

Thinking about causal inference research: Air pollution and asthma in the East Bay

CS/Stat C8R COCI Summer Bridge

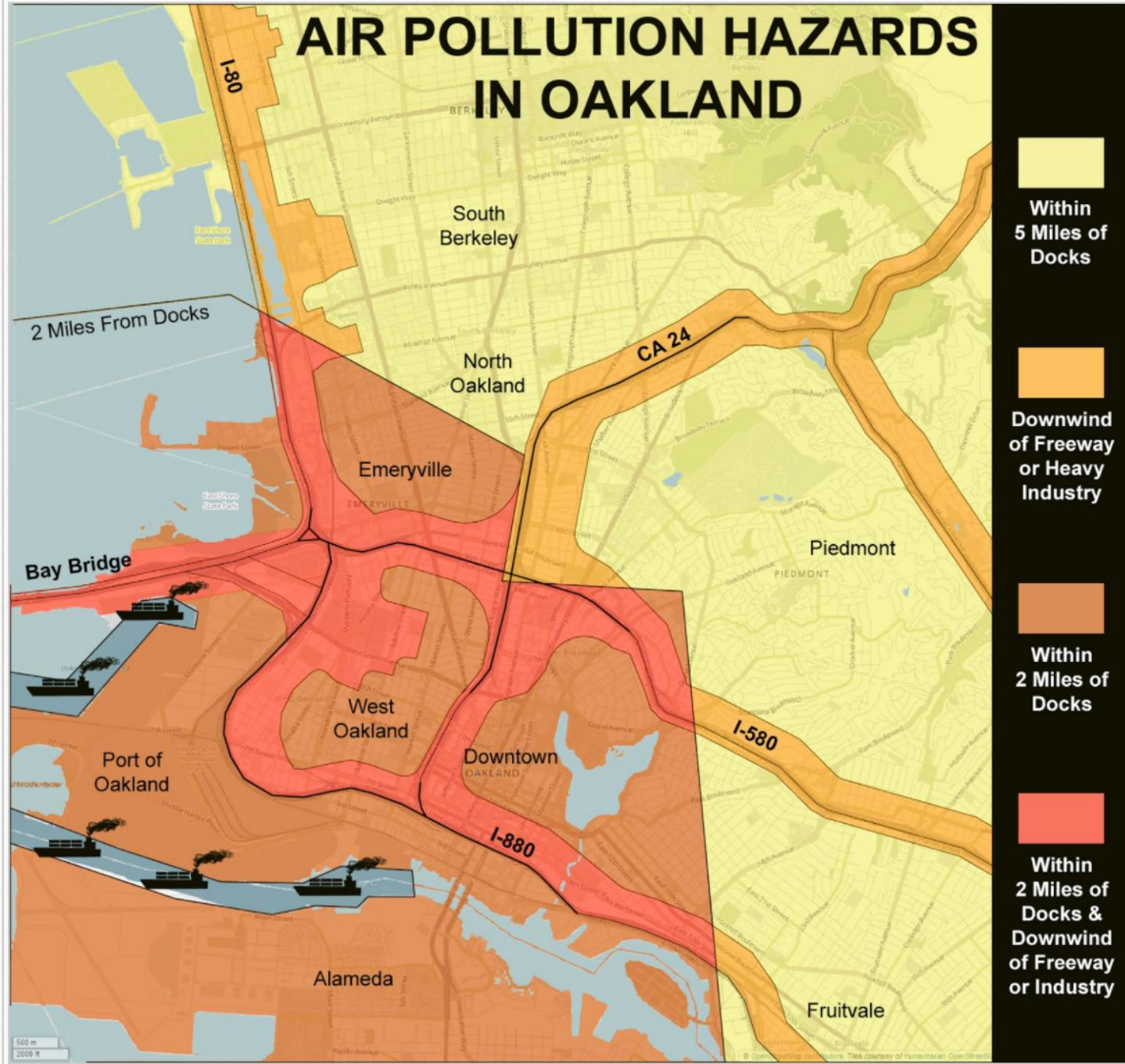
Evan Muzzall, D-Lab

evan.muzzall@berkeley.edu

<http://dlab.berkeley.edu/>

- AQI

- O₃
- Particulate
- CO
- SO₂
- NO₂

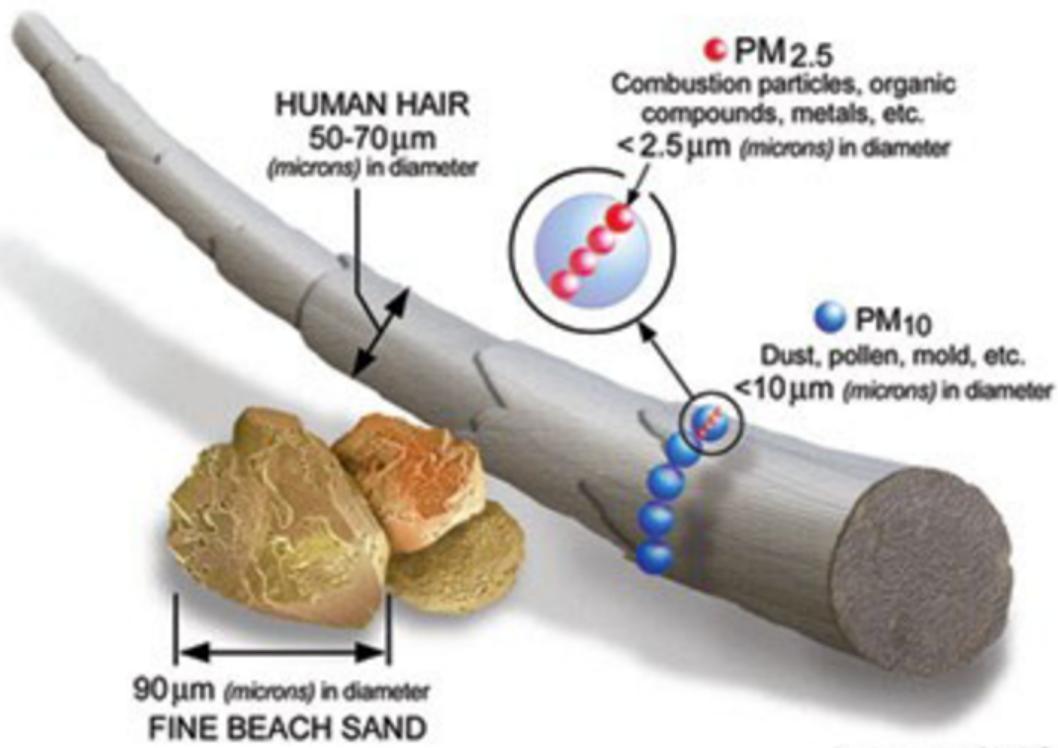


Particle Pollution (PM)

Particle pollution, also called particulate matter or PM, is a mixture of solids and liquid droplets floating in the air. Some particles are released directly from a specific source, while others form in complicated chemical reactions in the atmosphere.

[Help reduce particle pollution](#)

Particles come in a wide range of sizes. Particles less than or equal to 10 micrometers in diameter are so small that they can get into the lungs, potentially causing serious health problems. Ten micrometers is less than the width of a single human hair.



- **Coarse dust particles (PM_{10})** are 2.5 to 10 micrometers in diameter. Sources include crushing or grinding operations and dust stirred up by vehicles on roads.
- **Fine particles ($PM_{2.5}$)** are 2.5 micrometers in diameter or smaller, and can only be seen with an electron microscope. Fine particles are produced from all types of combustion, including motor vehicles, power plants, residential wood burning, forest fires, agricultural burning, and some industrial processes

Image courtesy of the U.S. EPA

Asthma

- 1.** What is asthma?

- 2.** Where does asthma occur most frequently? What are the characteristics of these populations? Why?

