Modeling the Likelihood of Eating Unhealthily in Florida's Counties

Anjali Narang

Data sources: TIGER 2010 shapefiles; *USDA ERS - Food Environment Atlas*. United States Department of Agriculture, Economic Research Service, Nov. 2012. Web. 11 Dec. 2012.

Projection: WGS_1984_Web_Mercator_Auxiliary_Sphere

References:
1. Crosta, Peter M. "Researchers Verify Link Between Type 2 Diabetes And Diet." *Medical News Today*. MediLexicon International Ltd, 30 July 2008. Web. 11 Dec. 2012.
2. Centers for Disease Control and Prevention. National Diabetes Fact Sheet, 2011. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2011.
3. *County Health Rankings & Roadmaps*. Robert Wood Johnson Foundation & University of Wisconsin Population Health Institute, 2012. Web. 20 Dec. 2012.

Intro to GIS
December 17, 2012

INTRODUCTION

As a college student, I have realized the importance of access to grocery stores, supermarkets, and various kinds of eateries in shaping my diet choices with limited time, energy, and income. Focusing on the relationship between diet and access to food, I sought to map counties with populations of adults most likely to have unhealthy eating habits; these counties could be used to target high priority counties to locate more cheap, healthy food options to help overcome practical barriers to healthy eating, like budget and physical access. Healthy food options would take the form of grocery stores/supermarkets or restaurants. It is important to note that I am not mapping unhealthy populations, but those with unhealthy *eating habits*, thus I am omitting other dimensions of health like levels of physical activity in my analysis. Since diet is a significant influence on health, improving diets would also affect overall health. I chose to analyze Florida, as it is a state with enough variation in my criteria used, and seems to rank higher in terms of people more likely to have unhealthy eating habits.

METHODOLOGY

The four county-level criteria I used in my final model of counties with unhealthy eating habits are:

1. Low income & low access to store (% of total population) (2010). Low access describes low access to large grocery stores and supermarkets, which are used proxies for healthy foods. This is in accordance with the logic of the USDA in its definition of the related concept of food deserts.
2. Density of fast food restaurants (fast food restaurants per square mile) (2009). I used this as a proxy for access to fast food restaurants/unhealthy food, whereas the first criteria concerned access to healthy food. It is important to note that I took into consideration whether fast foods are near, *not* whether they were nearer relative to healthy foods, because even if healthy foods were nearer or equally near, fast food would draw people of limited means because it is cheaper.
3. Adult obesity rate (% of total population) (2009).
4. Adult diabetes rate (% of total population) (2009).

Maps of these four factors are displayed on the bottom of my poster, alongside those of population density (2010) and race (2010) for points of comparison, although not used in my analysis. Density of fast food restaurants, however, does match up to the population density map, so population density is indirectly incorporated. Higher numbers in all these criteria signify greater likelihood to eat unhealthily.

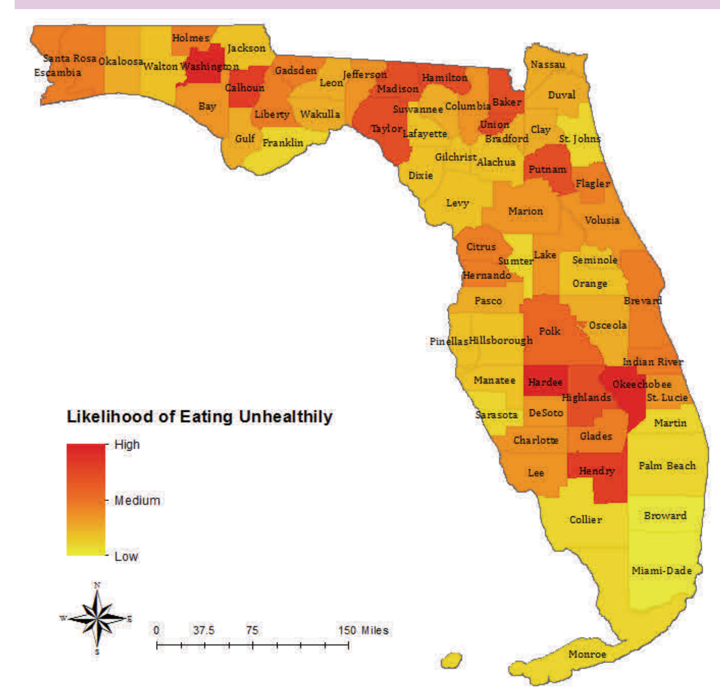
Reasons for choosing criteria:

Socioeconomic status, in conjunction with lack of access to fresh food, and the availability of cheaper, but unfortunately, unhealthier, food in the form of fast food restaurants, is likely to shape unhealthy eating habits - the problems of access are intensified for those of a lower socioeconomic status. Unhealthy diets and obesity are heavily linked, and there is also recent evidence of a link between unhealthy diets and type 2 diabetes.[1] Since type 2 is more prevalent than type 1 diabetes (type 2 accounts for 90-95% of diagnosed diabetes cases,[2] I assumed diabetes could serve as a good enough proxy for type 2 diabetes for the purposes of my analysis. However, I still weighted diabetes less heavily because of the lack of distinction in my data between type 2 and type 1, and because obesity is a risk factor for diabetes – the locations of obese and diabetic populations are likely to correlate.

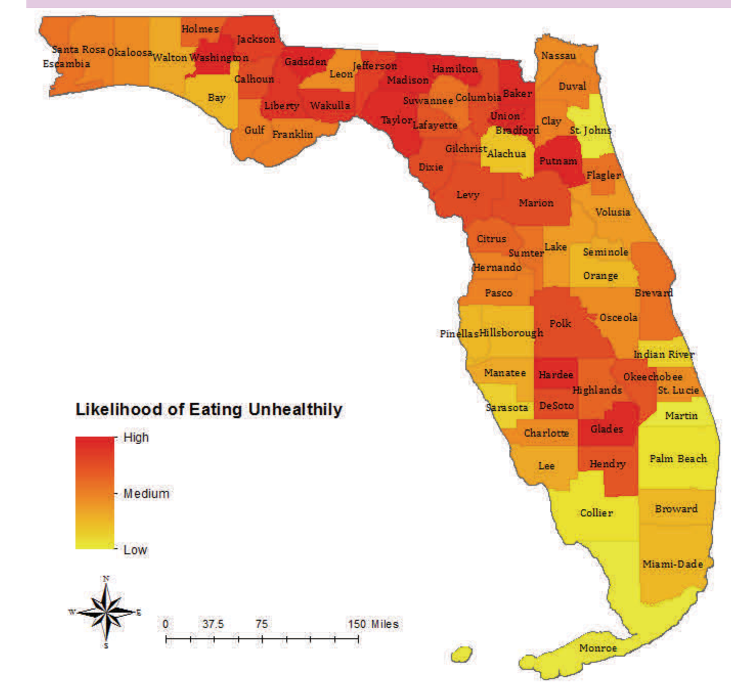
Although all four criteria are *correlated* with diet, the nature of their *causal* relationships differ; the first two can be categorized as 'causal' factors of an unhealthy diet, whereas the latter two can be categorized as 'resultant' factors. While the causal factors would indicate 'vulnerability' to eating unhealthily (thus, cheaper, nearer healthy food options would *prevent* the unhealthy eating habits), the latter two would more likely indicate that that they *already* eat unhealthily (cheaper, nearby healthy food options would thereby mitigate the unhealthy eating habits).

I created two intermediate maps, show below, one of which was of the two causal factors—low income & low access to store, and density of fast food restaurants, and the second of which was of the two resultant factors—adult obesity and diabetes rates.

