Examining Spatial Correlation of Clean-Energy Power Plants and Lung Cancer Incidence in New Jersey, 2019

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Background

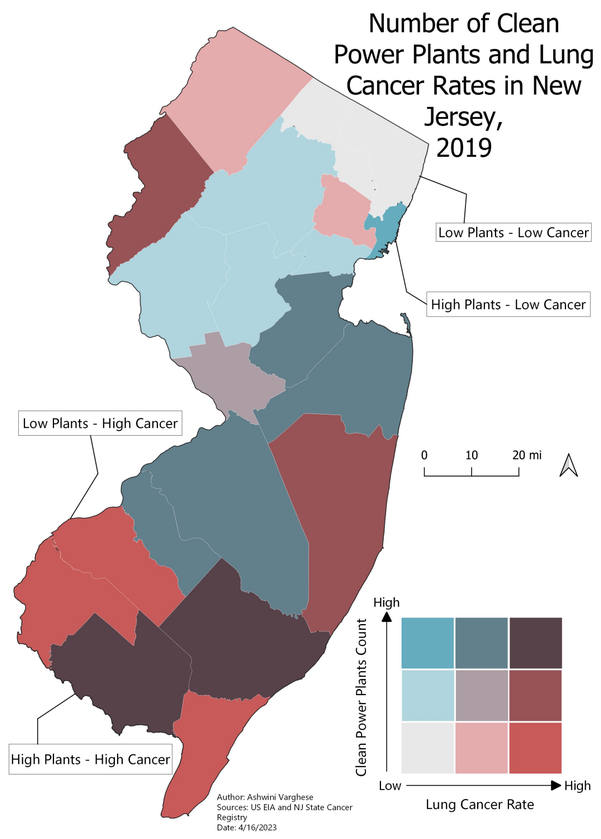
- Research has found significant associations between increasing solar energy and decreasing cancer incidence.[1]
- Solar power has not been linked to causing cancer and has been thought to indirectly decrease the risk of lung cancer by replacing traditional power sources that can emit particles and pollutants that cause lung cancer.[2]
- Lung cancer is the second most common cancer in the US.[3]
- New Jersey is ranked third in the US for generation of electricity from small scale solar power systems.[4]
- This project will examine for spatial correlation between lung cancer incidence and the number of renewable ("clean") energy power plants in New Jersey.

Methods

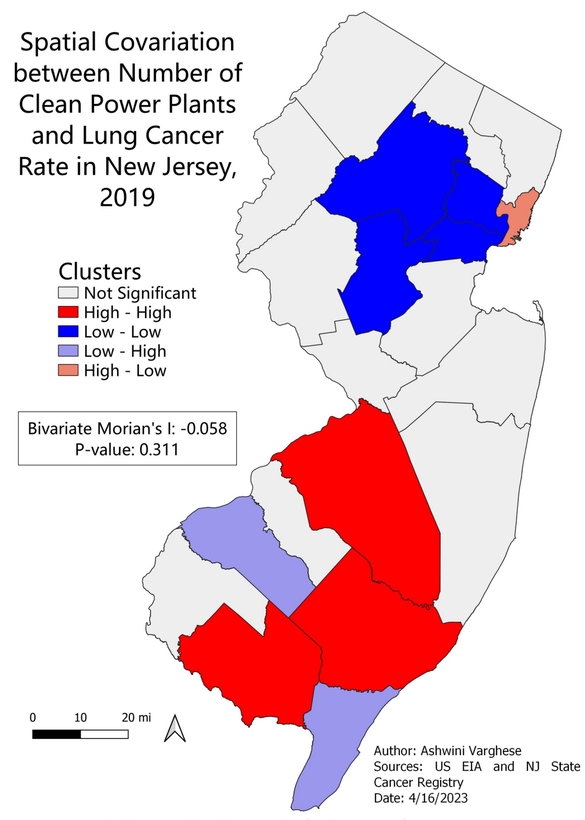
I. Exploratory data analysis (EDA) was conducted to visually examine for changes in lung cancer incidence and number of clean-energy power plants from 2015 to 2019, separately.
II. A bivariate map and a scatterplot was constructed to visually examine the correlation of the two variables in space.
III. A Bivariate Moran's I was constructed to find if there is spatial correlation between the two variables.