David Renna's project::

http://drenna6.blogspot.com/2010_09_01_archive.html

Check out California Breathing's asthma data:

<http://www.californiabreathing.org/asthma-data/county-asthma-profiles/alameda-county-asthma-profile>

See the maps here:

[Healthy Alameda County's Asthma Emergency Department Visit Rate](#)

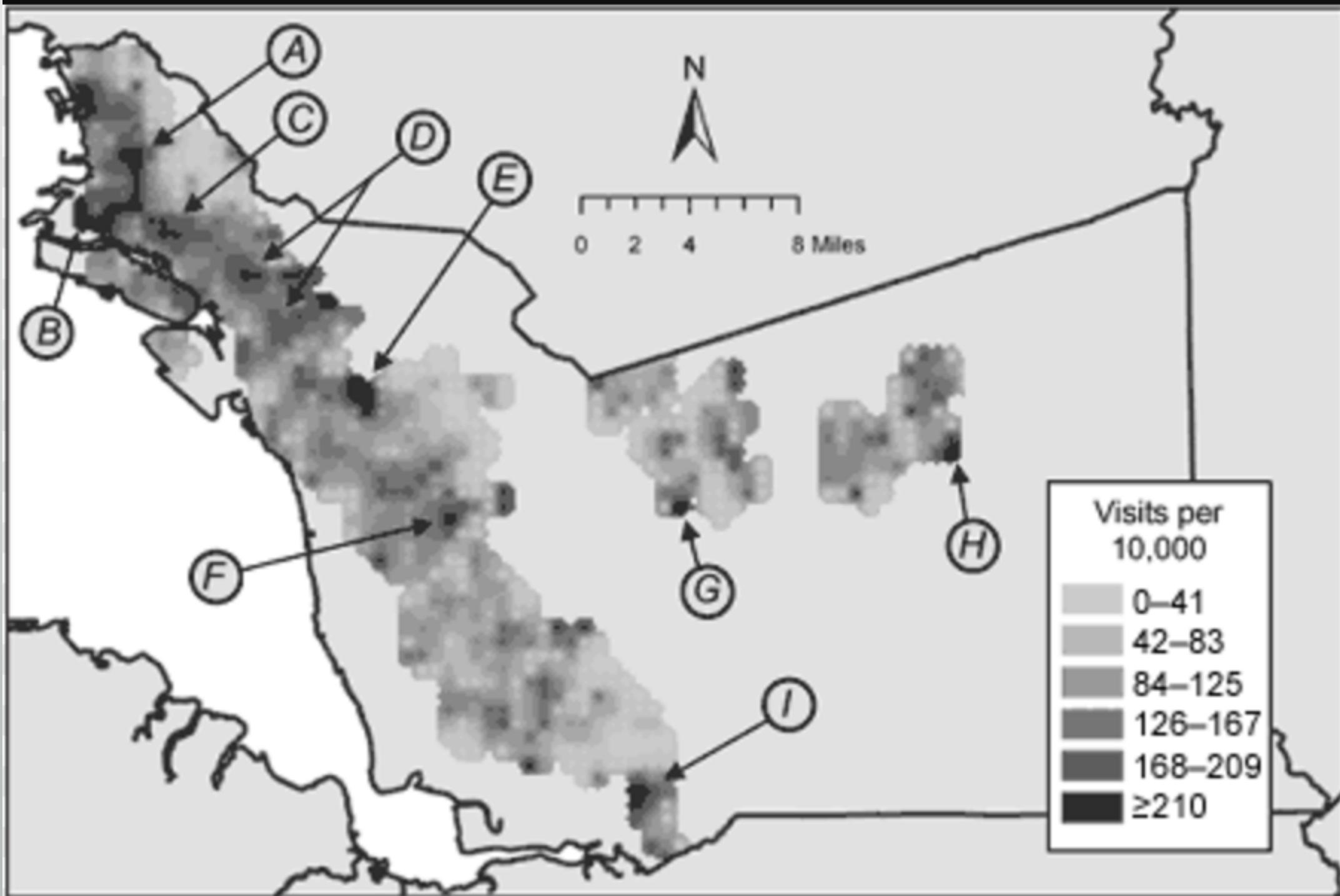
Age-Adjusted Asthma Hospitalization Data: 1994-96
Alameda, Contra Costa, San Francisco and Solano Counties
Regional Asthma Management and Prevention Initiative
April, 1999

