Introduction
- Long-term air pollution exposure has been consistently associated with mortality.
- Obtaining personal exposure information is not feasible.
- Reliance on air pollution concentrations predicted by spatio-temporal models.
- Different modeling choices in exposure and health models across studies.

Motivation
- Although conclusions are relatively consistent across studies, there is variability in reported effect estimates.
- Accurate and precise estimates are necessary for risk assessments and cost-benefit analyses of proposed policy actions.
- Impact in regulatory policy.

Goal: To rigorously assess the sensitivity of the reported results to modeling choices.

Study Description
- Outcome: all-cause mortality.
- Potential confounders: date of death, age of entry, year of entry, sex, race, Medicaid eligibility (SES proxy), and area-level covariates.

PM2.5 Exposure Assessment
- Three well-validated spatio-temporal models.
- PM2.5 concentrations predicted at 1 km x 1 km grid cells.

Methods

Confounding Adjustment
- Lack of randomization in observational studies.
- Adjust for confounding under a causal inference framework using generalized propensity scores (GPS) and area-level covariates.

Exposure Prediction Model
1. Qiu D (QD)1
2. Aaron VanDonkelaar (AV)2
3. Itai Klooq (IK)1

Assignment of exposure (area-weighted):
1. Average of the four grids nearest to the zip-code centroid.
2. Area-weighted aggregation.

Health Model Parameterizations
1. Cox hazards model with GEE.
2. Log-linear model with GEE.

Exposure Comparisons
Example: 2010 zip-code level aggregated PM2.5 surfaces using area weights.

PM2.5 Exposure Aggregation
- Developed area- and population-weighted aggregations.
- Using zonal statistics by performing a spatial merge.

Modeling Choices

Exposure Comparisons
- Comparison of hazard ratios under different PM2.5 models and aggregations.

Model Comparisons: Continuous Exposure
- Overall conclusion does not change depending on the modeling choices in this very large study.
- These differences might be important for smaller sample sizes.
- Obtaining accurate estimates would greatly inform risk assessments and cost-benefit analyses, impacting thus regulatory actions.

References
2. Qiu D, Ono Y, and Ono N. A hybrid prediction model for PM2.5 mass using optimal estimation and geographically weighted regression over Maricopa County, Arizona (USA). Atmospheric Environment, 100:90-100, 2015.

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