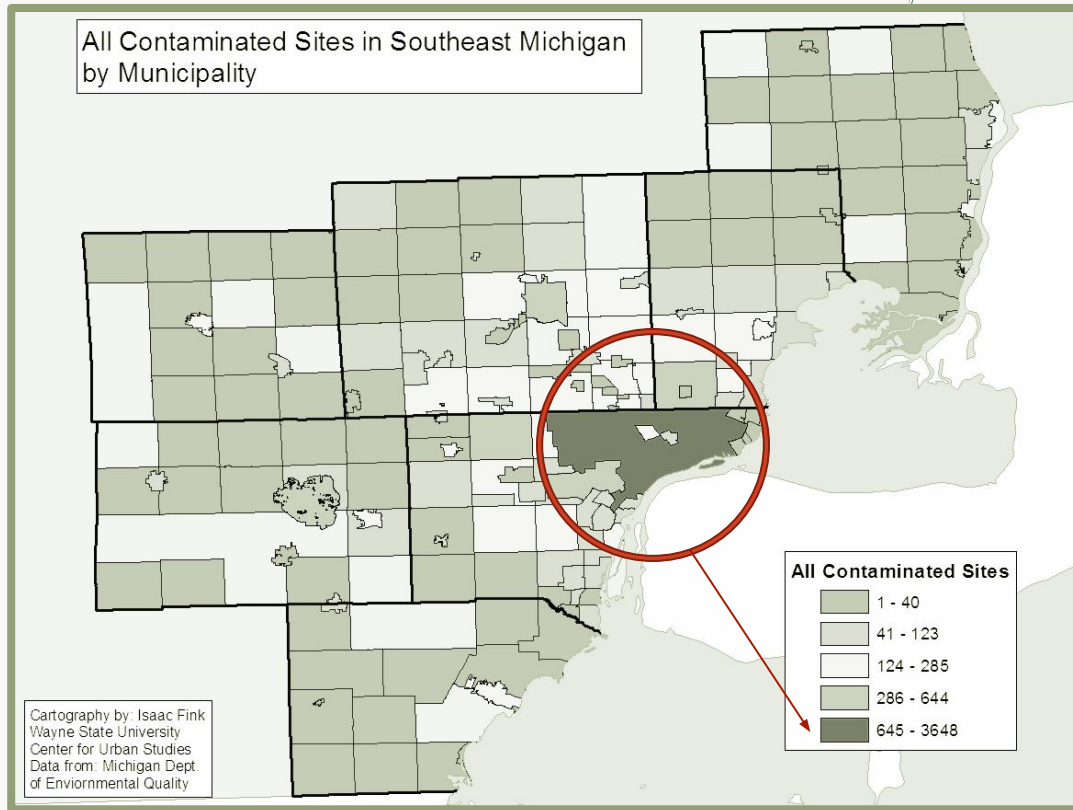# Disaster in Detroit?

Examining potential health risks for metro Detroiters as posed by Superfund sites

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All Contaminated Sites in Southeast Michigan by Municipality

All Contaminated Sites
- 1 - 40
- 41 - 123
- 124 - 285
- 286 - 644
- 645 - 3648

Cartography by: Isaac Fink
Wayne State University
Center for Urban Studies
Data from: Michigan Dept.
of Enviornmental Quality

01 What is a **Superfund Site?**

"Thousands of **contaminated sites** exist nationally due to **hazardous waste** being **dumped**, left **out in the open**, or otherwise **improperly managed**.

-epa.gov

These sites include:
- **manufacturing facilities**,
- **processing plants**,
- **landfills**
- and **mining sites**"

Quick History:

Overview of Superfund

via epa.gov

Late 1970s

Toxic waste dumps (Love Canal & Valley of the Drums) received national attention when public learned risks to human health & environment posed by contaminated sites.