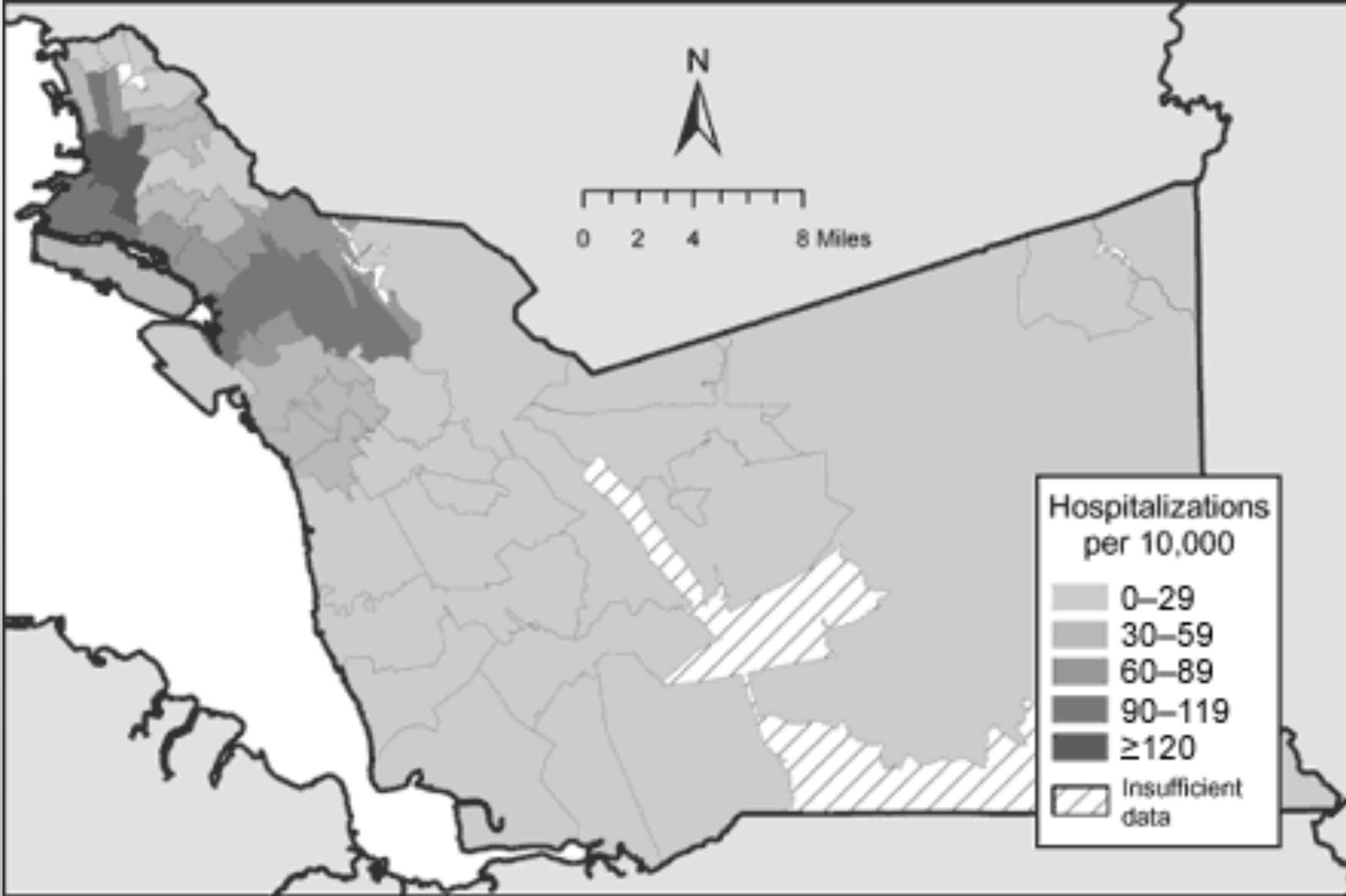


High
Medium
Low
No Data
Water

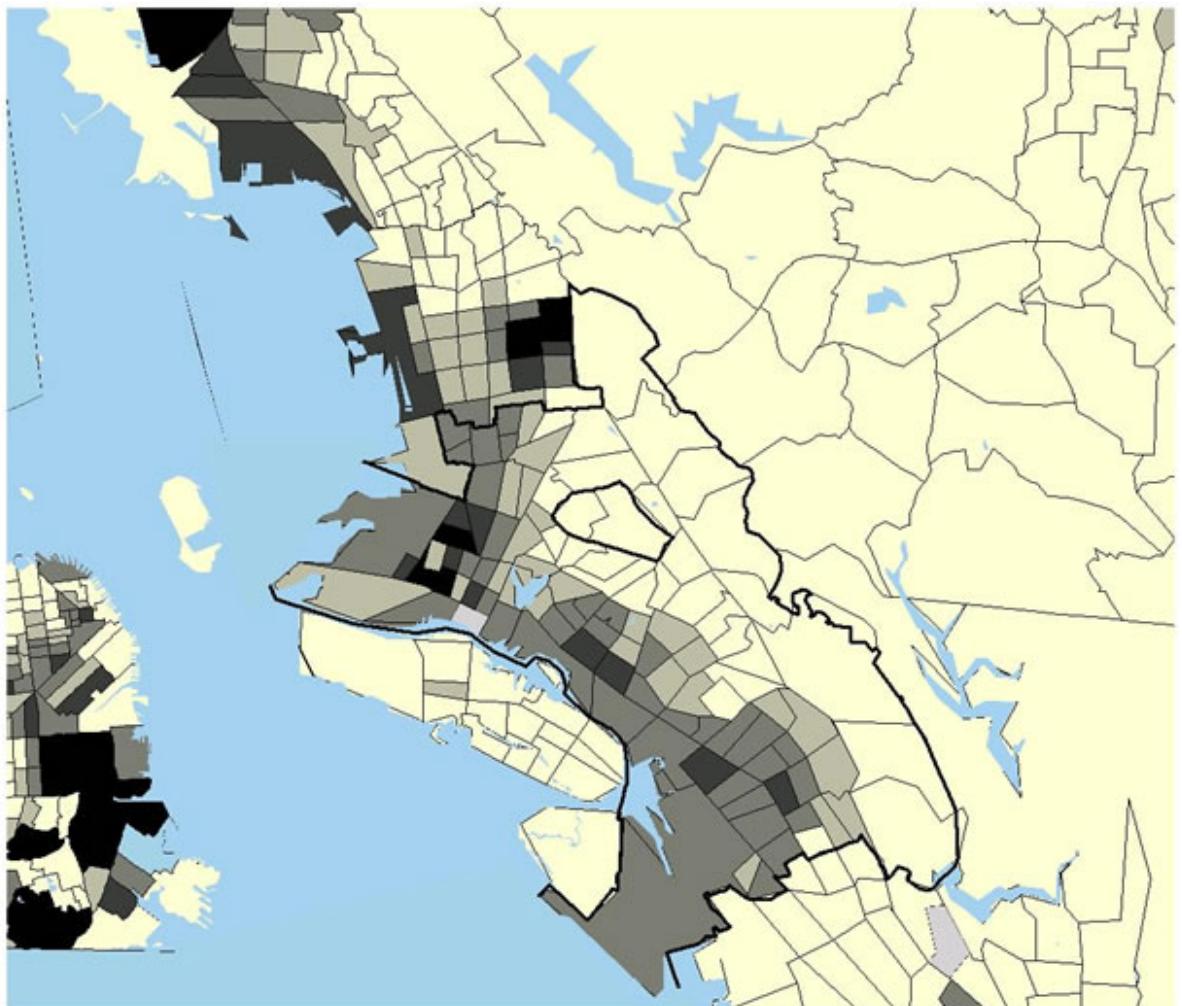
Note: Healthy People 2000 (HP 2000) target rate = 160/100,000
High = Rates with confidence intervals greater than the HP2000 target rate
Medium = Rates with confidence intervals that cross the HP2000 target rate
Low = Rates with confidence intervals less than the HP2000 target rate
No data = Less than 20 hospitalizations







