

STATISTICS COLLOQUIUM

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How risky is breathing? Statistical Methods in Air Pollution Risk Estimation

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ABSTRACT

Understanding the toxicity of particulate matter (PM) and its complex mixture is a top research priority identified by the National Research Council. To estimate the toxicity of PM, a patchwork of large and heterogeneous datasets on health outcomes, PM chemical components, and weather variables is now available on a national scale. The integration of these datasets is key to detecting the health effects associated with imperfectly measured, correlated, and potentially confounded environmental mechanisms.

In this talk we review statistical methods for analyses of large spatial-temporal data for identifying health consequences of PM. Specifically we will review methods for : 1) integrating effect estimates across different statistical models for confounding adjustment; 2) decomposing association between exposure and health into different spatio-temporal scales of variation in the data to control for confounding; and 3) estimating the time course of an adverse health outcome after exposure to air pollution. We apply the methods to the largest existing national databases for estimating health effects associated with PM exposure of varying size, and chemical composition.

The ability to make scientific findings reproducible is increasingly important in an area where substantive results are the product of complex statistical computations. We will review tools for making software and data available to the scientific community. The statistical methods reviewed in this talk, although motivated by air pollution studies, can be more generally applied for estimating health consequences of exposures of other chemical mixtures, including cigarette smoke, diesel exhaust, and the human diet.