'Causal' Factors



'Resultant' Factors



In weighting my criteria, I asked myself, what are the most important criteria in determining who is more in need of cheaper, healthy food options? The answer to this would be: low income & low access populations. Thus, I would be targeting populations who are likely to eat unhealthier because they are effectually forced to do so, because of price and access constraints, rather than those who do not face these same constraints, and choose to eat unhealthy food because it is, for example, tastier. I thus weighted low income & low access to store the most.

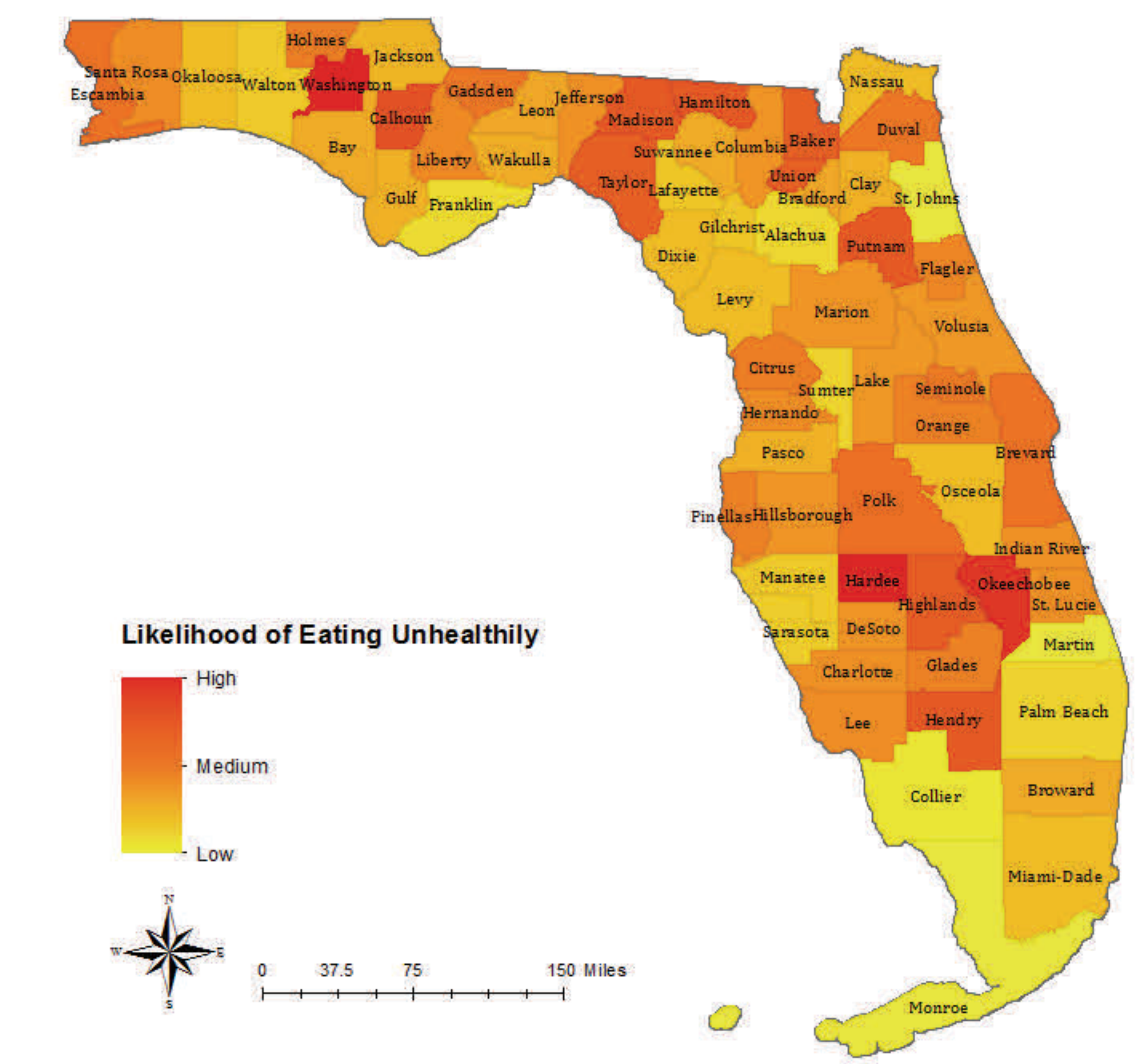
I overlaid the two intermediate maps for my final composite map of all four factors. I weighted causal factors more heavily (weight given=0.67) than resultant factors (0.33), because preventing/mitigating the causes is more effective than treating/mitigating the results in solving a problem. See the table below for weights that were given to each factor in each intermediate map and in the final map, as well as the statewide range for each factor. In my final composite map, after low income & low access, obesity was given the next most weight, then density of fast food restaurants, and lastly diabetes.

