**OLDER IS COLDER!**

**Critical Areas for Medicare Beneficiaries in Massachusetts**

**Introduction**

Massachusetts has a humid continental climate, with warm summers and very cold, snowy winters. Average annual temperatures for most parts of state is classified as cold (below 10°C). Areas like Boston and Cambridge are the beginning of a transition to oceanic climates, which has slightly warmer winters so their average annual temperatures are classified as cool (10°C-14°C) or warm (above 14°C).

It has been shown the morbidity and mortality from cardiovascular and respiratory disease in the elderly is strongly associated with cold weather and it can vary spatially. The older people have lower body temperature and their body doesn’t show diurnal temperature rise.

The danger of exposure to cold is high, and even with a mild drop in ambient temperature, there is already a risk of reduced body temperature. The danger presented by the cold to older adults is elevated due to a combination of physical and behavioral factors. The elderly with poor nutrition and less proper heating facilities are more vulnerable to the cold.

In this project, I am using sets of spatial data to identify the critical areas for elderly people in which the mortality rate from all-cause, cardiovascular and respiratory disease is high for them, the weather is cold and they belong to lower socioeconomic status class.

**Methodology**

The spatial unit of analysis in this project is zipcode. I collected the mortality data from Center for Medicare and Medicare Service, the temperature data from National Oceanic and Atmospheric Administration and the Median income data (as a proxy measure for physical and behavioral factors) from U.S. Census Bureau as the important spatial factors for each zipcode. These data were added to Massachusetts's zipcode polygon shape file using spatial joints and converted to raster by “polygon to raster” conversion tool.

Then I reclassify each raster as follows:

- Temperature was reclassified to Cold (below 10°C), Cool (10°C-14°C) and Warm (above 14°C).
- Mortality rate was reclassified to Low (below 10%), Medium (10-25%) and High (above 25%).
- Cardiovascular mortality rate was reclassified to Low (below 1%), Medium (1-2%) and High (above 25%) and Respiratory mortality rate was reclassified to Low (below 0.3%), Medium (0.3-0.7%) and High (above 0.7%).
- Median household Income was reclassified to Lower (below 25k%), Middle (25k-39k%) and Upper (above 39k%) class.

At the end I used the “raster calculation” tool to identify the critical zipcodes. In order to classify the zipcodes, their criticalness has been calculated based on mortality rate, temperature range and income class. The highest critical areas are the one with poor status in all three factors. At the other end of the spectrum we have the lowest critical area with appropriate status for all three factors.

**Results**

As the Temperature map shows the western part of Massachusetts is classified as cold and its average annual temperature is below 10°C. But from Boston and Cambridge the transition to oceanic climates starts. This climate has slightly warmer winters and as we can see in the map the average annual temperature is classified as cool (10-14) or warm (above 14 centigrade).

The Income map tells us the most of the Massachusetts neighborhoods are classified as middle class income group. The upper class are mostly concentrated in Boston great area and the lower class are mostly in Western part of the state.

The Mortality maps show that the mortality rate from all-cause and cardiovascular and respiratory disease is Medium or High for most of the areas in Massachusetts. The most critical areas (red color) have the worst value for mortality rate, temperature and income class and the least critical areas (light yellow color) have an acceptable level of all these. As the maps show for both all-cause and specific causes (cardiovascular and respiratory), the majority of zipcodes in Massachusetts have critical status. The eastern part of the Massachusetts is benefiting from warm oceanic climate but the western part is very cold. Temperature is out of our control and we can not change it. Changing the income class also seems undosable but providing an appropriate level of health care services to elderly people in the critical areas can be an effective solution to this problem.

**References**