

Beyond Pathogens

Unravelling Mortality through an Environmental Lens in the United States, 2000—2019

Shuai Zhou¹, Chuan Liao¹, Ziqing Wei¹, and Guangqing Chi²
1. Cornell University; 2. The Pennsylvania State University



BACKGROUND

- Human-induced environmental change has significant impacts on population health, particularly mortality.
- Most previous studies come from an epidemiological angle while paying less attention to mortality that integrates environmental and social dimensions.
- The linkages between environmental exposures and cause-specific mortality across rural and urban areas are not clear.

OBJECTIVE

To explore the impacts of environmental exposures on age- and causespecific mortality rates across rural and urban counties in the United States.

DATA, VARIABLES, AND METHOD

Data

Age- and cause-specific mortality rates from 2000 through 2019 at the county level are derived from the Institute for Health Metrics and Evaluation (IHME). We focused on three causes of mortality that are susceptible to environmental exposures: cardiovascular diseases (**CVD**) and chronic respiratory diseases (**CRD**).

Variables

Environmental exposures, including annual average **precipitation**, **temperature**, and **PM2.5**, are sourced from high-resolution (0.04-degree) climate data products.

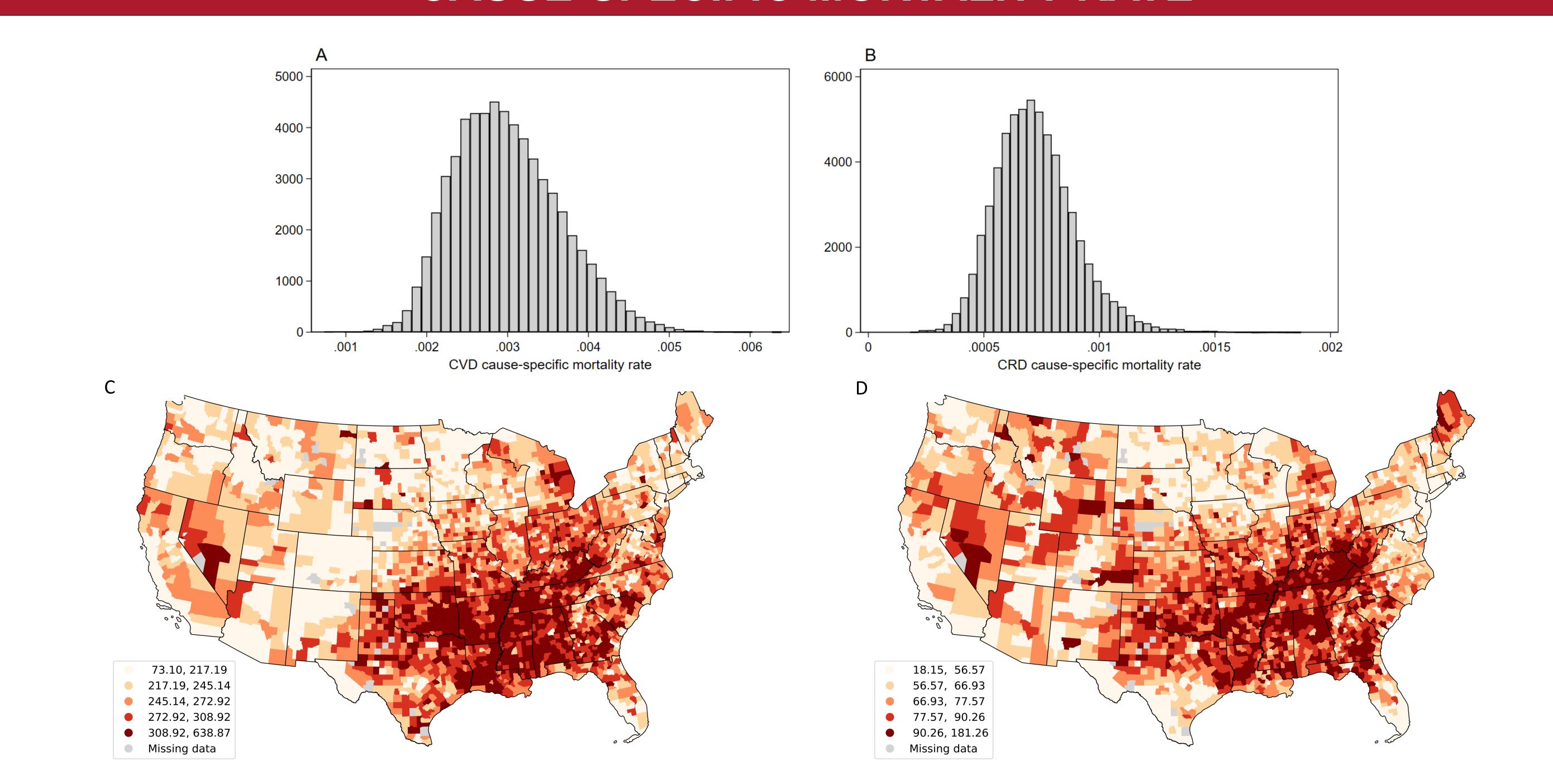
Socioeconomic covariates, including household income, employment rate, and insurance coverage, are obtained from the American Community Survey (ACS).

