Accounting for model uncertainty in estimating the relative risk of mortality associated with heat waves.

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Background and Aims: Estimating the risks heat waves pose to human health is a critical part of assessing the future impact of climate change. While uncertainty in climate model predictions has been studied thoroughly, model uncertainty in estimating the subsequent health effects has not been well explored. This work assesses the contribution of model uncertainty and develops an approach to systematically incorporate model uncertainty into heat wave risk estimation.
Methods: We propose a flexible class of time series models to estimate the relative risk of mortality associated with heat waves and conduct Bayesian model averaging (BMA) to account for the multiplicity of potential models. Methods are applied to data from 105 U.S. cities for the period 1987-2005. We identify those cities having a high posterior probability of increased mortality risk during heat waves, examine the heterogeneity of the posterior distributions of mortality risk across cities, assess sensitivity of the results to the selection of prior distributions, and compare our BMA results to a model selection approach.
Results: Our results show that no single model best predicts risk across the majority of cities, and that for some cities heat wave risk estimation is sensitive to model choice.
Conclusions: While model averaging leads to posterior distributions with increased variance as compared to statistical inference conditional on a model obtained through model selection, we find that the posterior mean of heat wave mortality risk is robust to accounting for model uncertainty over a broad class of models.
References:
Bobb JF, Dominici F, Peng RD (2011). A Bayesian model averaging approach for estimating the relative risk of mortality associated with heat waves in 105 U.S. cities. Biometrics, to appear.