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GEOG 461: Section AB

Assignment #3:

Accessibility Measures and Network Analysis

Purpose:

The purpose of this assignment was to model accessibility to mammography facilities for women in the age group of 40-74 years residing in towns located in New London County, Connecticut. This analysis is based on three components: the women's origins based on centroid locations of New London towns, the destination of the 9 New London mammography facilities, and the distance to the mammography facilities determined by an origin-destination (OD) cost matrix created using the Network Analysis extension in the ArcMap GIS setting.

Methodology:

The first step in this assignment was to add the required shapefiles and databases into our ArcMap GIS setting. For this assignment, we added three data sources: the database of towns (towns.shp), the database of town centroids (origin.shp), and the database of mammography facilities (facilities.shp) in New London. Opening the attribute tables for each added layer will give us additional information to perform our analysis. In particular, we are interested in two fields: FEM4074 in the origin.shp, which gives us the 2010 population of women aged 40-74 years (2010 Census Bureau Fact Finder), and ESTCAPAC in the facilities.shp, which gives us the estimated capacity of each mammography facility.

We then symbolized and classified both the origin and facility data layers with graduated symbols. The origin layer was symbolized based on the FEM4074 field, and the facility layer was symbolized based on the ESTCAPAC field. Both were classified using the Natural Breaks method, and into 3 classes each. Afterwards, we also brought in a data layer of the street network in New London (tl_2010_09011_streets_Projected_ND.nd).

To create an OD cost matrix, we utilized the Network Analyst toolbar extension in ArcMap, and based it on the street network database layer. Loading the origins and destination datasets into the extension updates the OD cost matrix to include the 21 origin centroids and 9 mammography destinations in New London. Clicking the “Solve” button on the toolbar will update the Lines entry to 189 Lines, representing all the possible routes between each origin and each destination. Exploring the Total_LENGTHFT field in the Lines layer’s attribute table under the OD cost matrix will give us the travel distance between each origin and centroid in feet. Finally, we exported the Lines layer into its own separate shapefile, and added it into our Table of Contents.

In this exercise, modelling accessibility was based on the ratio of attractiveness to distance from each origin to each destination is summed over all destinations for a given origin. Attractiveness was determined by the ESTCAP of each facility. To do so, we joined the Facilities layer with the Lines layer so that we have access to the ESTCAP of each facility. Afterwards, we created a new field in the Lines attribute table titled “ACCESS”, which will be used to later to model accessibility. The field was populated with values in miles units after entering the equation [facility.ESTCAPAC]/(([Lines.Total_LENG]/5280)^2) into the field calculator for the ACCESS field. Finally, we summed the new values in the “ACCESS” field using the “Summarize” tool in ArcMap, outputting a “Sum_Output” database table giving each origin a measure of potential accessibility measure. Looking back on the methodology, another measure that we could have used to measure the attractiveness of the facility was to use average ratings of the facility instead. When it comes to health care and access, people tend to prefer facilities and resources that will provide them the highest quality of health care, even deciding that driving further and into a new town is worth the accumulated distance cost. However, I also do not disagree with the use of estimated facility capacity as a determinant of facility attractiveness either, as patients are also more likely to find a facility attractive if they are able to receive care from a professional as soon as possible.

To map the potential accessibility measure, we joined the “Sum_Output” database table to the Towns layer, and classified the data into Quantiles, using the Graduated colors scheme. We broke the data into 5 classes to map the potential accessibility measure, and chose an appropriate color ramp. For our final map presentation, I chose to include data of both the mammography destinations, as well as the town centroid locations. Mammography facilities data also includes classification data based on estimated capacity, while the town centroids also includes classification data based on population of women aged 40 – 74. I included these two data sources in my final presentation as I believe them to be informal and useful in creating observations and possible explanations.

