

Investigating Air Pollution and Breast Cancer Mortality in California

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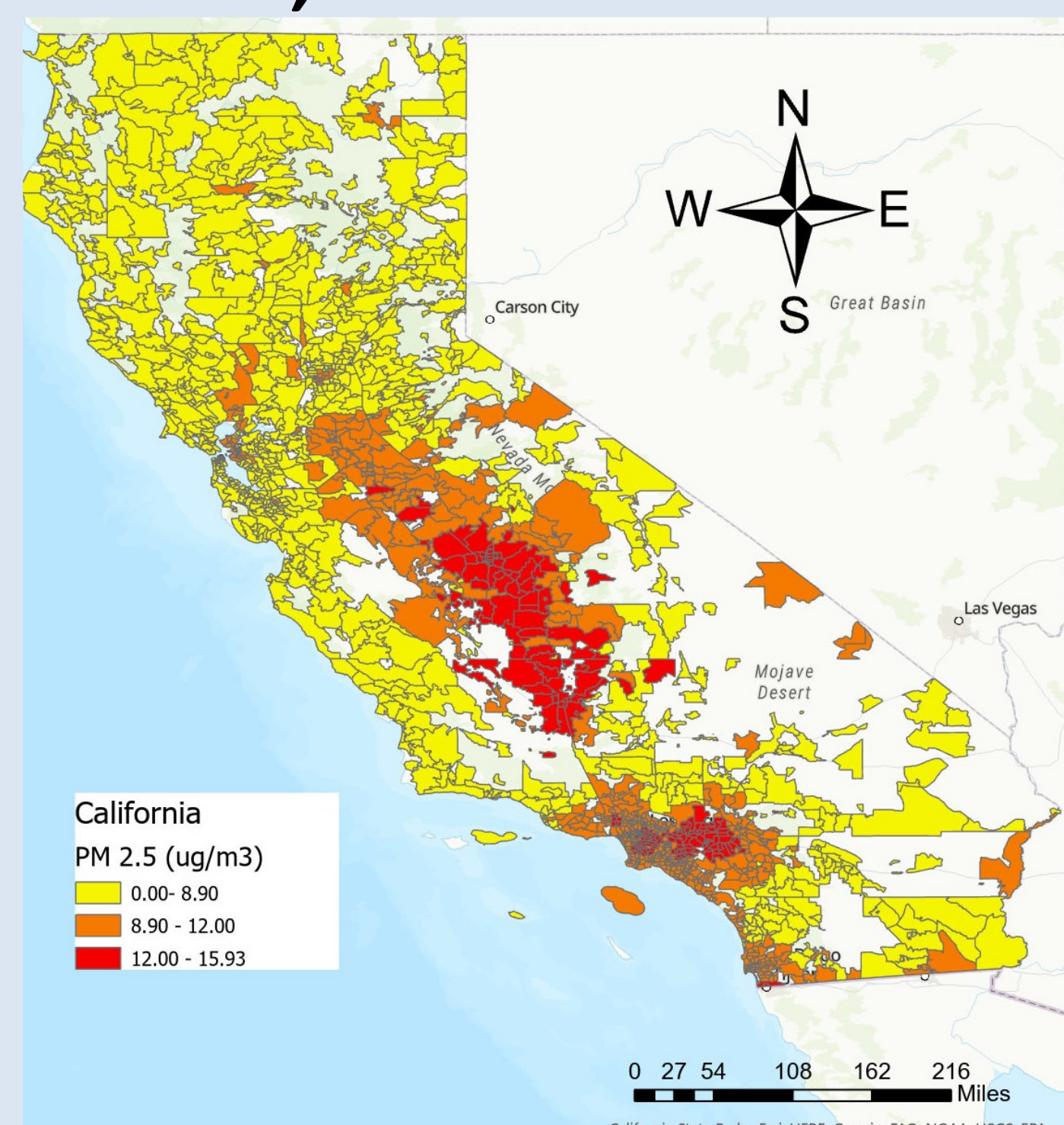
BACKGROUND

In the United States, the most common cancer among women is breast cancer, 1 in 8 women at risk (ACS, 2023). At the state level, California's age-adjusted breast cancer mortality (BCM) rate is 18.8 per 100,000 over the 5-year average of 2016-2020 (CDC, 2023). Despite established risk factors for BC, there is emerging research on the impact of environmental factors on breast cancer mortality, mainly ambient air pollution (DuPre et al., 2019; Cheng et al., 2022). One of these air pollutants is particulate matter 2.5 (PM2.5), which is a group 1 carcinogen as defined by the World Health Organization (EPA, 2022; Zhou et al., 2022).

