Statistical Methods for Time Series Analyses of Air Pollution and Health

Abstract

Epidemiological evidence from time series and cohort studies of air pollution and health is central to major policy decisions concerning the risk of death associated with short and long-term air pollution exposure. The nature and characteristics of the data make risk estimation challenging, requiring development of state-of-the-art statistical methods able to detect health risks that are very small relative to the combined effects of confounders and residual variation.

In this course we will review epidemiological and statistical methods in air pollution risk estimation. We will present the course material with data from the two largest studies ever assembled in air pollution and health. The first is the National Mortality Morbidity Air Pollution Study (NMMAPS), a multi-site time series study which includes time series data from the 90 largest US locations for the period 1987-2000. The second is a recently started National Medicare Cohort Study (NMCS) which includes morbidity and mortality individual level data on the entire US population of elderly for the period 1999-2001.

By use of these national data sources we will discuss: epidemiological evidence of the health effects of air pollution; confounding and effect modification in time series studies; statistical modeling for air pollution risk estimation (including semi-parametric Poisson regression, random effect models), and policy implications.

Sources of model uncertainty call for a systematic assessment of model choice and for development of new methods. Importantly, the weight given by this scientific evidence in setting policy requires a level of confidence in findings that is difficult to attain in the small effects/many potential confounders context, regardless of the sophistication of the statistical approach