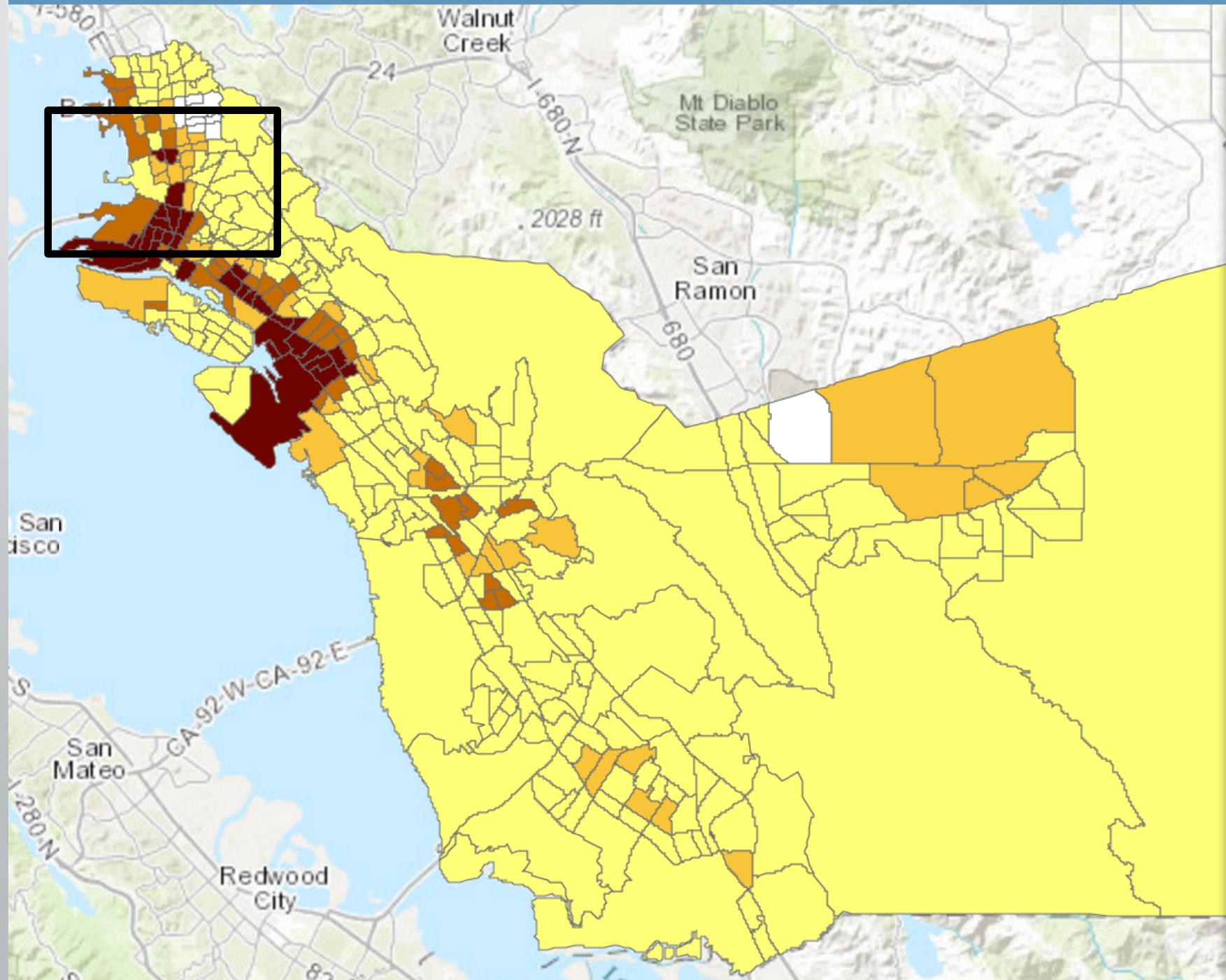
- Air pollution
- Asthma
- Poverty



1 inch = 3 miles

Lines are 1990 Census Tracts



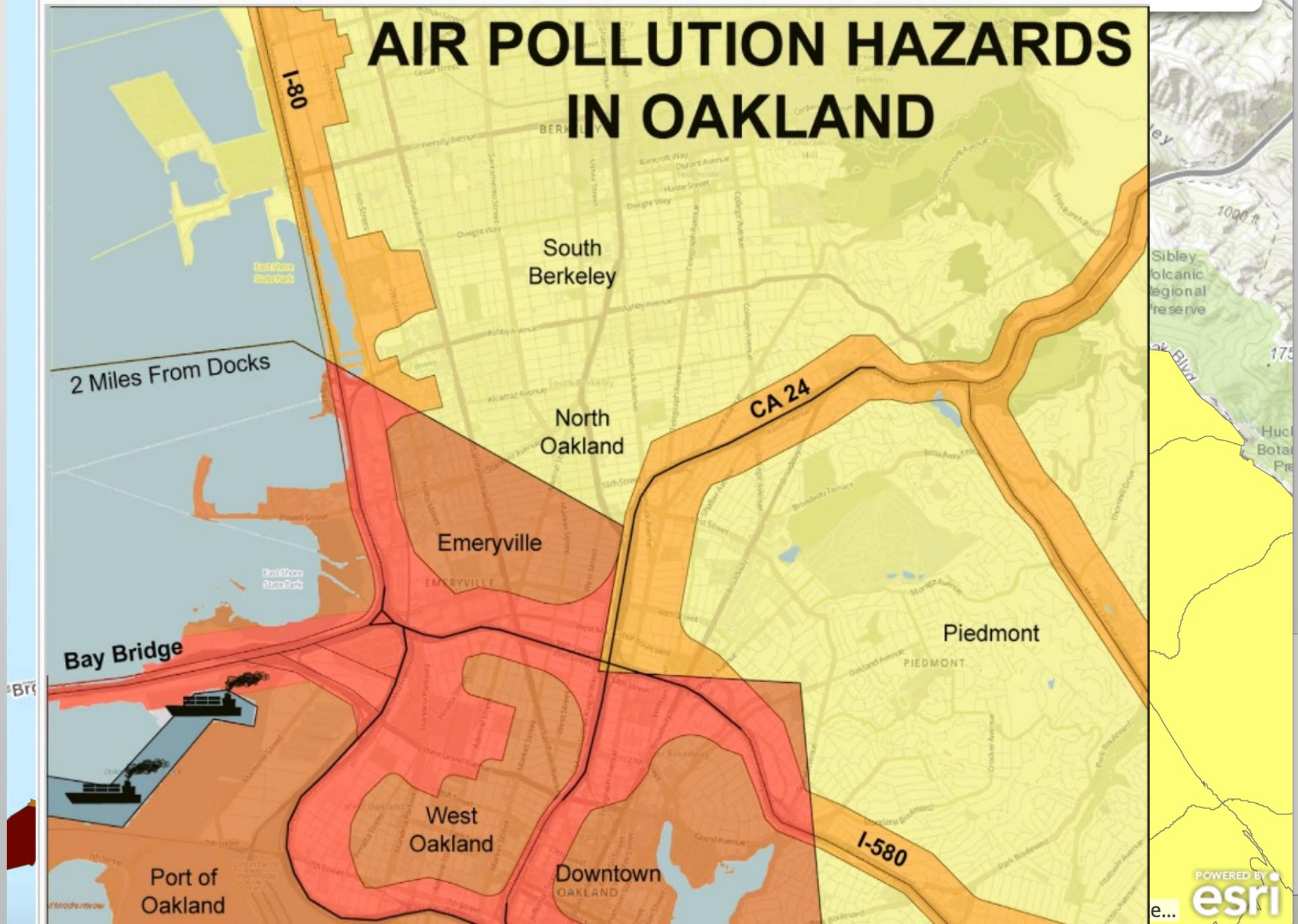


LEGEND

Persistent Poverty 1970-2013

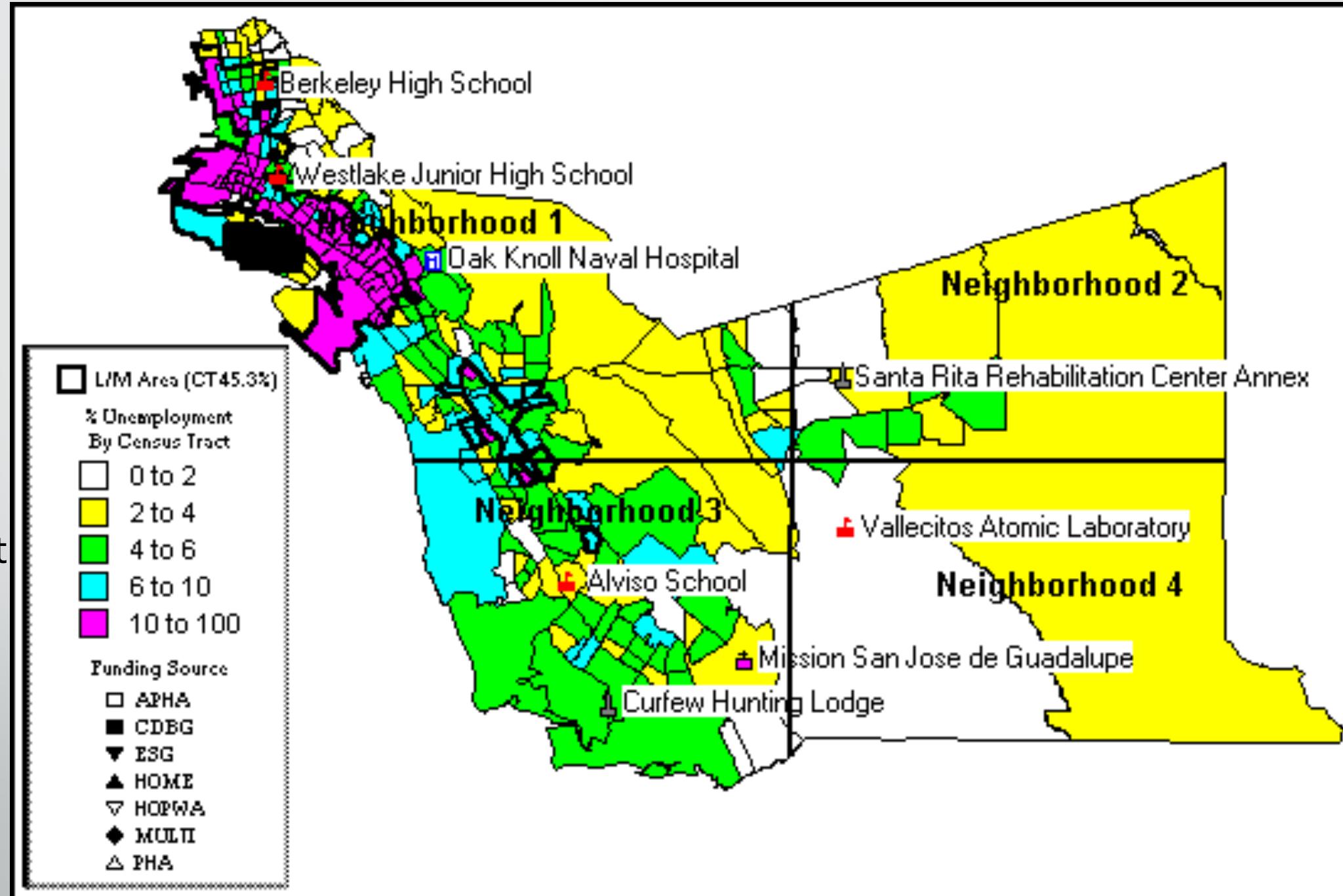
- 5 Decades High Poverty (Persistent Poverty)
- 1-4 Decades High Poverty, Currently In Poverty
- 1-4 Decades High Poverty, Not Currently In Poverty
- 0 Decades High Poverty
- Excluded

