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Estimating the Independent Effects of Multiple Pollutants in the Presence of Measurement Error: An application of a measurement error resistant technique

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Running Title: Measurement Error Correction

Key Words: air pollution, daily-mortality, measurement error, particulate matter, carbon monoxide.

Abbreviations:
CO – Carbon monoxide
IHAPSS – Internet-based Health and Air Pollution Surveillance System
NMMAPS – National Mortality and Morbidity Air Pollution Study
NO_2 – Nitrogen dioxide
O_3 - Ozone
PM_{10} – Particulate matter of aerodynamic diameter less or equal to 10 $\mu m/m^3$
SO_2 – Sulfur dioxide

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ABSTRACT

Misclassification of exposure usually leads to biased estimates of exposure-response associations. This is particularly an issue in cases with multiple correlated exposures, where the direction of bias is uncertain. It is necessary to address this problem when considering associations with important public health implications such as the one between mortality and air pollution, since biased exposure effects can result in biased risk assessments. The National Morbidity and Mortality Air Pollution Study (NMMAPS) recently reported results from an assessment of multiple pollutants and daily-mortality in 90 US cities. The independent associations of the selected pollutants with daily-mortality were assessed in two-pollutant models. Excess mortality was found to be associated with PM_{10}, but not with other pollutants, in these two pollutant models. The extent of bias due to measurement error in these reported results is unclear. Schwartz and Coull recently proposed a method that deals with multiple exposures and, under certain conditions, is resistant to measurement error. We applied this method to re-analyze the data from NMMAPS. For PM_{10}, we found similar results to those reported previously from NMMAPS (0.24 % increase in deaths per 10$\mu g/m^3$ increase in PM_{10}). In addition we report an important effect of carbon monoxide which had not been observed previously.