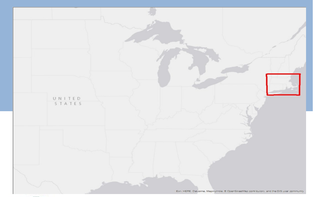
Diabetes prevalence and the food environment:
a spatial analysis of the relationship between food outlets and diabetes



Background:

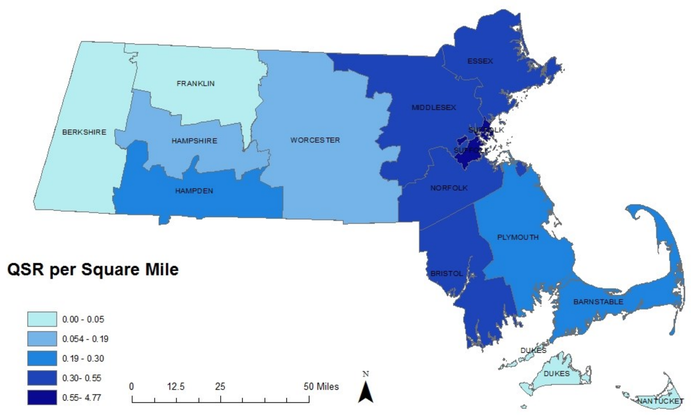
Diabetes rates have more than doubled since 1997, with a total of 29.1 million (9.3%) Americans living with diabetes in 2012.[1] Massachusetts has a diabetes rate of 8.8%, falling near on the upper end of the spectrum with regards to other states; West Virginia has the highest rate at 12%.[1] As rates continue to rise public health professionals are researching lifestyle and environmental risk-factors for the disease. The food environment is one example.

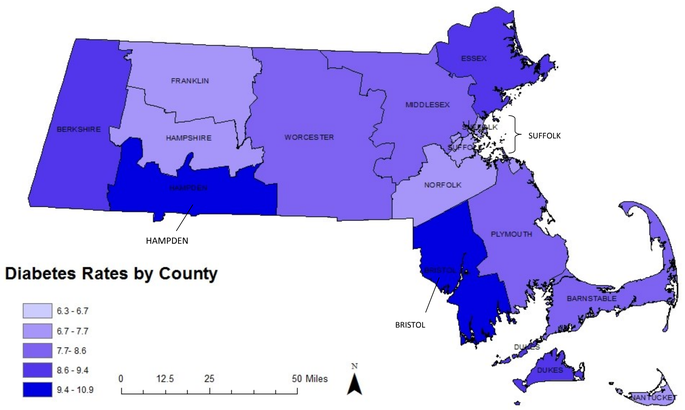
Limited (or quick) service restaurants (QSR) are defined by the US Census Bureau as, establishments primarily engaged in providing food services where patrons generally order or select items and pay before eating. Food served at QSRs tend to be high in calories, fat and sugar. In adults, eating at QSRs is associated with higher BMI, weight gain and insulin resistance which are all risk factors for diabetes.[2] For youth, eating at QSR is associated with a higher intake of fat, total calories and sugar sweetened beverages, and a decrease intake of fruits and vegetables.[2]

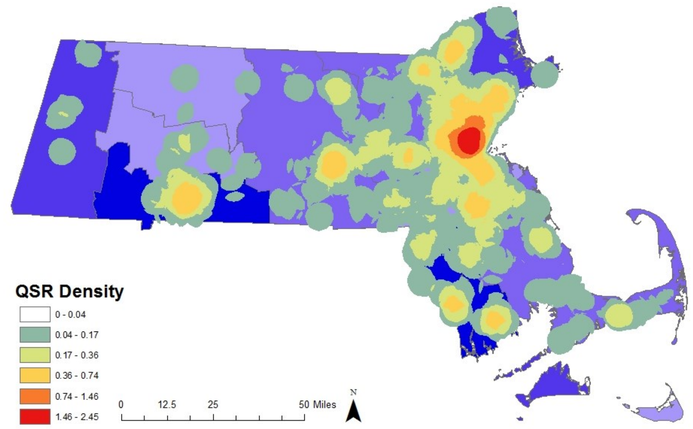
The goal of this spatial analysis is to look at the geographic layout of QSRs and full service grocery with relation to income and diabetes rates. Identification of problem areas in Massachusetts will inform public health and policy decisions.