METHODS

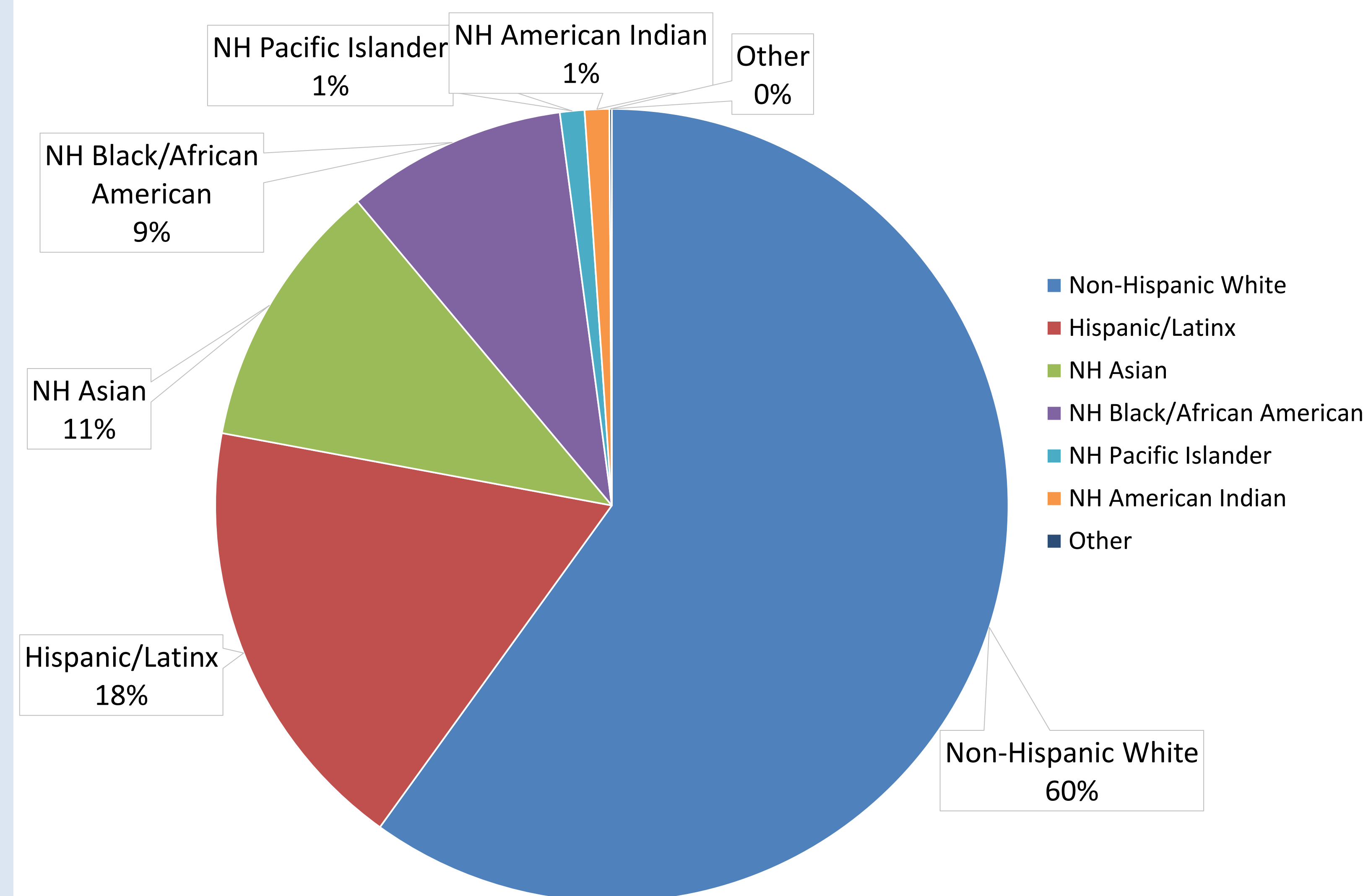
Secondary data was collected from the California Department of Public Health (CDPH) Data and Vital Statistics, CalEnviroScreen 4.0, and the American Community Survey (ACS) from the Census. Multiple linear regression was used to test the significance between air pollution and age-standardized breast cancer mortality rates.

Figure 1. Particulate Matter 2.5 Concentrations at the Zip Code Level, California