Methods

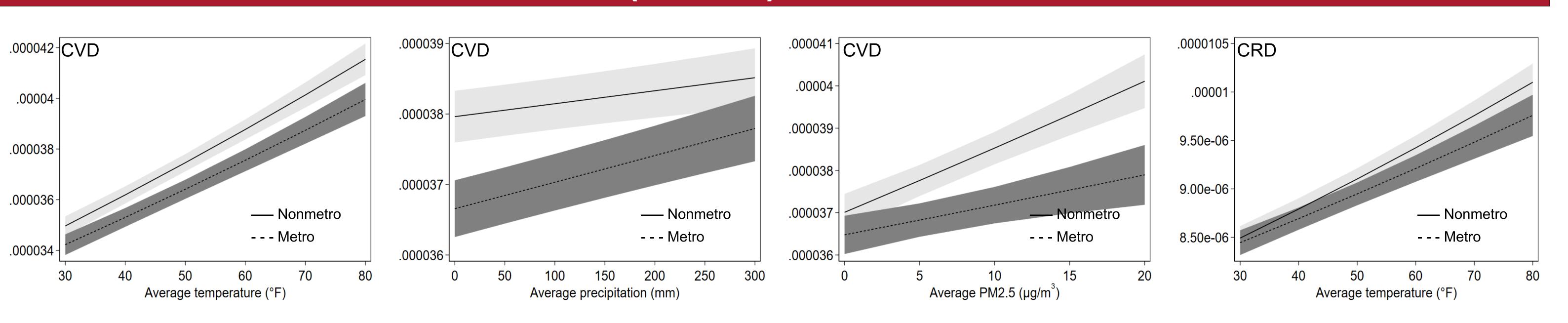
Since the dependent variable is a non-negative rate, we employed negative binomial regression models because they are well-suited for modeling non-negative, right-skewed data.

To test whether the impacts of environmental exposures vary across rural and urban areas, we included the interactions terms between environmental exposures and county's metropolitan status. Year and county fixed-effects are included to adjust for unobserved factors such as technological advancements and policy and infrastructure changes.