AIR POLLUTION HAZARDS IN OAKLAND

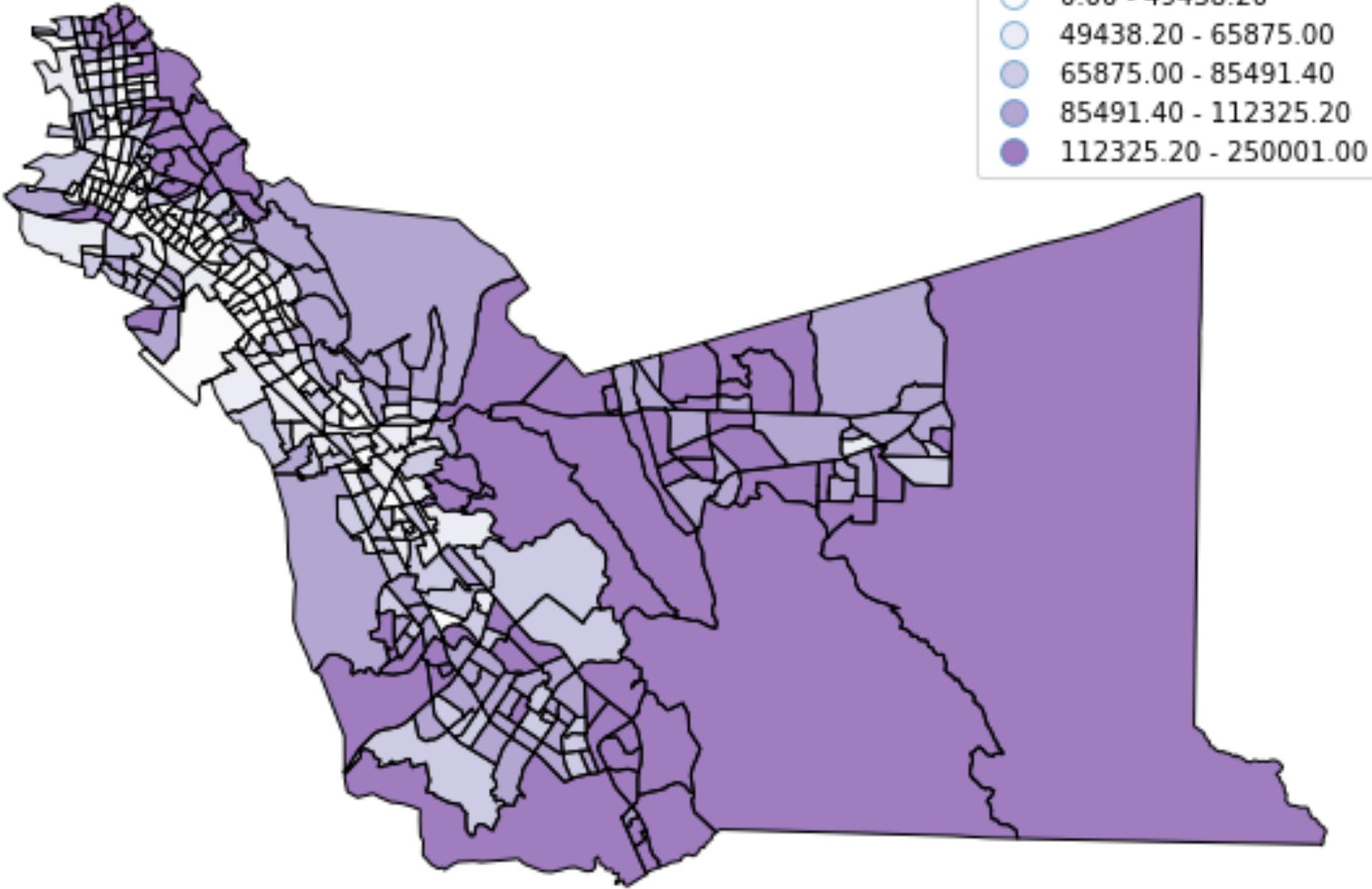


- Return to the research question: will reduced truck idling cause less asthma?
 - What about other sources of pollution?
- What else do we know?