	Statewide Range	Causes*0.67	Results*0.33	Final (Causes*0.67) * (Results*0.33) = (Final*1)
Low income & low access to store (% of total population)	0.2 – 21.5	0.67	X	0.4489
Density of fast food restaurants (FFR per square mile)	0 – 0.73	0.33	X	0.2211
Adult obesity rate (% of total population)	19.7 – 38.4	X	0.75	0.2475
Adult diabetes rate (% of total population)	7.2 – 14.3	X	0.25	0.0825

Most important tools used in ArcGIS: joins (Food Environmental Atlas data from .csv file to TIGER Census 2010 county shapefiles); polygon to raster; calculate statistics; reclassify to reclassify each factor raster into 5 classes ranging from a low of 1 to a high of 5; and, lastly, raster calculator, with a stretched color scheme.

FINAL RESULTS

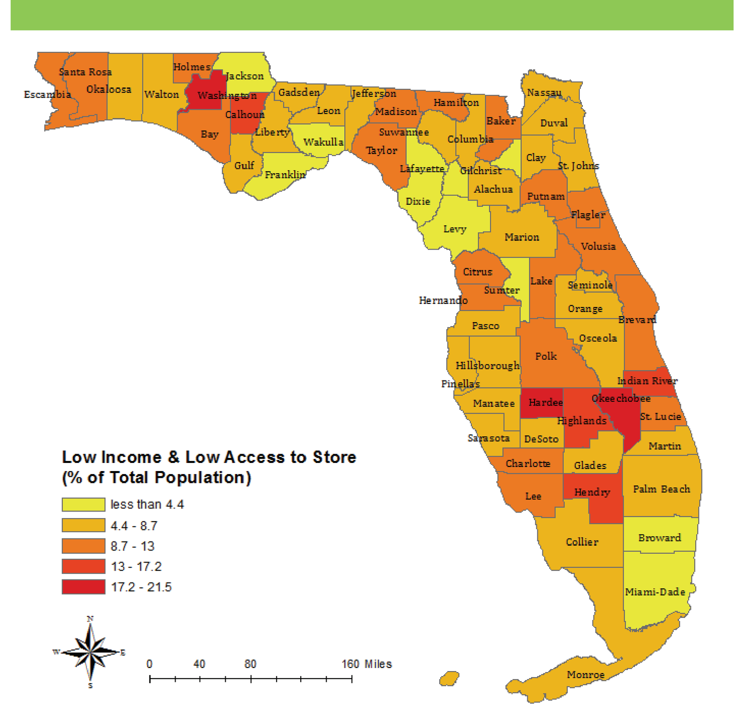
Likelihood scores ranked from a low of 1.45, to a high of 4.12 (rounded to two decimal places). The counties with the highest scores were 1) Washington- 4.12, 2) Hardee- 4.03, and 3) Okeechobee-3.70. The counties with the lowest scores were St. Johns, Martin, and Monroe, all with a score of 1.45.



