Hospital Distribution, Financial Stability, and Health Outcomes in Michigan Counties
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GEO 425

I investigated how the distribution of hospitals in Michigan counties is related to different demographic factors surrounding the wealth of a county and the overall health outcomes of the county. My overall research question was: does a higher density of hospitals in Michigan counties result in higher life expectancies and lower hospital stays and do those relationships correlate with wealthier counties? I used hot spot analysis to identify any areas that are more wealthy, have higher life expectancies, or have a greater proportion of hospitals to people than the surrounding areas. I found that there were observable relations between the spread of hospitals and health outcomes and demographics, but some of the results challenged my hypothesis.

Starting with demographics, I focused primarily on the financial stability of a county rather than factors like race because I was interested in if a county could afford more hospitals, if that would influence the number of medical facilities the county had access to. My expectations based on visual analysis of income and the distribution of hospitals was that higher income counties did have more hospitals within them and hot spot analysis confirmed this. Southeast Michigan had a cluster of hot spots that had a 99% confidence level. These hot spots indicate counties with high income are likely to be surrounded by other counties with high income, and the confidence level shows that this is not a random relationship and can be attributed to an actual spatial relationship. This large cluster of hot spots is also the area with the greatest number of hospitals in the state. Comparatively, northern Michigan had a cluster of cold spots with a 99% confidence level, and in this area were the smallest number of hospitals, with several of the counties with cold spots having zero hospitals within them. I also included a variable displaying the percentage of the county that fell below the poverty line. There was one cluster of hot spots with 99% confidence towards northern Michigan, in an area with very few hospitals. Other than that one cluster, there were a few cold spots but only with 90-95% confidence levels, so the relationships were slightly less strong. Based on the hot spot analysis of income and poverty levels, hospital distribution seemed to be higher in places that were wealthier and had fewer people in poverty.

The other factor I looked at was health outcomes of each county. I focused on life expectancy and the number of preventable hospital stays at the county level. After running hot spot analysis, I got results I was not expecting. There was only one life expectancy cold spot in the same area as the cold spot for poverty percentage with 99% confidence level. This area does have a very low number of hospitals, but beyond that, there were no other clusters indicating a relationship between hospital distribution and life expectancy. The amount of preventable hospital stays had the most surprising hot spot results. There were clusters of cold spots in the Upper Peninsula indicating a lower number of preventable hospital stays. There is a large cluster of hot spots in southeast Michigan especially around metro Detroit. These results are opposite of my prediction that more hospitals would result in less preventable hospital visits. However, these results make more sense when you look at the number of hospitals per person in the county rather than just the overall number of hospitals. While southeast Michigan has the