- Air pollution
- Asthma
- Poverty
- Unemployment



Alameda County, CA - Median Household Income by Census Tract

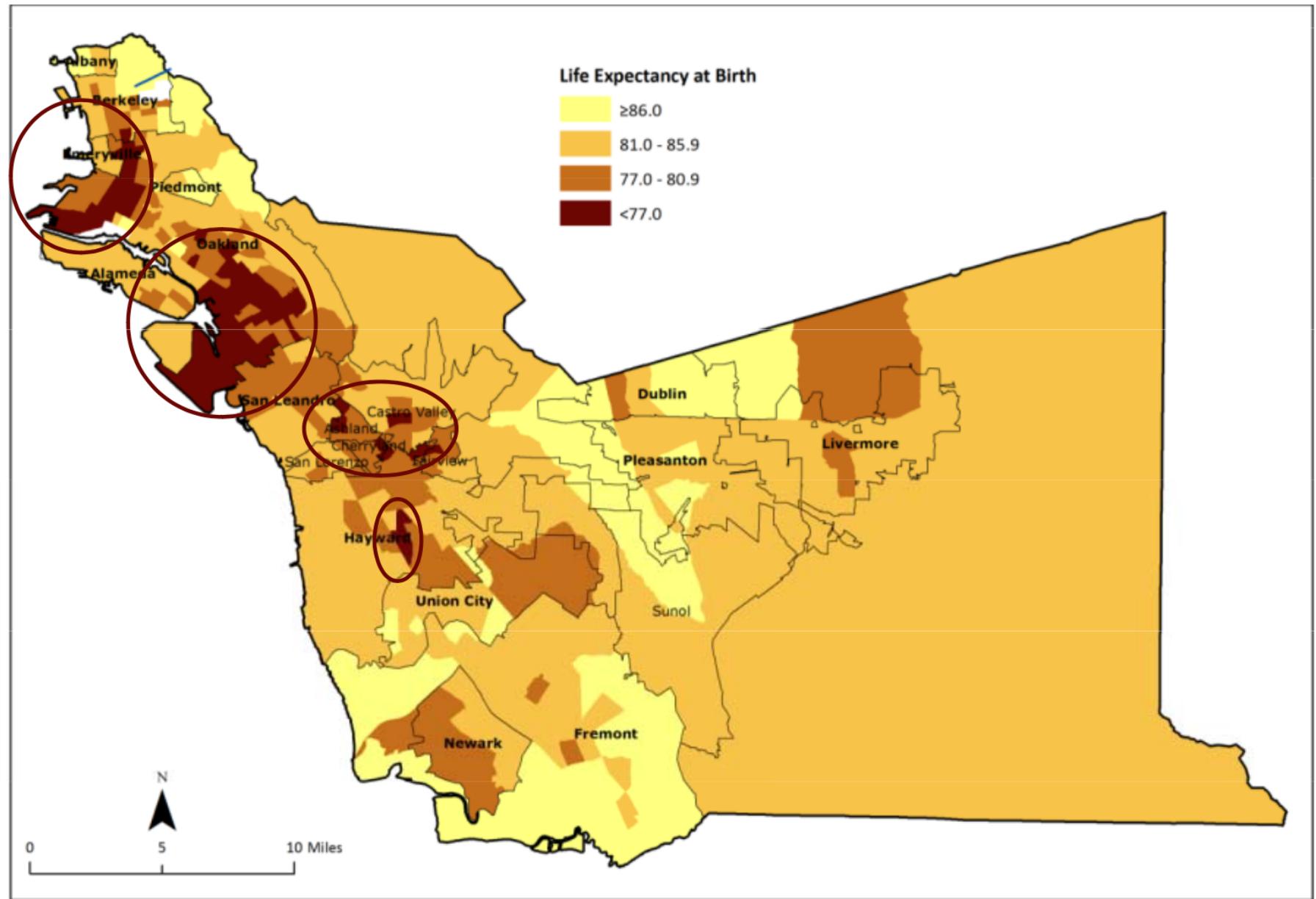


- Air pollution
- Asthma
- Poverty
- Unemployment
- Income

Health Inequities by Place

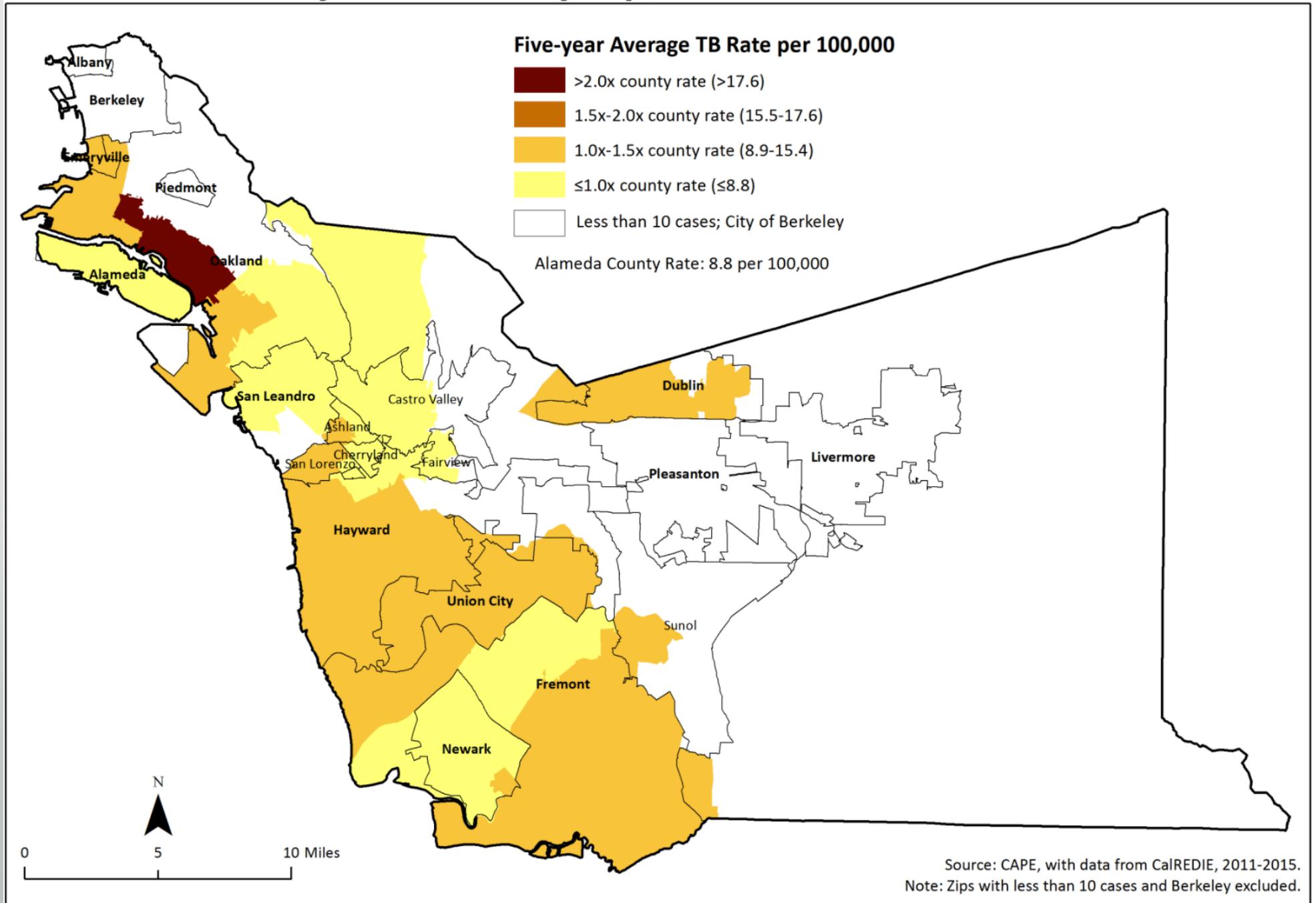
Life Expectancy by Census Tract

- Air pollution
- Asthma
- Poverty
- Unemployment
- Income
- Life expectancy



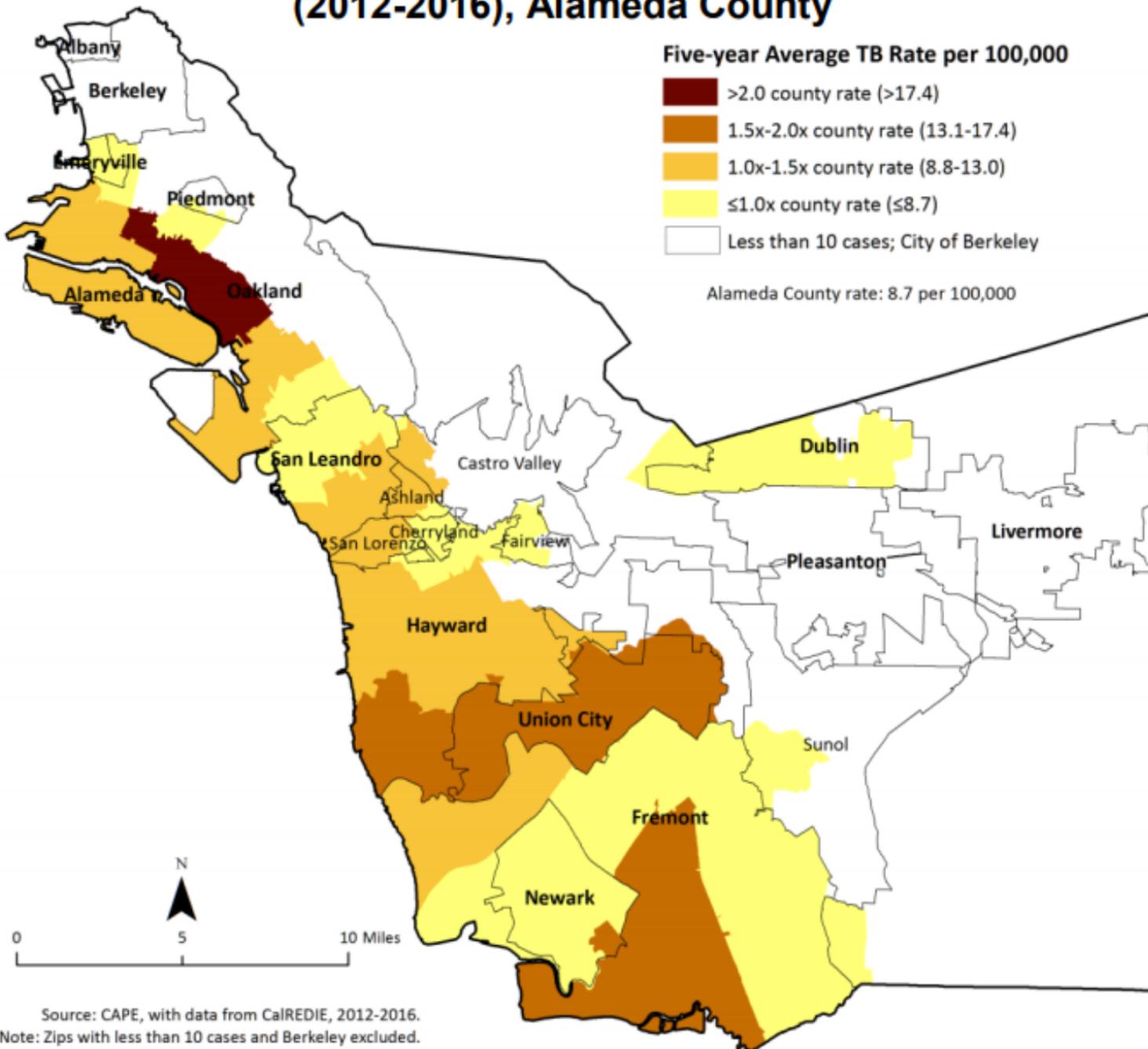
Alameda County TB Rates by Zip, 2011-2015

- Air pollution
- Asthma
- Poverty
- Unemployment
- Life expectancy
- Tuberculosis