December 11, 1980

In response, Congress established the **Comprehensive Environmental Response, Compensation and Liability Act** (**CERCLA**)

CERCLA = Superfund

Informally, **CERCLA called Superfund.**
- Allows EPA to clean contaminated sites.
- Also, forces parties responsible to perform cleanups or reimburse the government for EPA-led cleanup work.

Power of Superfund

When no responsible party for contamination, Superfund gives EPA the funds & authority to clean up contaminated sites.

Superfund's Goals:

Protect human health & environment by **clean up contaminated** sites

Involve communities in Superfund **process**
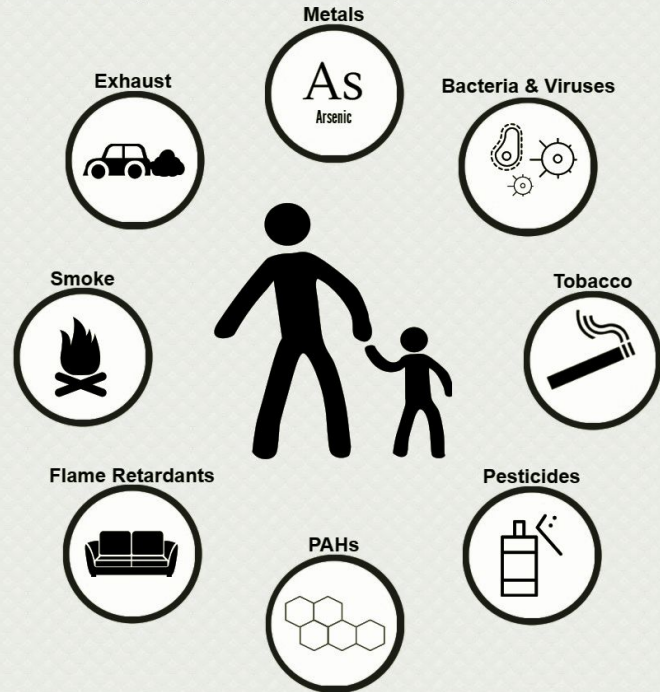
Make **responsible** parties **pay** for **cleanup** work

Return Superfund **sites** to **productive use**

via epa.gov

Environmental Exposures

Exposure Biology is challenged with detecting and measuring combined environmental exposures and figuring out the potential human health effects. Each person experiences these exposures every day.

Metals

As
Arsenic

Exhaust

Bacteria & Viruses

Smoke

Tobacco

Flame Retardants

PAHs

Pesticides

NIH
NIEHS

This infographic is adapted from the Exposure Biology Infographic produced by the National Institutes of Environmental Health Sciences. http://www.niehs.nih.gov/research/supported/exposure/bio/
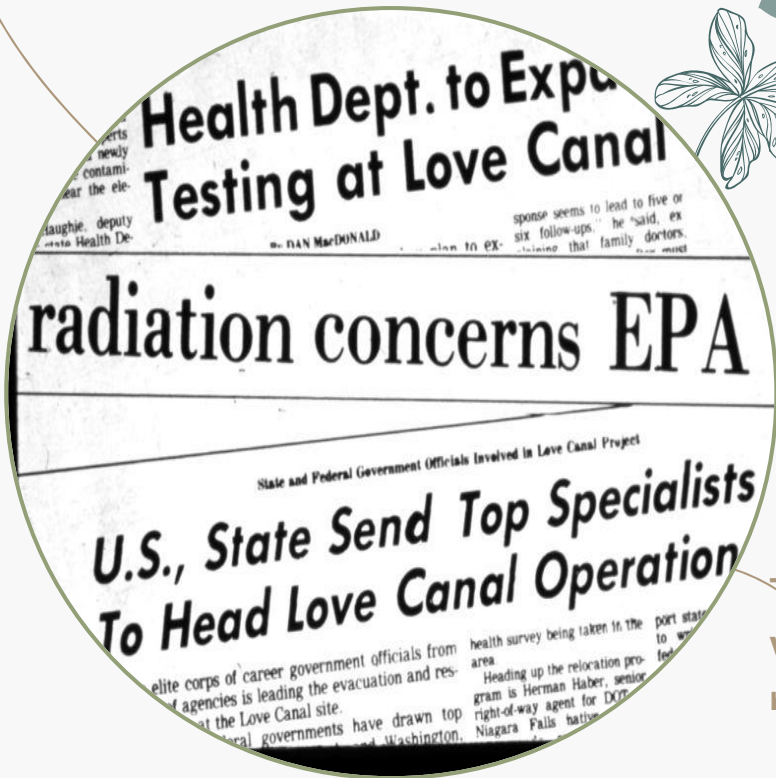
02 Project Purpose:

Investigate whether the presence of an above-average number of Superfund sites in the Metro Detroit area has a discernible impact on the health of the surrounding communities.

To explore this relationship comprehensively, we analyze and visualize key health indicators, including Asthma Hospitalization rates, Cancer Mortality data, and Air Quality Index measurements.

Through this data visualization project, we aim to contribute valuable insights, in hopes of fostering a data-driven understanding that may inform future actions and policy decisions.

Air Quality Visualization:

Air Quality Index(AQI)

- Color coded index to report Air Quality

- ↑ Greater the Value = ↑ Higher Health Concern

- Ranges 0 - 500 in six categories

- For example:
  - Below 50 : Good;
  - Above 300 : Hazardous

Air Quality Index: Visualization
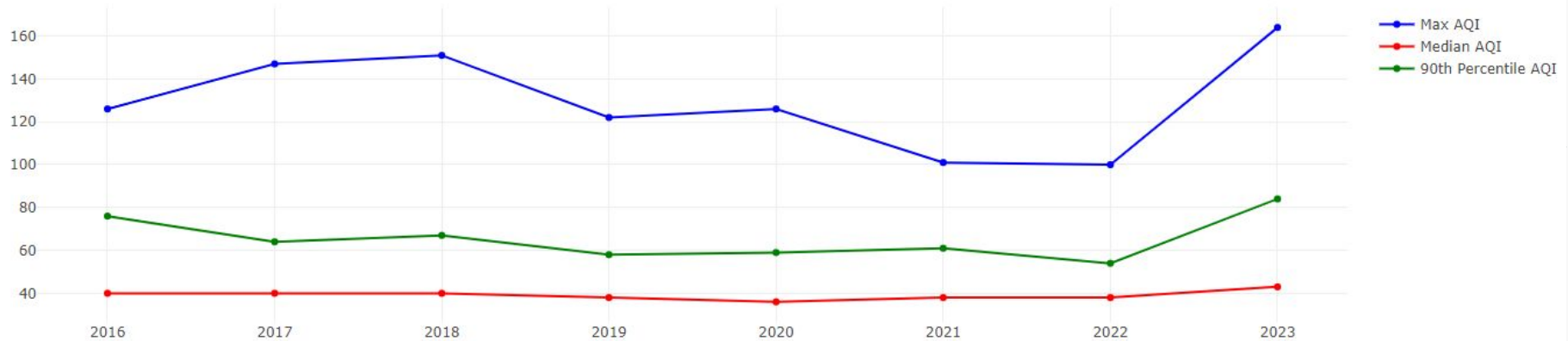
"Quality of days Based on AQI"

The **Grouped Bar chart** shows number of **days** with each **category of AQI** in Wayne, Oakland and Washtenaw counties.

- Chart created using Javascript libraries **D3** and **Chart.js.**
- The **dropdown box** allows user to select a county.
- The **legend color** used are standard AQI colors.

- The categories with zero count can be opted out using the legend.

Air Quality Index: Visualization & Analysis

- LIne chart depicts Maximum, Median and 90th percentile of AQI from years 2016 to 2023 in Wayne, Oakland And Washtenaw counties.

- **D3** and **Plotly** libraries are used in the line chart.
  - A **drop down Box** helps the user to see the chart for each counties.

