Contamination and Cancer:
A Spatial Analysis of the Relationship Between Superfund Sites and Cancer Incidence

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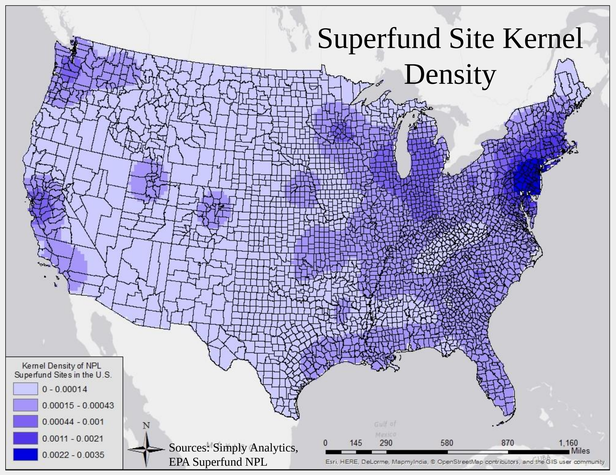
Introduction:

Research shows **that "environmental contaminants will cause cancer."[1]** Superfund sites are lots of land contaminated by hazardous waste that pose a threat to humans and/or the environment. Small scale case studies near specific superfund sites in Pennsylvania and Kansas have shown higher levels of cancer incidence in their surrounding areas[2,3]. This research seeks to answer the following questions: **Is there a regional correlation between counties with higher rates of cancer incidence and counties with more superfund sites? Who is at the highest risk of living near a superfund site?**



Region	Northeast	Southeast	Midwest	Southwest	West
# of Superfund sites	579	348	469	116	285
Density of Superfund sites (per mi^2)	0.0036	0.00060	0.00062	0.00020	0.00030

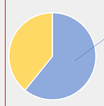
Sources: Simply Maps, EPA Superfund NPL

Fig.1+2: Superfund sites affect a large portion of the U.S. population, with the highest concentrations of Superfund sites located in densely populated regions of the Northeast.

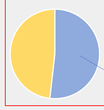
Study Area:

The Northeast region of the U.S. is home to the largest cluster of superfund sites. Its main Superfund cluster is located near large population centers, making it an important area to study.

Key Finding:



60.8% of counties with above average densities of superfund sites have above average cancer rates

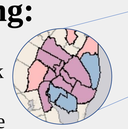


Only 51.8% of all counties have above average cancer rates

Methods and Results:

To best model the potential effects of superfund sites, I compare the raw count of superfunds per square mile by county to the cancer incidence per 100,000 by county. I use Moran's I to find clusters of counties with high superfund densities and high cancer rates. This map shows clusters of counties with high cancer rates and high Superfund density, which overlap significantly.

Key Finding:



People of color, specifically Black people, are the most likely to live within 0.5 miles of a superfund site in any of the 9 highest risk counties.

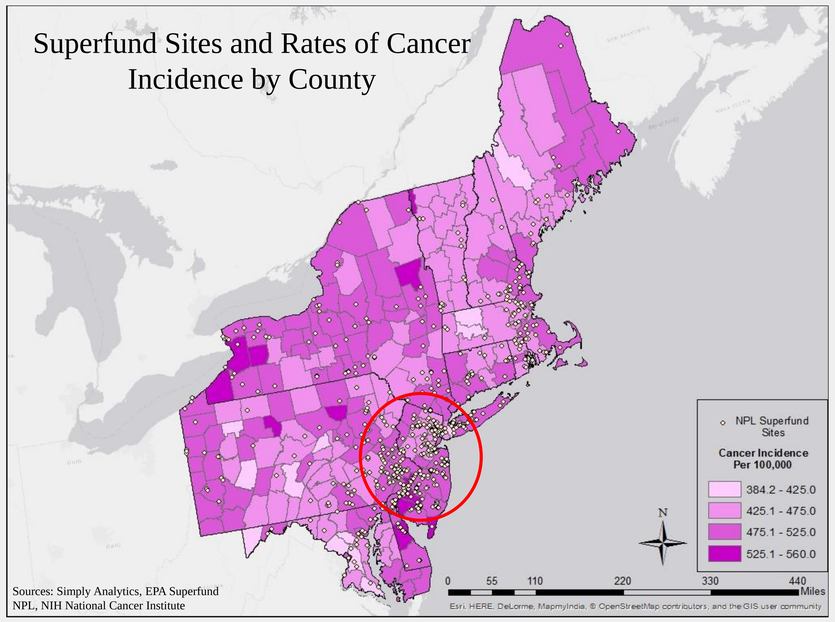


Fig. 3: The largest cluster of Superfund sites spans across parts of Pennsylvania, New Jersey, Delaware, and New York. Many of the counties in this cluster have above average cancer rates.