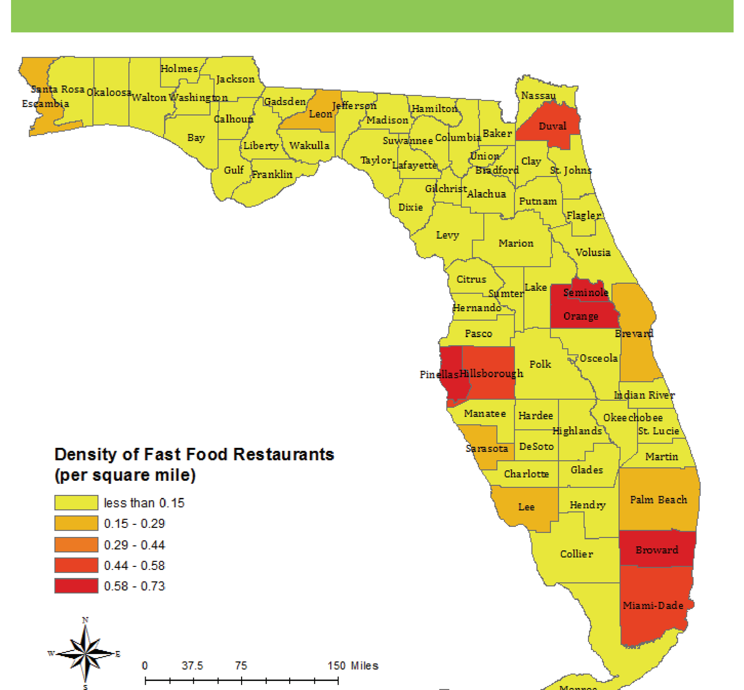
CONCLUSIONS

My analysis largely mirrors Florida's health county rankings[3], which include a wide variety of health criteria beyond those relevant to diet, demonstrating the importance of diet in shaping overall heath, or at least that diet and health are strongly correlated. County-level data on the prevalence of type 2 diabetes data, and the expenditures on fast food and ratio of fresh food/prepared food consumption, that were only available on a state-level from the USDA, could have improved the accuracy of my map. The next step in such an analysis would be to model areas *within* the counties to locate healthy food options near clusters of populations that fit criteria similar to the four I used.