- The recent worsening of air quality caused by fires and smoke in Canada
  - **(Department of Environment, Great Lakes and Energy(June 27, 2023)

Asthma Hospitalization Visualization:
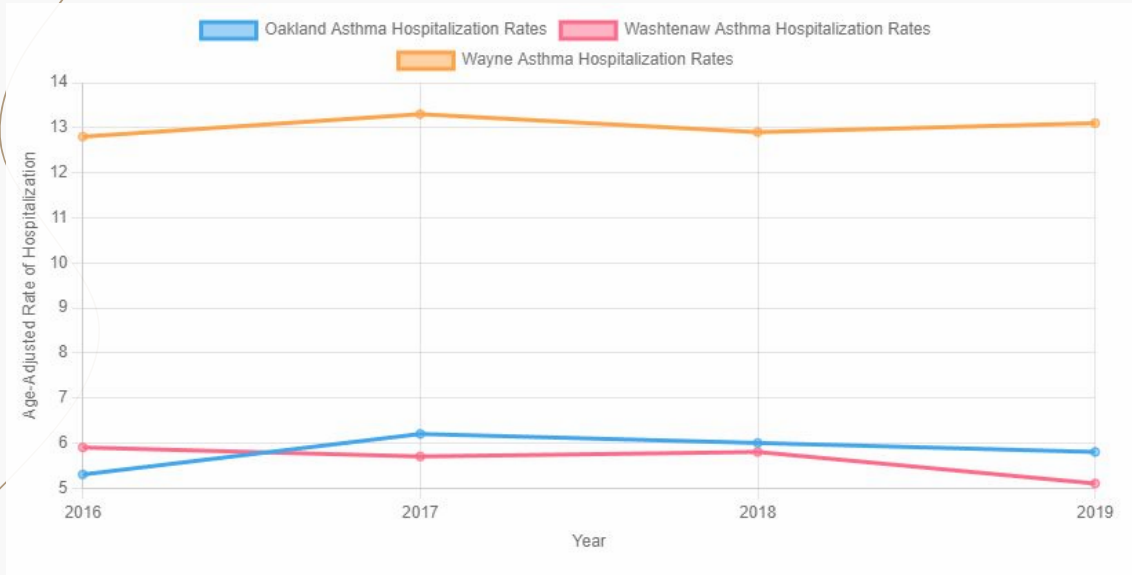## Analysis & Interpretation

Chart created to visualize the rates of asthma across three counties in metro Detroit.

Chart rendered using **Chart.js**, a new library, to visualize asthma rates.

Navigate to the top of legend & click on the county that you're not interested in seeing anymore. Corresponding graph will be removed from view.

From the chart, the values across all years **spike in Wayne county** in comparison to Oakland or Washtenaw county residents.

