties had the highest obesity rates. Graduated symbols were then laid on top of the obesity rate choropleth map to compare median income, leisure time inactivity, fast food locations per capita, and distance to a healthy food retailer to obesity rates. To obtain a better metric for fast food location density, a field containing fast food locations per capita was created by dividing fast food locations per county by that same county's population. This number was multiplied by 1000 to find fast food locations per 1000 people. Moving forward, this study sought to find out what conditions in a county led to higher obesity rates. To accomplish this, the intersect tool was utilized to find the nexus of high inactivity, low income, high distance to food retailers, and high fast food per capita, which were then compared to high obesity rates. A high obesity rate was defined as a county with an obesity rate of 38% or higher. High inactivity was defined as a county with more than 30% of its population being inactive during leisure time. High distance to a healthy food retailer was defined as being 4.2 miles or more. High fast food locations per capita was defined as greater than .259 locations per 1000 people. Low median income was defined as households that make less than $20,000 a year. The resulting selected counties were then compared to see what relationship, if any, the variables of interest had with high obesity rates.

Data Sources

Figure 1) National Historic Geographic Information Systems (NHGIS): Median Income in the Past 12 Months (in 2011 Inflation-Adjusted Dolars) by Place of Birth in the United States. 2011 American Community Survey: 5-Year Data [2007-2011, Tracts & Larger Areas].

Figure 2) Healthy Insights South Carolina. Average household distance to nearest grocer or supermarket that accepts Supplementary Nutrition Assistance Program. https://healthyinsight.org/dashboard.html

Figure 3) National fast food locations by address (2007). Fastfoodmaps.com.

Figure 4 and 8) Centers for Disease Control and Prevention. 2010 obesity and leisure time inactivity data. http://www.cdc.gov/diabetes/atlas/countydata/atlas.html

Figure 7) South Carolina county shapefile. \\fushare\gisdata\SouthCarolina\PiedmontGeology (used for all South Carolina outlines and 2014 population data)

All maps developed using Environmental Systems Research Institute (ESRI) ArcDesktop, 10.4.3.

References

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