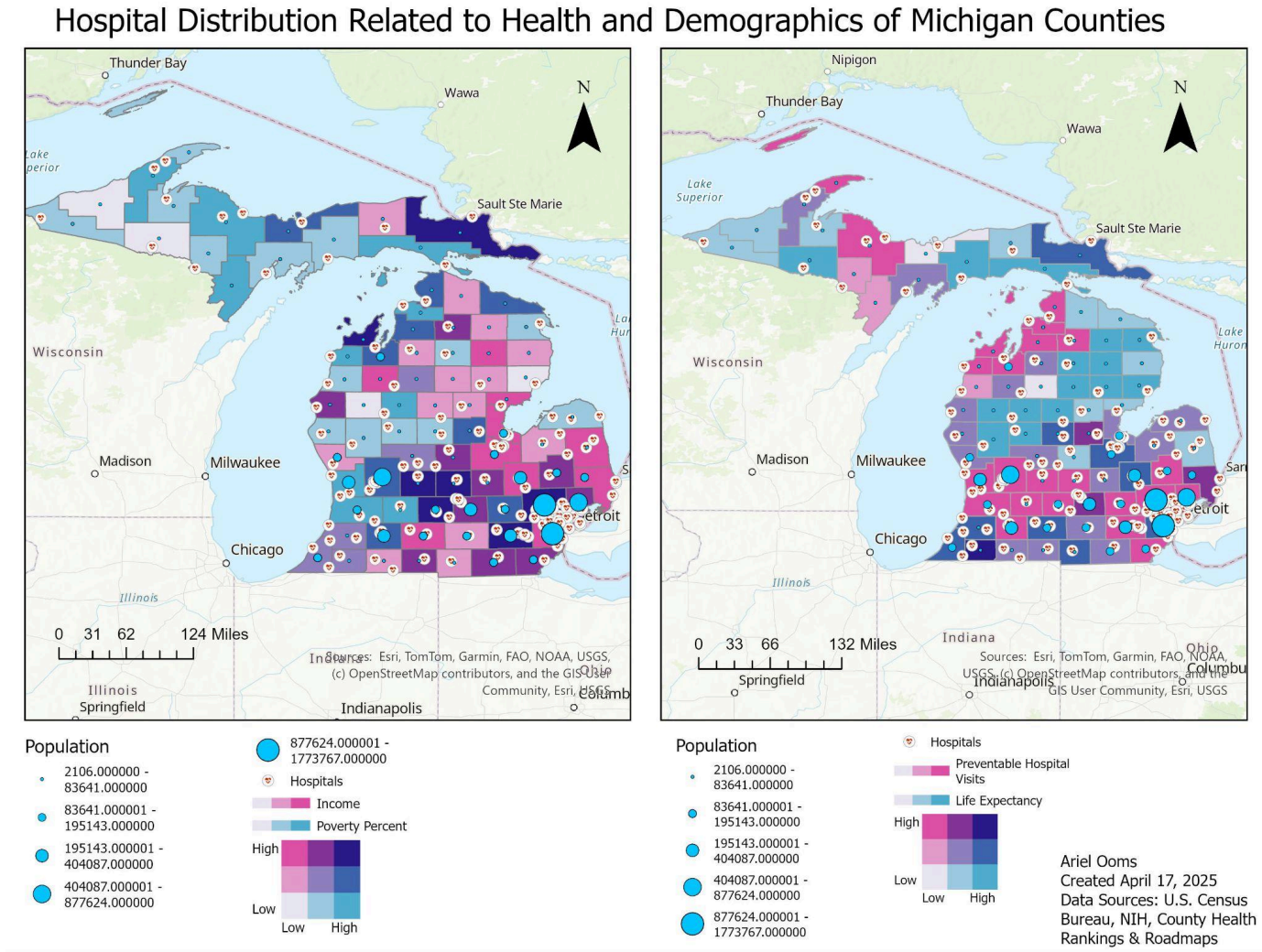
highest number of hospitals, its population is also the largest, and the number of hospitals per person is much lower than it is in the Upper Peninsula.

My results indicate a relationship between the financial wellness of a county and the number of medical facilities it contains. Well-off counties with very low poverty are able to afford more hospitals in their counties. Health outcomes are less related to the number of hospitals in a county. Counties with the highest number of hospitals also have the highest population and the highest number of preventable hospital stays. This can be tied to the distribution of hospitals per person in each county. Highly populated areas, even with lots of hospitals, cannot care for everyone that is sick. Less densely populated areas, even with just a few spread out hospitals, are more able to take care of everyone in the county.

Analysis Steps:

1. Gather and download data: county boundaries of Michigan, hospitals in Michigan, county level data on poverty, income, life expectancy, preventable hospital stays, and population.
2. Join Field: join standalone tables for income, poverty, life expectancy, hospital stays, and population by county name to the county boundaries table.
3. Select only hospitals: Using select by attribute, only select hospitals because I am only interested in hospitals for this analysis, not other types of medical facilities like nursing homes or psychological facilities.
4. Calculate Hospital Distribution Field: divide the number of hospitals in a county by the population for the number of hospitals per person in each county.
5. Visual Analysis: symbolize each variable using graduated symbols to visually identify areas with lower values and higher values to search for any obvious patterns.
6. Hot Spot Analysis (Getis-Ord Gi*): Run hot spot analysis on each variable (income, life expectancy, percent poverty, preventable hospital stays) and evaluate clusters of hot or cold spots and their associated confidence levels.
7. Symbolize for final map: use bivariate symbology to display income and poverty on the same map. Use bivariate symbology to display life expectancy and preventable hospital stays on the same map. Use dot density to show population for each county. Include hospitals as points.
8. Create the final layout: Add a legend, title, North arrow, scale, and both maps.

Final Map


Hospital Distribution Related to Health and Demographics of Michigan Counties
Thunder Bay
Wawa
Sault Ste Marie
Wisconsin
Madison
Milwaukee
Chicago
Illinois
Springfield
Indianapolis
0 31 62 124 Miles
N
Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community, Esri, USGS
Population
2106.000000 - 83641.000000
83641.000001 - 195143.000000
195143.000001 - 404087.000000
404087.000001 - 877624.000000
877624.000001 - 1773767.000000
Hospitals
Income
Poverty Percent
High
Low
Low High
Nipigon
Lake Superior
Lake Huron
Indiana
Ohio
0 33 66 132 Miles
Preventable Hospital Visits
Life Expectancy
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Data Sources: U.S. Census Bureau, NIH, County Health Rankings & Roadmaps