Additional analysis and information is needed to conclude whether spike in asthma cases are indeed from exposure to Superfund sites, or otherwise.
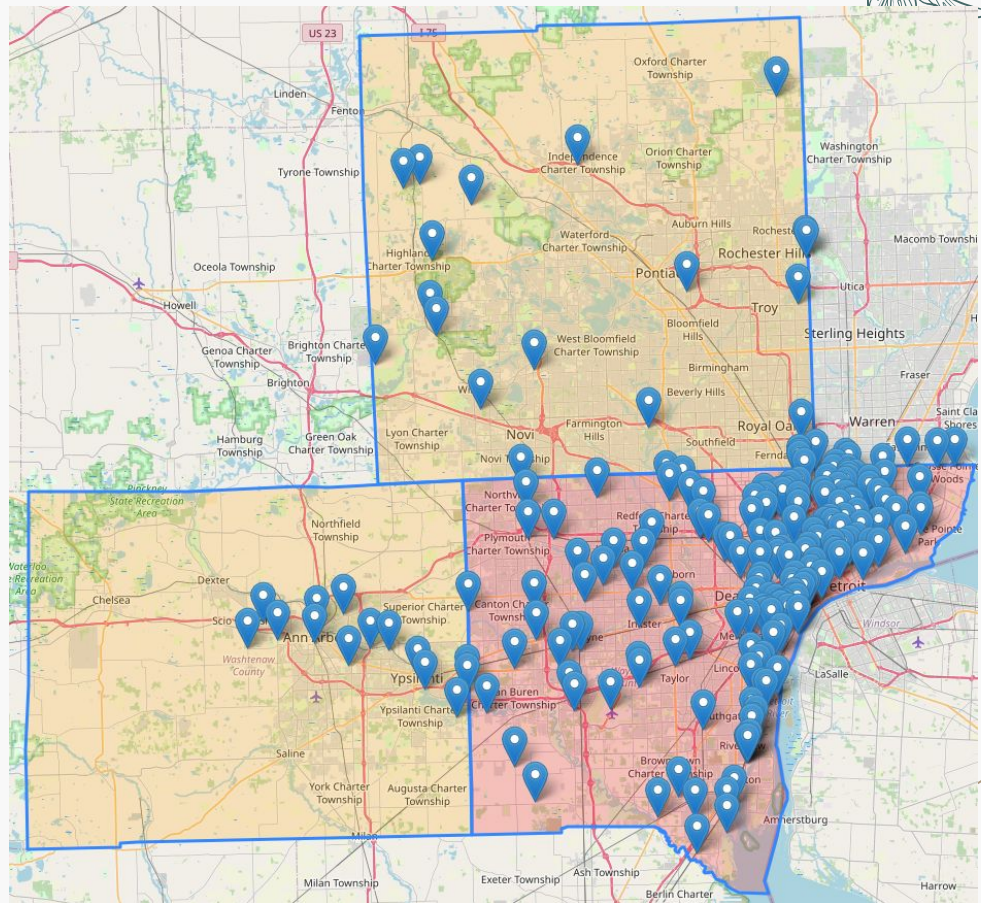
Asthma Hospitalization

Server created to visualize relationship, if any, between those **hospitalized for asthma** & any **proximity to a Superfund site.**
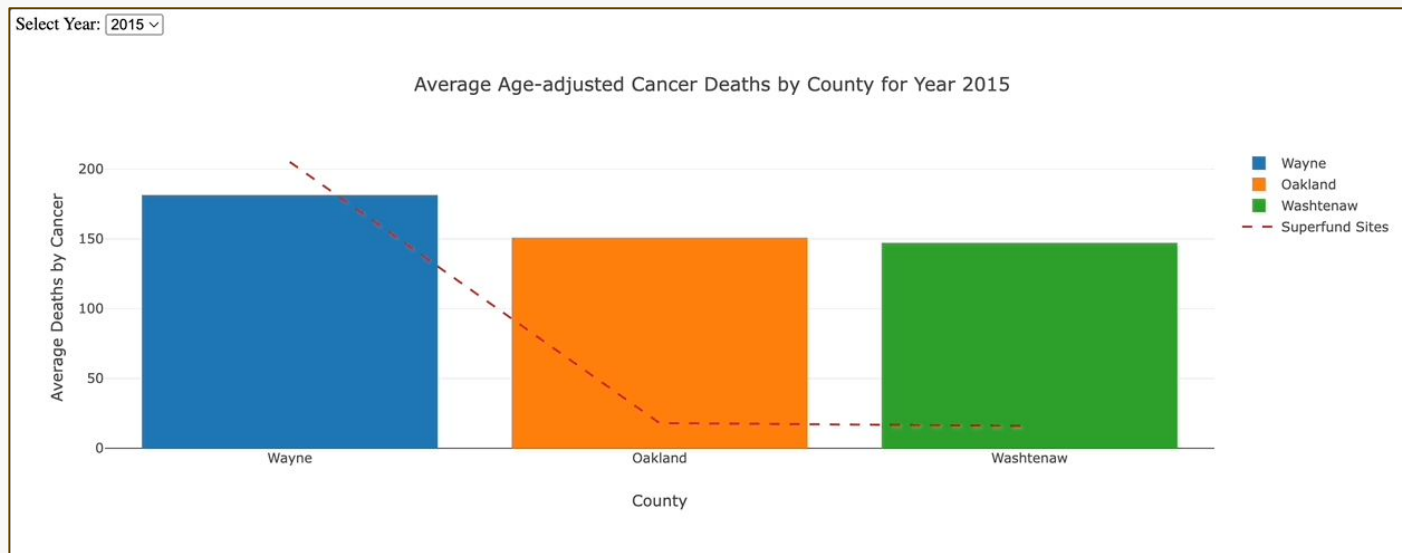
Leaflet and **D3;** Leaflet was used to render the map via OpenStreetMap, and D3 was used to import the GeoJSON data.