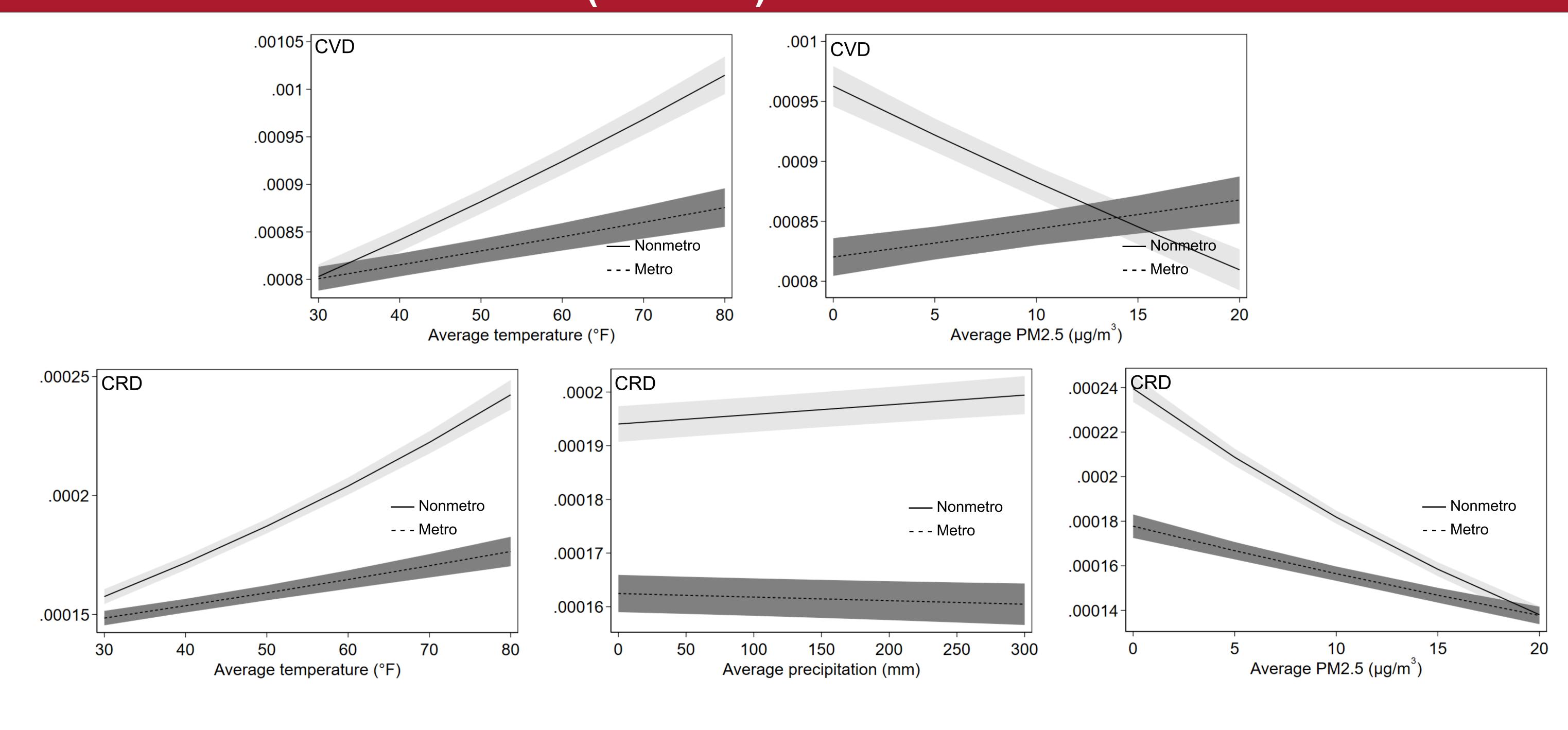
CAUSE-SPECIFIC MORTALITY RATE



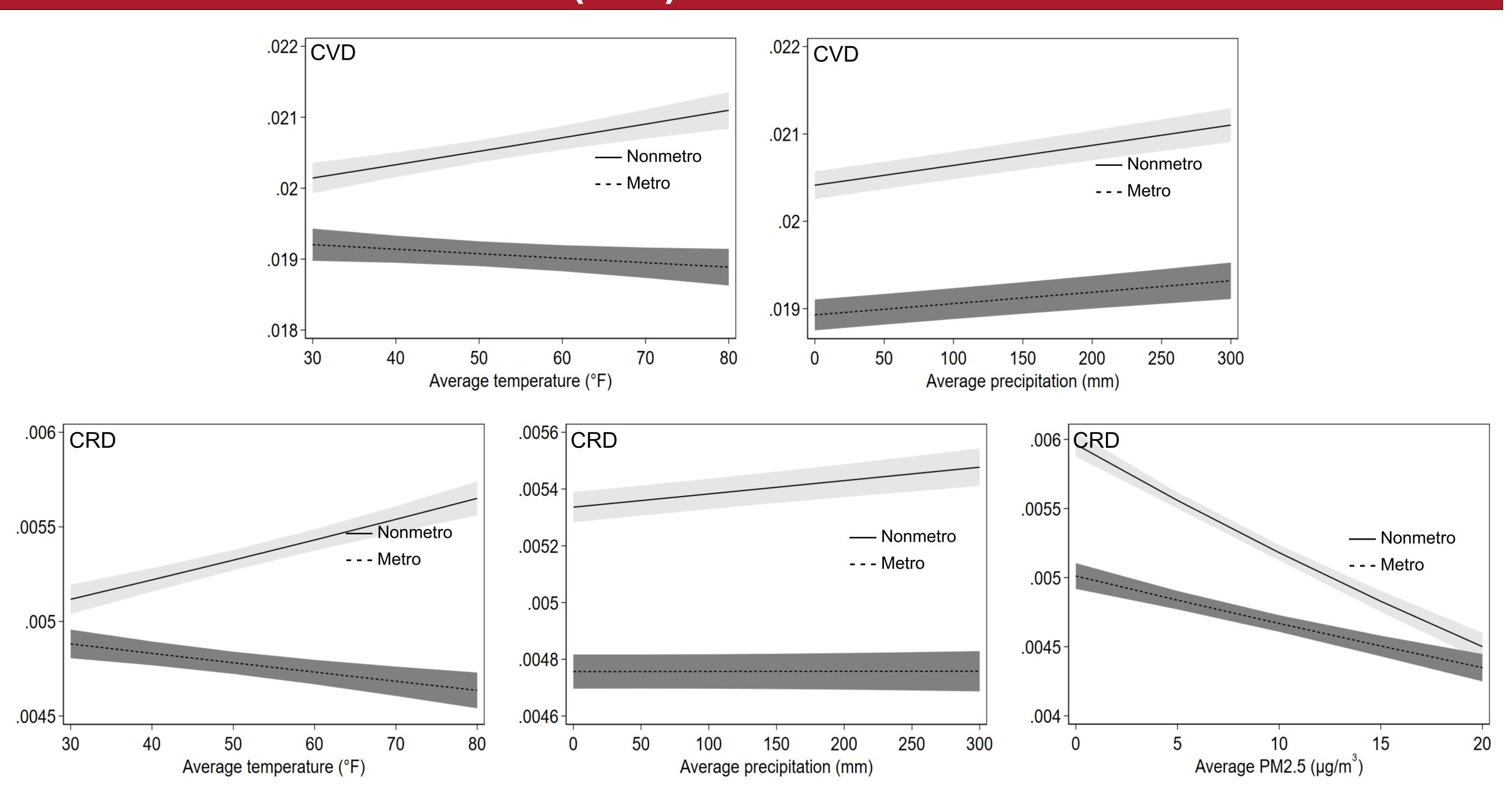
CHILDREN (0 — 14) MORTALITY RATE



ADULT (15 — 64) MORTALITY RATE



ELDER (65+) MORTALITY RATE



CONCLUSIONS

- Environmental exposures such as rising temperature, precipitation, and PM2.5 affected population health, causing heightened CVD- and CRD-related deaths.
- Children were more susceptible to environmental exposures, as such exposures increased CVD- and CRD-related deaths in both rural and urban counties.
- Generally, rural counties were hit harder by environmental exposures, as both CVD- and CRD-related mortality rates were higher than urban counties.
- Interestingly, rural counties may offer health benefits to adult and elder populations, as PM2.5 exposure tended to be associated with lower CVD-and CRD-related mortality rates compared to urban counties.

IMPLICATIONS

This study offers valuable insights into the complex interplay between environmental factors and population health. These insights have the potential to significantly contribute to the field of public health by guiding the development and implementation of targeted intervention strategies to safeguard and improve the health of populations and communities, particularly in the face of growing environmental challenges.