Data Sources include:
- US EIA for data on clean-energy power plants
- NJ State Cancer Registry for cancer data
- US Census site for the NJ cartographic boundary file

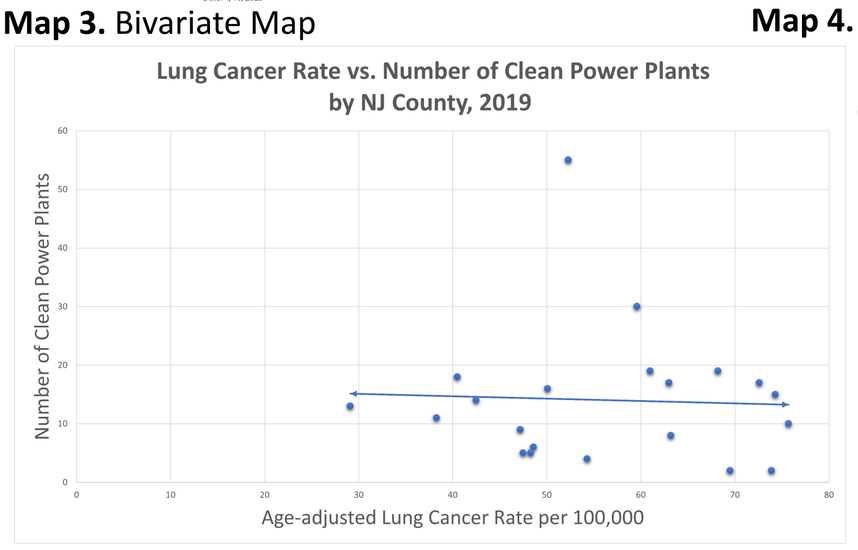
Software used:
- QGIS 3.22 LTR – creation of all maps
- GeoDa 1.20 – Bivariate Moran's I
- Microsoft Excel – data cleaning and processing