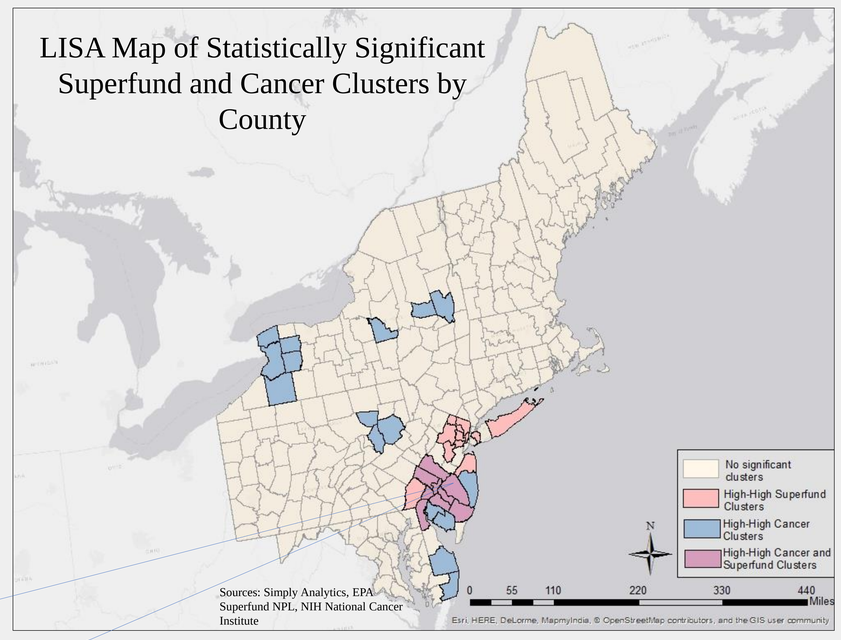


Fig. 4: There is a high degree of overlap between clusters of high cancer counties and clusters with of counties with high superfund densities.

Conclusions:

This analysis shows a significant spatial correlation between rates of cancer incidence and superfund density at the county level. **Counties with higher superfund densities generally have higher cancer rates.** It also shows that the risk of living nearest to these sites is unequal; **people of color are more likely to live near superfund sites.** These results are congruent with the existing literature on environmental hazards and cancer risk.

This study has some limitations. Methodologically, the results assume that counties are unaffected by their neighbors' superfund densities. Thus, these results likely underestimate the correlation between superfund density and cancer. In addition, county level data is too coarse; individual or block group level data could have made for more nuanced, accurate analysis of local effects of superfunds on cancer rates[4] and of who is at the highest risk of living near a superfund site, and likely would have resulted in stronger correlations in each case.

Data Sources:

- Simply Analytics (2017). U.S. Counties Data 2015 retrieved October 15, 2017 from Simply Analytics Database
- Simply Analytics (2017). U.S. Census Tracts with Race Data 2015 retrieved October 15, 2017 from Simply Analytics Database
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2. Budnick, L. D., Sokal, D. C., Falk, H., Logue, J. N., & Fox, J. M. (1984). Cancer and Birth Defects Near the Drake Superfund Site, Pennsylvania. *Archives of Environmental Health: An International Journal*, *39*(6), 409–413.
3. Neuberger, J. S., Mulhall, M., Pomatto, M. C., Sheverbush, J., & Hassanein, R. S. (1990). Health problems in Galena, Kansas: A heavy metal mining Superfund site. *Science of The Total Environment*, *94*(3), 261–272.
4. Maantay, J. (2007). Asthma and air pollution in the Bronx: Methodological and data considerations in using GIS for environmental justice and health research. *Health & Place*, *13*(1), 32–56.
5. Adeola, F. O. (1994). Environmental Hazards, Health, and Racial Inequity in Hazardous Waste Distribution. *Environment and Behavior*, *26*(1), 99–126.