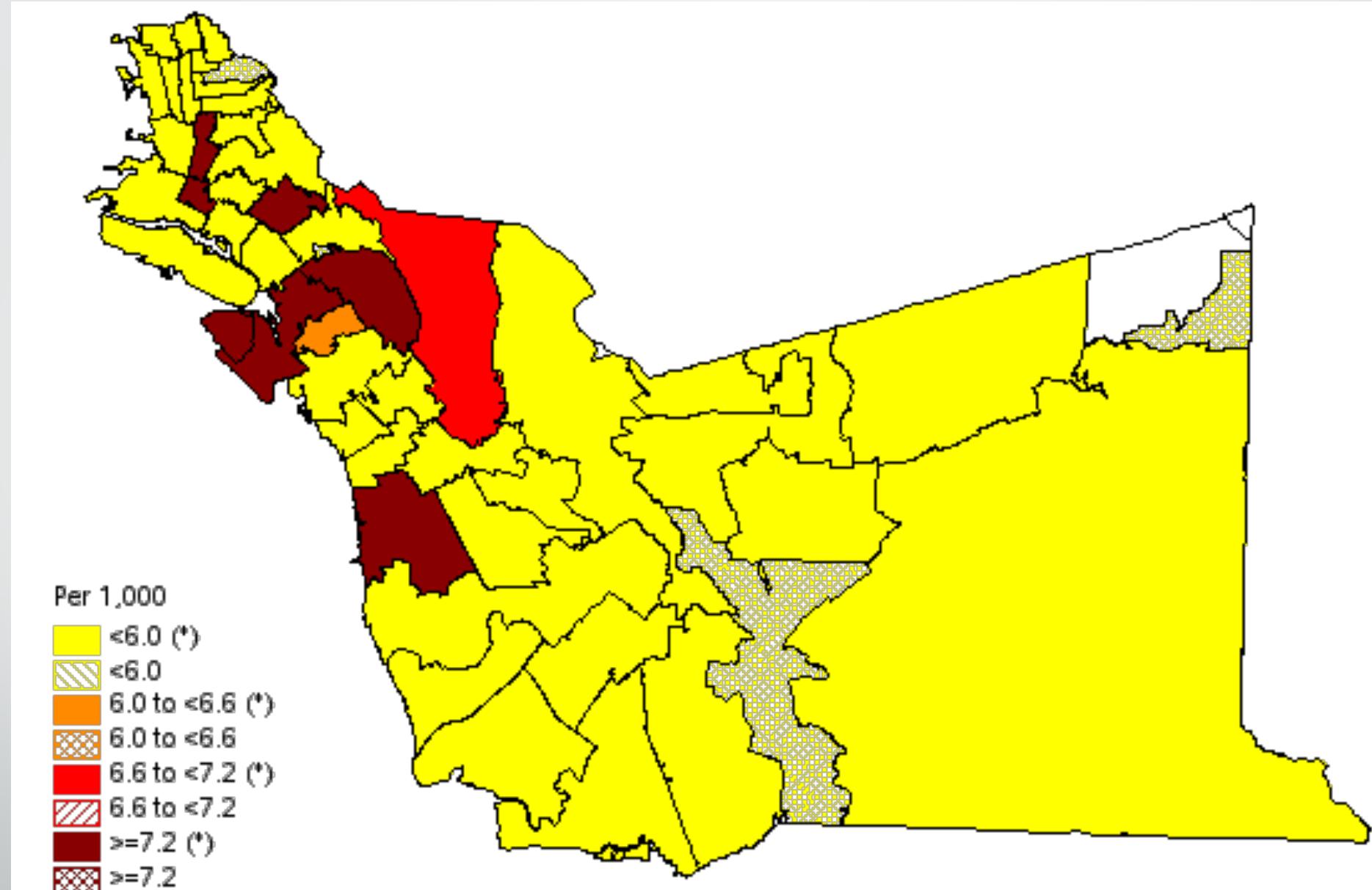


- Air pollution
- Asthma
- Poverty
- Unemployment
- Life expectancy
- Mortality
- Tuberculosis
(cont.)

**Figure 3: Average Annual TB Rates per 100,000 by Zip Code
(2012-2016), Alameda County**

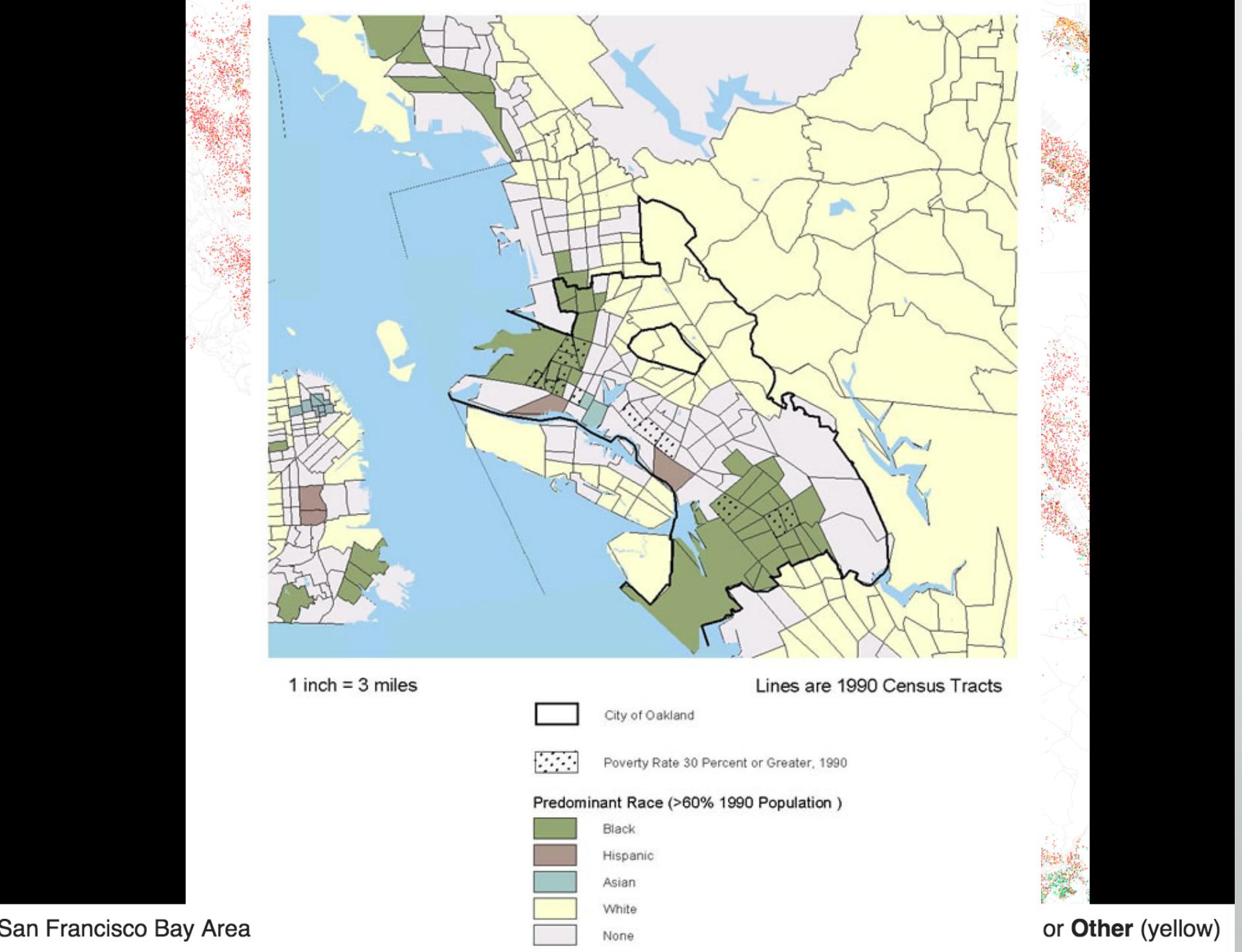


- Air pollution
- Asthma
- Poverty
- Unemployment
- Life expectancy
- Tuberculosis
- Infant mortality