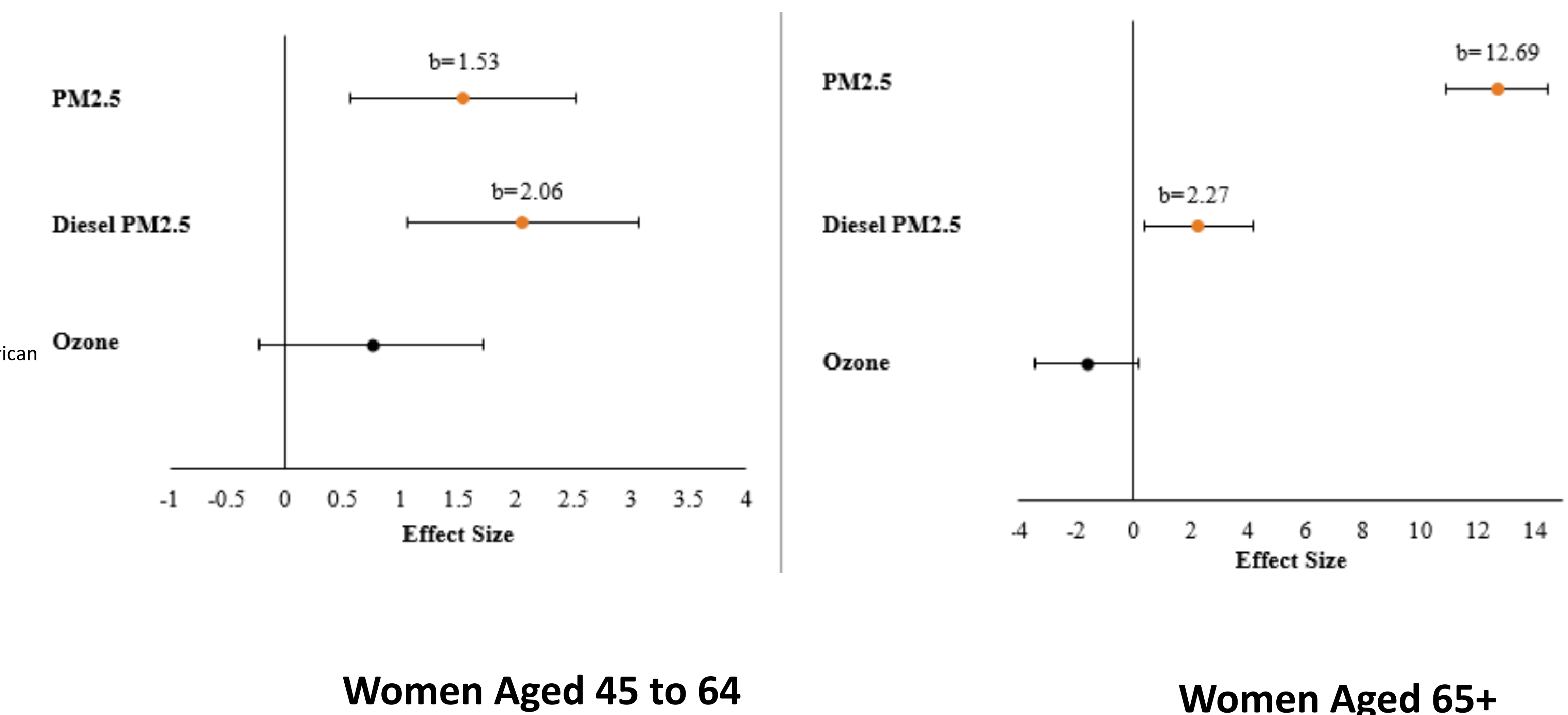
RESULTS

Figure 2. Percentage of Breast Cancer Mortality by Race/Ethnicity in California



- PM2.5 was significantly associated with BCM in both middle-aged group ($b=1.53$, 95% CI=[0.56, 2.51]) and the older age group ($b=12.67$, 95% CI=[10.91, 14.47]).
 - A one SD increase in PM2.5 was associated with an increase in BCM rates by 12.7 per 100,000 women
 - PM2.5 accounted for approximately 4% of the variance in BCM
- Diesel PM was significantly associated with BCM in middle-aged group ($b=2.06$, 95% CI=[1.05, 3.07]) and the older age group ($b=2.27$, 95% CI=[0.35, 4.19]).
 - Among the older age group, a one SD increase in Diesel PM was associated with an increase in BCM rates of 2.3 per 100,000 women.

Figure 3. Effect Size (beta) of Air Pollution Variables Estimated by Ordinary Least Squares Regression on Age-Adjusted Breast Cancer Mortality by Age Group



Discussion

The model adjusted for race, poverty and insurance coverage. Along with air pollution, the percentage of the population that is privately insured was significantly associated with BCM in the older age group ($b=26.85$, 95% CI=[25.24, 28.46]). The percentage of African Americans was also significantly associated with BCM in both the middle-aged group ($b=2.79$, 95% CI=[1.89, 3.69]) and the older age group ($b=2.75$, 95% CI=[1.11, 4.39]). While the findings may indicate statistical associations, it is essential to acknowledge the multifaceted nature of BCM, with various factors contributing to the observed patterns. Further research and a deeper exploration of potential mechanisms are warranted.

Conclusion

This is the first study to investigate the impact of air pollution and social determinants of breast cancer mortality in California at the zip code level. This study provides compelling evidence of a significant spatial association between PM2.5 and BCM rates with policy implications for stricter air quality regulations and urban planning policies. Further research is needed to establish causality and the mechanism of action at the population level.

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