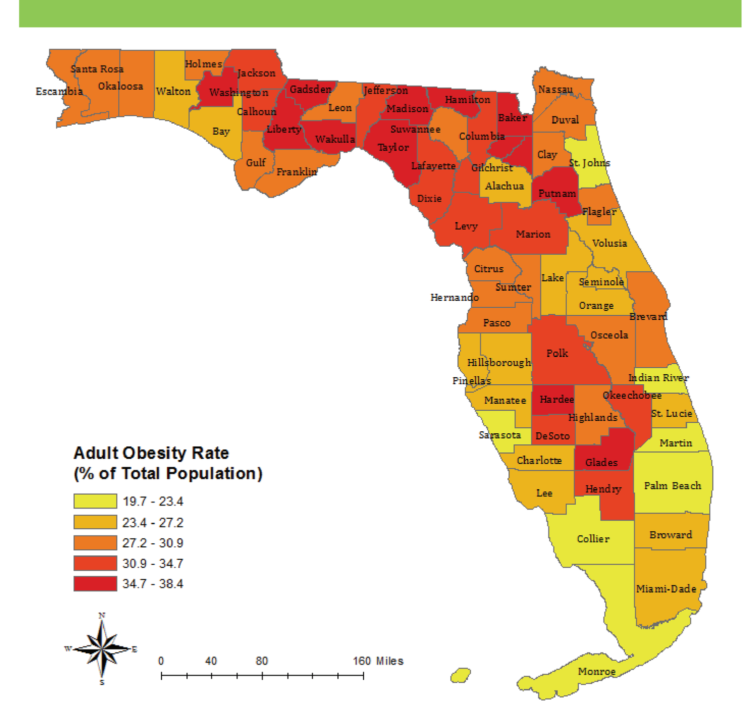
Low Income & Low Access to Store



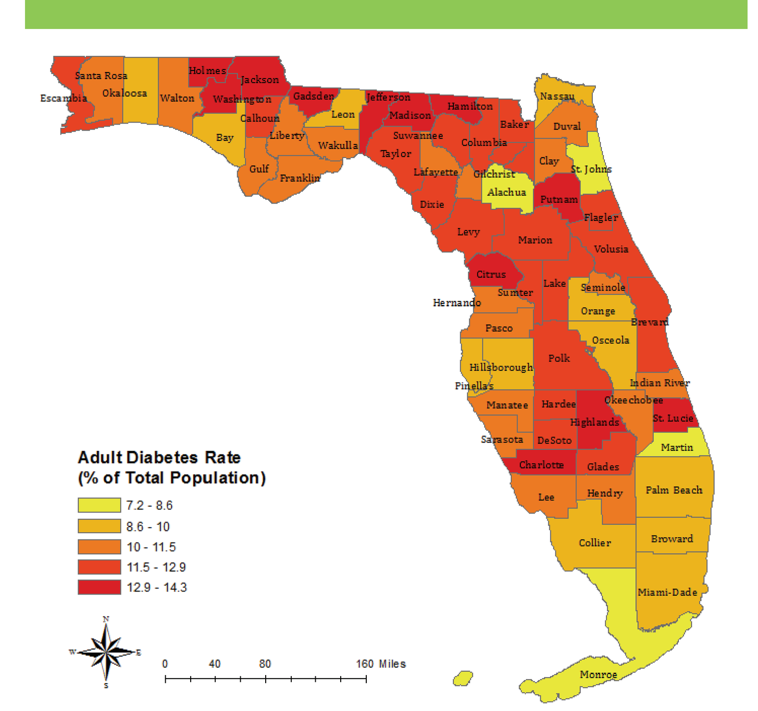
Density of Fast Food Restaurants



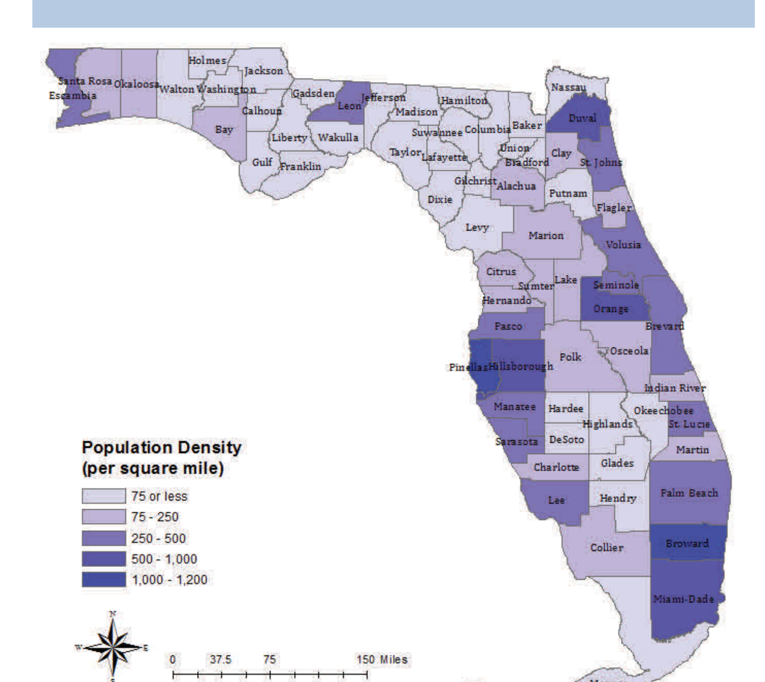
Obesity



Diabetes



Population Density



Race