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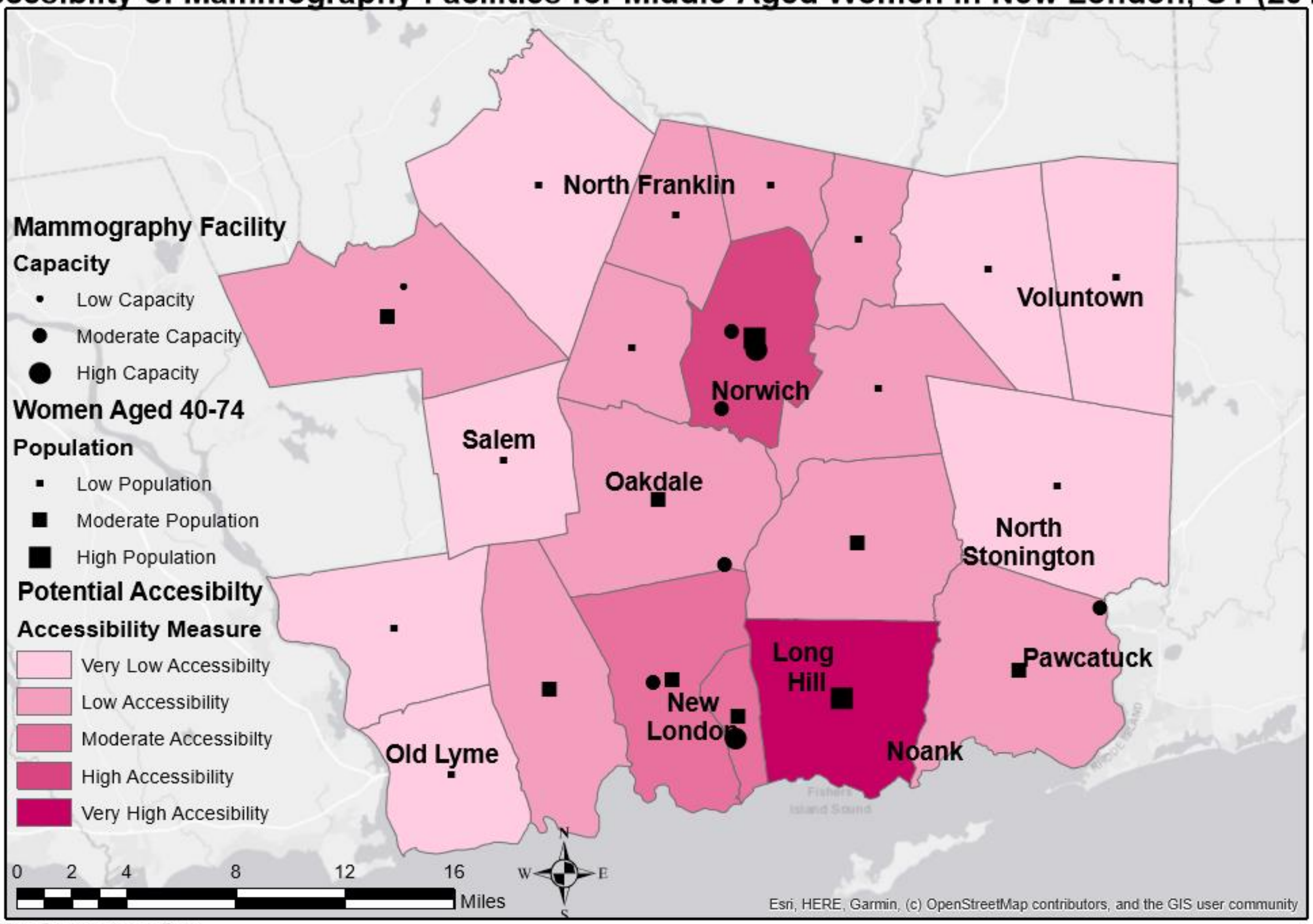
Map:

Accesibilty of Mammography Facilities for Middle-Aged Women in New London, CT (2010)



Map Creator: Jason Park
Creation Date: February 3rd, 2020

Projection: Lambert Conformal Conic
Data Date: 2010 U.S. Census Bureau
Source: U.S. Census Bureau TIGER database, U.S. Food and Drug Adminstration

Substantive Results: Explanation + Interpretation:

Based on the map produced, there were several observations that could be made. First, I concluded that towns that contain, or are within close proximity to, a mammography facility tend to have the greatest degree of potential accessibility to facilities, and are clustered around the southern regions of New London, CT, such as near Long Hill and Noak. I would consider these locations to have an abundance of access to healthcare, and are highly served communities. This observation is logical, as women residing in or near towns close to a mammography facility have less distance to cover, and as a result, have less barriers to healthcare access than do women who reside in towns where distance to a mammography facility is greater.

The second observation that I concluded was that the geographical location of the mammography facilities tended to be clustered towards the southern towns of New London, Connecticut, where the population of women between the ages of 40-74 who need an annual mammography test are generally higher. While it makes sense that mammograph facilities would be clustered towards towns with larger population of women aged 40-74, it also creates an inequality of access to healthcare facilities for women residing in the northern towns of New London, CT. As a result, northern towns, such as Voluntown, tend to be underserved while southern towns, such as Long Hill, tend to have the best access to healthcare facilities.

Based on these observations, if I were acting as a regional health manager in New London, CT., I would recommend the creation of new facilities especially in the North-eastern parts of New London to remove inequalities of access in all towns in the county. If this recommendation is not possible, I would also suggest implementation of more mobile healthcare facilities, or perhaps facilities specializing/focused on mammography examinations, to be created and located in the towns with very low potential accessibility to mammography facilities in New London, Connecticut. Specifically, I would focus on implementing this strategy in towns furthest away from the central/southern region of New London, where mammography facilities are more frequently located. Examples of such towns I would focus on include: North Franklin, Voluntown, and Old Lyme, as these cities tend to be the furthest removed from the nearest mammography facility. Removing a barrier to a key determinant of social health will result in more health equity in New London, Connecticut.