National Institute of Environmental Health Sciences

Effects of Flood Risk and Climate Change on Census Tract-Level Health Outcomes

Alvin Sheng and Kyle P. Messier
NC State University and Spatiotemporal Health Analytics Group, Predictive Toxicology Branch, NIEHS

Background

Floods have been linked to various health outcomes such as mental disorders and chronic diseases. This is likely due to psychosocial and posttraumatic stress caused by natural disasters and inadequate responses to them.

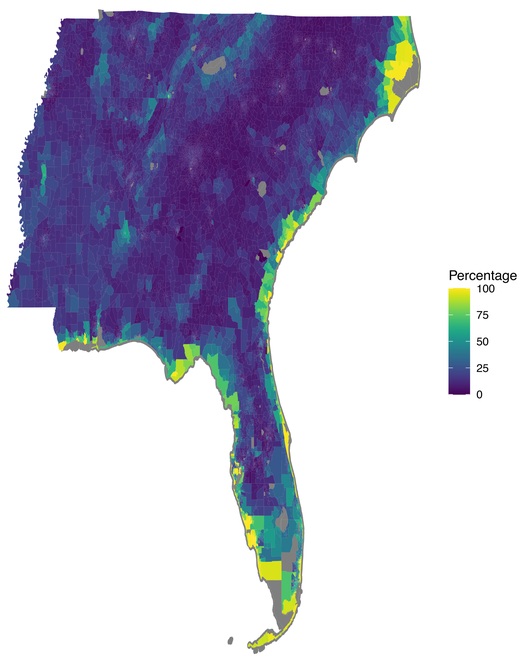
Objective

We estimate the effect of the flood risk at a given census tract on the prevalence of coronary heart disease (CHD) among adults. We also estimate the effects of several social vulnerability indices (SVIs), air pollution, and prevalence of smoking among adults on this health outcome. We focus on 7 states in the Southeastern U.S.: North Carolina, South Carolina, Tennessee, Georgia, Alabama, Mississippi, and Florida.

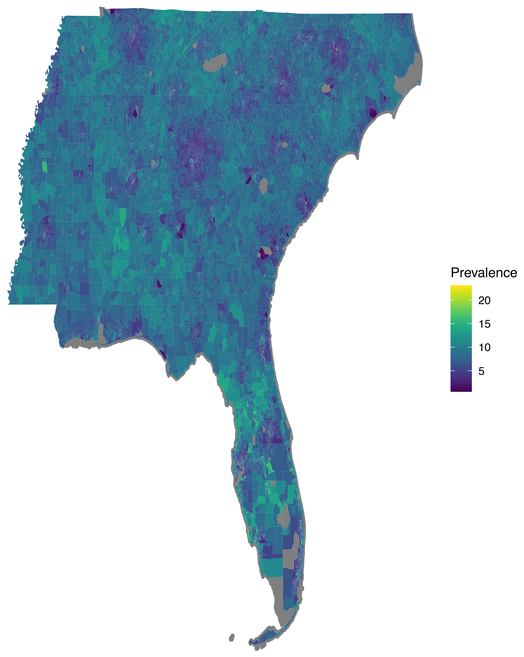
Data

Flood Risk (21 covariates)	- Percent of First Street properties at 3 levels of severity (almost certain, substantial, any risk) and 2 time points (2020, 2050) - Average risk score (1 to 10) - Percent of properties with given risk score
Social Vulnerability Index (16 covariates)	- Percentage of the population below poverty, unemployed, without high school diploma, aged 65 or over, aged 17 or younger, with disability, in single-parent households, with minority status, with poor English, in multi-unit structures, in mobile homes, in crowded quarters, without vehicle, in group quarters, or are uninsured. - Per Capita Income
Air Pollution Concentrations (6 covariates)	- Concentrations of six pollutants from a land use regression model made by the Center for Air, Climate and Energy Solutions: CO, NO2, O3, PM10, PM2.5, SO2
CDC Prevalence (1 covariate, 1 response)	- Prevalence of current smoking among adults - Prevalence of coronary heart disease among adults

Percent of Properties with Any Risk of Flooding in 2050, in each Census Tract



Census Tract CHD Prevalence

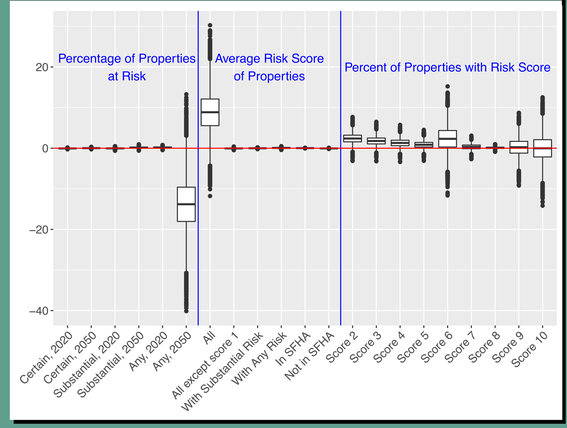


Methods

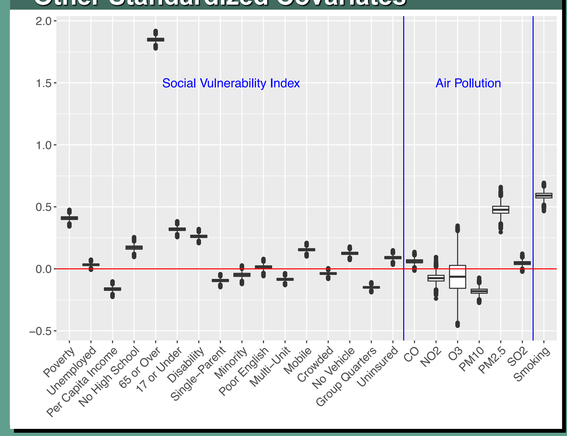
We fit a Bayesian hierarchical model (BHM) where the CHD prevalence at a census tract is a linear function of several flood risk measures, SVIs, air pollution concentrations, and smoking prevalence in the tract. To account for the spatial correlation among census tracts, we use a latent Gaussian conditional autoregressive (CAR) model.

In a CAR model, the random effect in a census tract is encouraged to be close to those in adjacent tracts, inducing spatial dependence.

Posterior Distributions of Coefficients for Flood Risk Standardized Covariates



Posterior Distributions of Coefficients for Other Standardized Covariates



Discussion

Many of the SVIs and air pollutants are associated with a net increase in CHD prevalence. In particular, the percentage of the population 65 or over, PM2.5 concentration, and smoking prevalence are associated with large increases in CHD prevalence.

Even though the flood risk covariates are on overall associated with an increase in CHD prevalence, the only significant covariate under the 5% level was the percent of properties with any risk of flooding in 2050, which is associated with a decrease in CHD prevalence.

Future Directions

- Account for multicollinearity among the flood risk covariates.
- Incorporate other flood risk measures derived from 3-meter level raster data.
- Implement more complex BHMs that include measurement error and multiple response variables.

References

Keep track of all the references you're consulting

Make an overleaf document so you can use BibTex

Example citation:

Gavin J, Jennison C (1997). "A subpixel Image Restoration Algorithm." Journal of Computational and Graphical and Statistics, 6, 182–201.

(This can be wrapped up towards the end.)

Acknowledgments

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