When hovering over pins representing Superfund site locations, you can view the name & address. In addition, the counties are shaded to represent how asthmatic the residents in the respective counties are.

Based on this map, there appears to be some **possible correlation** between the rate of asthmatic individuals and the number of Superfund sites.

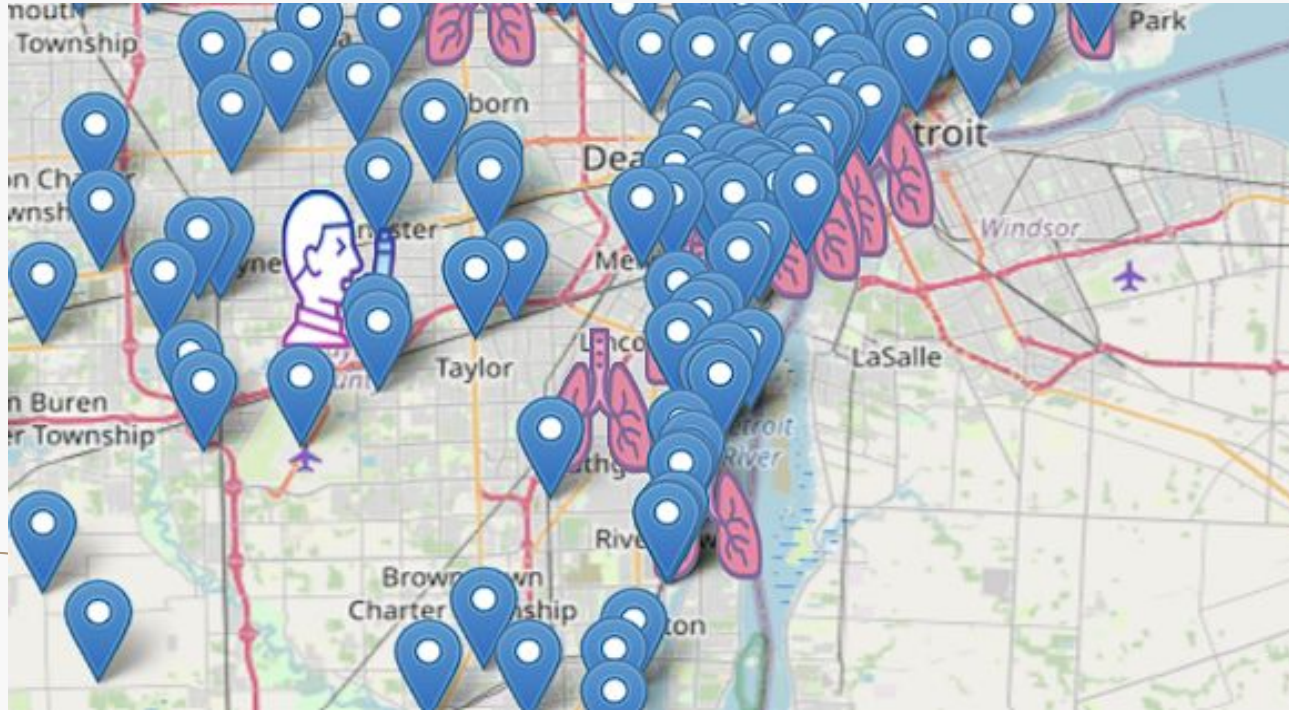# Cancer Mortality Visualization: Analysis & Interpretation

The **Plotly** chart represented in the GIF here illustrates the difference in age-adjusted death rates between our identified counties, depending on year. There is a drop-down menu in the upper right to switch between the years 2015-2020 and specific numbers for each county appear when you hover over the bars.
There is a dashed line on top of the chart that represents the number of Superfund sites in each county.