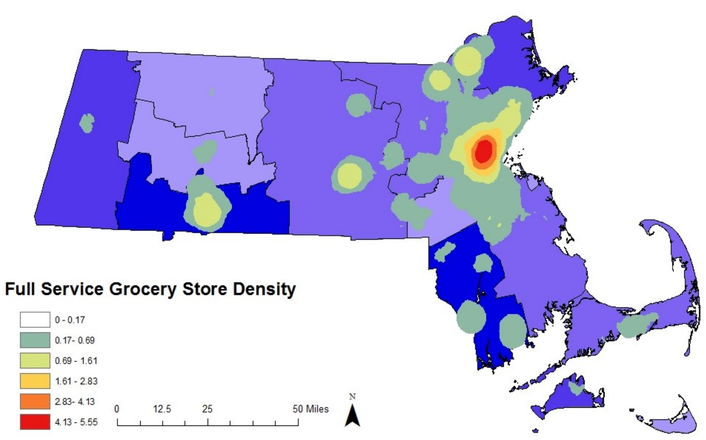
Methods:

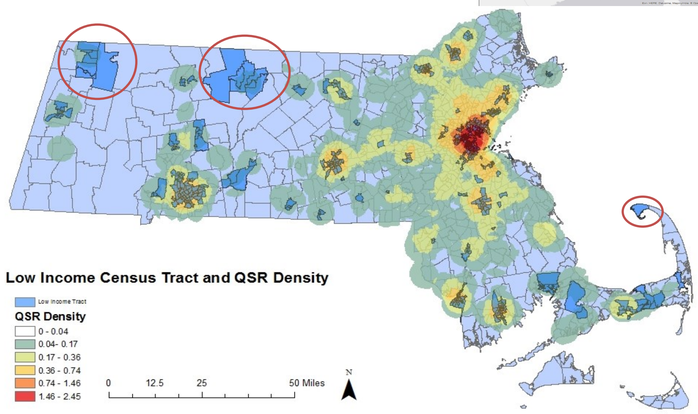
Maps were created with ArcGIS 10.3.1, using data from USDA Food Access Research Atlas (2010), USDA Food Environment Atlas (2011), MassGIS and Reference USA. Data was joined (using spatial and table data) to shapefiles containing Massachusetts counties and census tracts. Diabetes rates and low-income census tracts, are shown using a choropleth map to show rates, while other variables (QSR and Grocery Stores) are represented by use of the point density tool. To calculate QSR per square mile the field calculation tool was used. QSR chains were chosen based on QSR Magazine's listing of the top ten grossing companies (McDonalds, Subway, Burger King, Wendy's, Taco Bell, Dunkin Donuts, and Chick-fil-A). Starbucks and Panera were left out of this analysis because of their tendency to serve healthy food.











Low Income census tracts are defined based on the Department of Treasury's New Markets Tax Credit Program criteria

Results:

The highest rates of diabetes occur in Hampden county, 10.3%, and Bristol county, 10.9%. Hampden County has one large cluster of QSRs in the Springfield area, while Bristol County has several areas of high QSR densities. When compared to grocery store density, the same cluster exists in Hampden county, leaving the rest of the county with low access to full service grocery stores. Large parts of Bristol County also have low access to grocery stores, with the exception of two main cities in the southern end of the county, New Bedford and Fall River. Suffolk county, encompassing the Boston metro area, has a diabetes rate 7.7% and the highest concentration of QSR in the state.

Bristol County has 10.5% of the total QSRs in the state, and almost 1 QSR every 2 square miles. Hampden county has 7% of QSRs in the state and 1 QSR every 4 square miles. Middle Sex county has the largest percentage of QSR in the state at 18%, with 1 QSR every 2 square miles.

This analysis shows QSRs and Grocery Stores are clustered in metropolitan areas of Massachusetts and have high concentrations in low income census tracts. Though, the maps show that in some low income areas there is a low concentration of both QSRs and grocery stores. Further analysis should be done to examine the food environment in these areas.

Discussion:

The thematic associations shown here demonstrate that there are counties within Massachusetts with high rates of diabetes and high concentrations of QSRs. The common clustering of grocery stores and QSRs around metropolitan areas warrant further research to tease out other environmental factors impacting diabetes. This analysis was limited by the availability of county level diabetes rates. Data at a more granular geographic level will better inform policy and public health officials to target hotspot areas. A more thorough analysis would incorporate other potential risk factors for diabetes, like convenience stores, distance from common public areas (schools, community centers, etc.), access to open space and food access measures. A strength of this analysis is the addition it makes to the body of literature of how the food environment relates to diabetes. Much research has focused on obesity, as diabetes rates increase it is important to also focus on this chronic disease.

The Boston metro area is an outlier and should not be the focus of the hot spot cluster. The area of Boston is small with a large population which can skew results. More granular data is necessary to fully understand the spatial relationship of diabetes and QSR density in the Boston metro area.

Sources:

[1] Center for Disease Control and Prevention. Diagnosed Diabetes. Retrieved from: http://gis.cdc.gov/grasp/diabetes/DiabetesAtlas.html

[2] Austin, S. B., Melly, S. J., Sanchez, B. N., Patel, A., Buka, S., & Gortmaker, S. L. (2005). Clustering of fast-food restaurants around schools: a novel application of spatial statistics to the study of food environments. *American Journal of Public Health*, *95*(9), 1575-1581.

Other: USDA Food Access Research Atlas, USDA Food Environment Atlas, MassGIS, Reference USA.

Cartographer: Carolyn Panzarella
Created for: MPH262, Dr. Thomas Stopka
5/6/16

Tufts University | School of Medicine