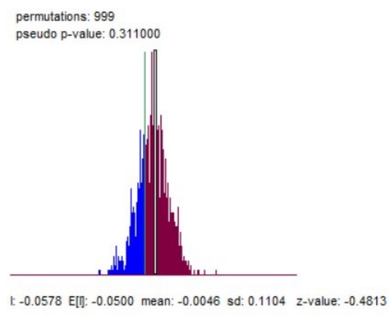
Map 3. Bivariate Map



Map 4. Spatial Correlation



Graph 1. Scatterplot of Lung Cancer Rate and Power Plants

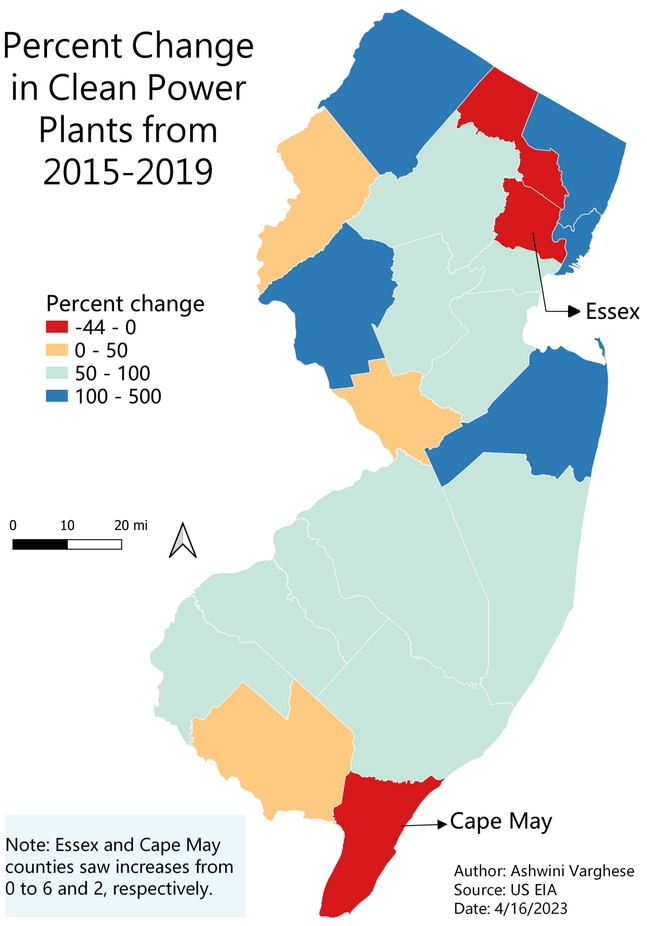


Graph 2. Randomization results

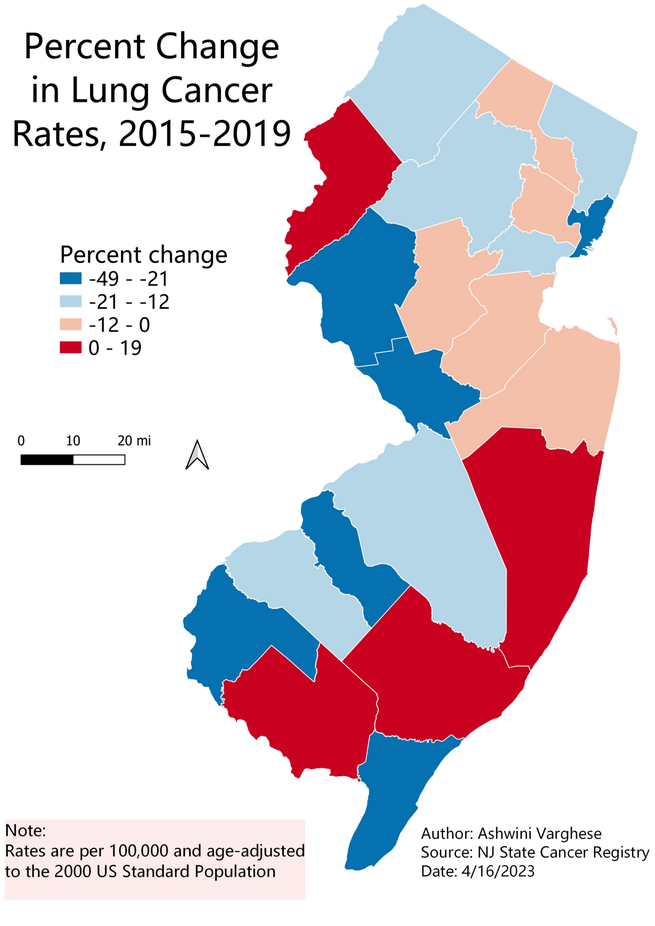
Results

- EDA found that from 2015 to 2019, all but one county have seen an increase in clean energy power plants and all but 4 counties have seen a decrease in lung cancer incidence.
- Bivariate mapping and a scatter plot show a slight, inverse linear relationship between the two variables of interest.
- Upon spatial covariation analysis using Bivariate Moran's I, we get a Moran's I value of -0.058 and a p-value of 0.311.

Map 1. Percent Change of Clean Power Plants



Map 2. Percent Change of Lung Cancer



Conclusions

- Visually, there seems to be an appreciable increase in clean-energy power plants and decrease in age-adjusted lung cancer incidence by county from 2015 to 2019.
- When mapped together, there seems to be a slight inverse relationship where counties with higher lung cancer incidence are associated with lower numbers of clean-energy power plants.
- A Bivariate Moran's I of -0.058 does indicate a negative spatial correlation, however, a p-value of 0.311, which is greater than 0.05, indicates that there is no statistically significant spatial correlation.
- **Limitations:** For a state like New Jersey with only 21 counties, the data may not have been large enough to confidently detect spatial correlation
- **Next Steps:** Consider a regression model with covariates such as race, co-morbidities, income, etc.

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References

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3. *Lung cancer statistics: How common is lung cancer?* Lung Cancer Statistics | How Common is Lung Cancer? (2023, January 12). Retrieved April 16, 2023, from https://www.cancer.org/cancer/lung-cancer/about/key-statistics.html
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