Based on the gap in severity between the Superfund count for the counties and the minimal difference between the death rates, I would infer that the the number of Superfund sites does **not** influence the death rate via cancer in a significant way, and that the difference in rates is mainly based on other underlying causes.

Map Visualization: Analysis & Interpretation

Based on the data visualizations generated from our **mapping exercise**, there **appears to be a correlation** between the locations of Superfund sites and areas experiencing poor air quality.

This correlation suggests that proximity to Superfund sites **may** be a **significant factor** influencing air quality.

03 Challenges & Solutions

Challenges Faced

Narrowing down the use of a new JavaScript library was challenging.

Additionally, not all years represented across all datasets; some ended at 2021, while others only extended to 2019, so that was taking into consideration when representing and cleaning the data.

Lack of latitude and longitude coordinates, but county information provided (a lot of mapping needed latitude & longitude)

Ethical Considerations

All health data was already stripped of all individual identifiers (PHI) & aggregated.

To account for the age bias/weight across different counties, asthma hospitalization & cancer death rates were age-adjusted.

All data used was publicly available & permissible to use; therefore, to our knowledge, **HIPAA was not violated**, **nor** any of its **ethical considerations** (such as **confidentiality**, **respect for the individual's privacy**, and **responsible handling of sensitive healthcare data**.)

04 **Conclusion**

EXPLORATION

Does abundance of and proximity to Superfund sites negatively impact health of residents in the Detroit Metro Area?

Final Insights

*Based on the **mapping data** and **visualizations**, **poor air quality** and **Superfund sites overlap fairly consistently**.

*Due to the nature of **many of the Superfund sites in Detroit** (i.e. **manufacturing** and **processing plants**), this **connection makes sense**.

***Poor air quality** exacerbates asthma symptoms**, as depicted by the relationship mapped between county air quality levels, Superfund sites, and asthma prevalence in our three counties.

***Cancer** is **difficult to correlate with Superfund sites** alone. While exposure to carcinogens at certain Superfund sites could lead to a higher risk of the disease, there are many underlying factors.

Citations

Project 3: Danger in Detroit? Superfund Information	United States Environmental Protection Agency. (2023, October 30). *What is Superfund?*. epa.gov. https://www.epa.gov/superfund/what-superfund
Superfund Locations Dataset	EPA Facility Registry Service, E., & Superfund Enterprise Management System (SEMS), (2019). EPA Superfund Sites. *EPA regulated superfund sites.* map, Wyoming Geospatial Hub. Retrieved January 16, 2024, from https://data.geospatialhub.org/datasets/feab83a05c2f40dca1e0aac4ba740fe2_21/explore?location= 42.333159%2C-83.072639%2C8.00.
Air Quality Dataset	United States Environmental Protection Agency . (2016). Annual Air Quality Index (AQI) by County_2016 -2021. Wayne, Washtenaw, Oakland; https://aqs.epa.gov/aqsweb/airdata/download_files.html.
Cancer Mortality Dataset	Michigan Department of Health & Human Services. (2023). Five-year Average Invasive Cancer Incidence & Mortality Trends Oakland County, Wayne County, Washtenaw County, Michigan Residents,1985-2021. *Cancer Incidence 2020*. chart, Michigan Department of Community Health.
Asthma Dataset	Michigan Health & Hospital Association Service Corporation . (2016). Age-Adjusted Rate of Hospitalization for Asthma per 10,000 Population - Selected year(s). *MiTracking*. map, Michigan Environmental Public Health Tracking.