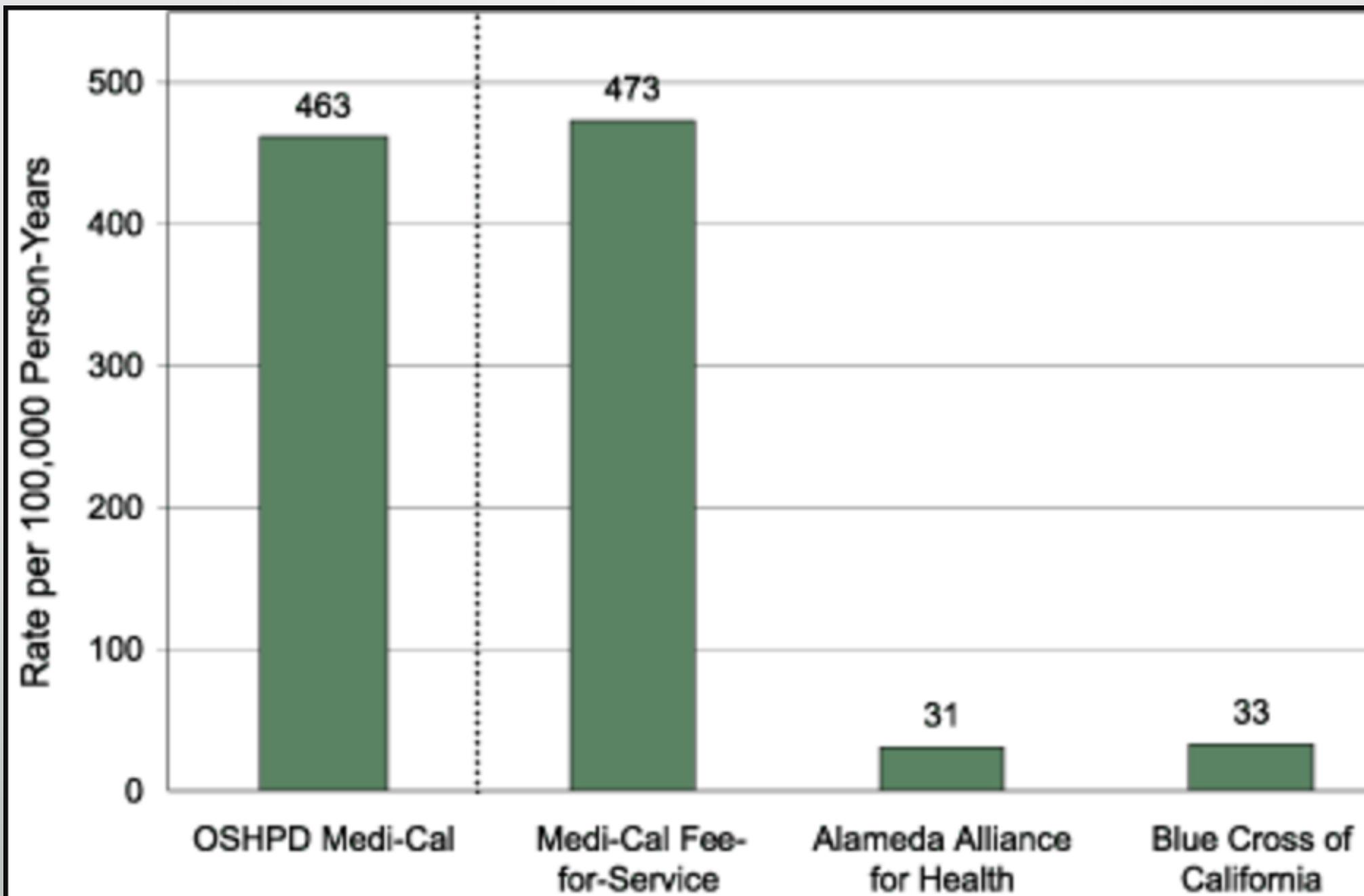


The star in parenthesis after the legend entry indicates a statistically significant rate compared to the Healthy People 2020 Objectives ($\alpha=0.01$; two-tailed test).
For white areas in the map, no data are available.

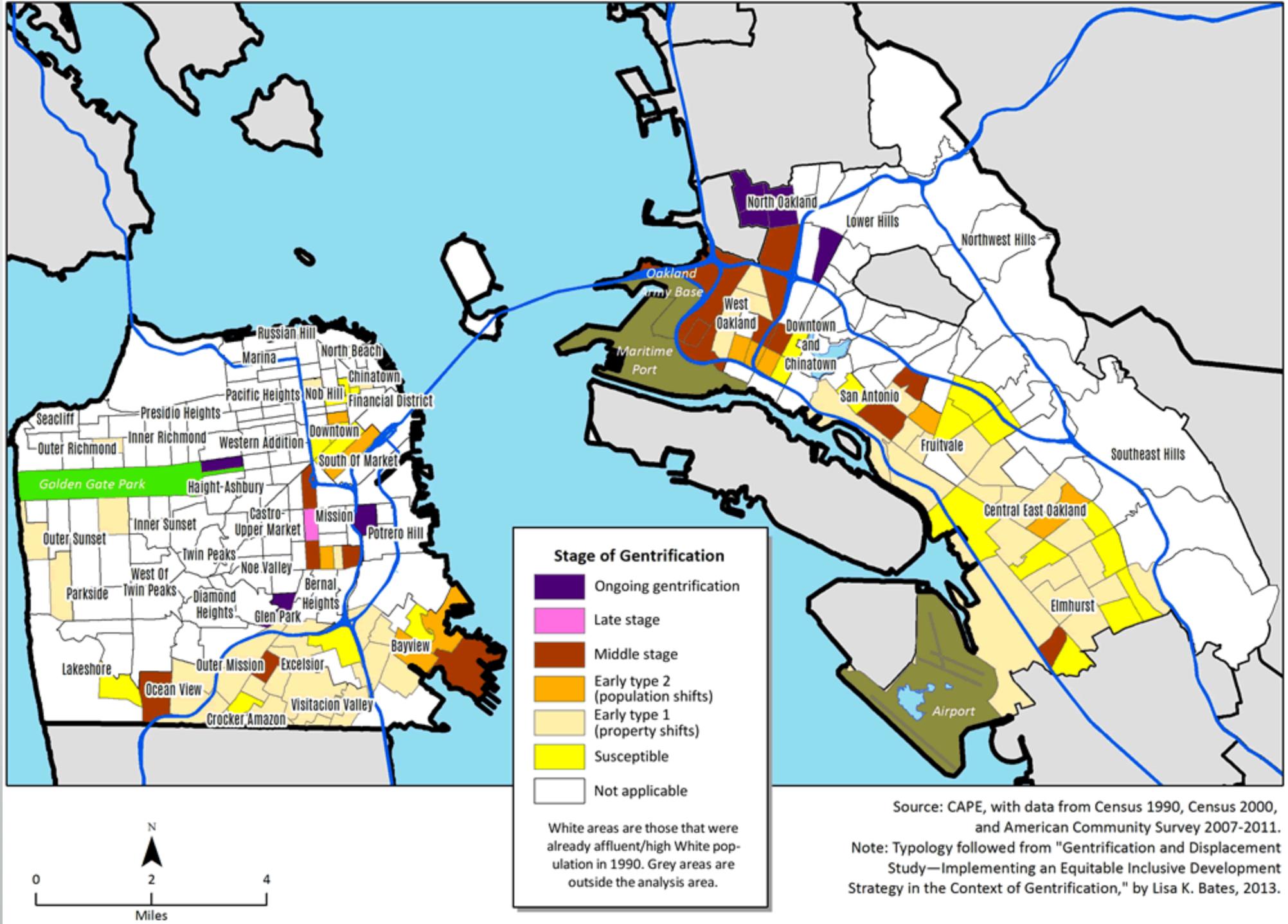
- Air pollution
- Asthma
- Poverty
- Unemployment
- Life expectancy
- Mortality
- Tuberculosis
- Race



- Air pollution
- Asthma
- Poverty
- Unemployment
- Life expectancy
- Mortality
- Tuberculosis
- Race
- Insurance coverage



- Air pollution
- Asthma
- Poverty
- Unemployment
- Life expectancy
- Mortality
- Tuberculosis
- Race
- Insurance coverage
- etc...



- What are some challenges of approaching causal inference research?
 - Identifying data sources
 - Temporal and spatial congruity
 - Identifying relevant features
 - Asking relevant research questions
 - Statistical modeling
 - Quantifying uncertainty
- Return to the research question: how might you assess whether or not the legislation requiring less emissions of idling trucks will cause reduced rates of asthma hospital admissions given the other variables?