THE SENSITIVITY OF TIME-SERIES HEALTH EFFECT ESTIMATES TO FINE PARTICULATE MATTER (PM2.5) CHEMICAL COMPONENTS SAMPLING SCHEDULES

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Background and Aims: The U.S. EPA Speciation Trends Network (STN) is a resource used to investigate the association between PM2.5 chemical components and health in time-series studies. However, the temporally-sparse sampling on every third or sixth day reduces the number of days available for analysis and may influence resulting associations and interpretations. The Denver Aerosol Sources and Health (DASH) study obtained daily speciated PM2.5 data over five years allowing us to examine the impact of less than daily monitoring data on health effect estimates.
Methods: We performed a time-series analysis using daily PM2.5 chemical component concentrations and daily hospitalization counts from 2003 through 2007. Three every third-day sets of time series data for component concentrations were created from daily data, imitating the STN monitoring schedule. A fourth scenario was created using DASH data limited to the actual valid sampling days reported at the closest STN monitor. Four PM2.5 chemical components, elemental and organic carbon, sulfate, and nitrate, measured in the DASH study were examined. Relative risks (RRs per interquartile range increases) of hospitalizations for PM2.5 components at day lags 0 to 3 were estimated for each of the four systematically-missing and for the complete time-series using the Generalized Additive Model. Estimated RRs were compared across sampling schedules.
Results: The estimated RRs often varied between limited and complete sampling schedules and between the four limited sampling schedules, depending on PM2.5 components and hospitalization diagnoses. For example, the association of asthma hospitalization and of nitrate at lag0 using complete time-series data (RR = 0.999; 95 % confidence interval (CI) = 0.998, 1.010; 0.86 $\mu g/m^3$ increase) was elevated and statistically significant in one of the every-third-day scenarios (RR = 1.024; 95 % CI=1.005, 1.043).
Conclusions: Estimated effects of PM2.5 components on hospitalization in time-series studies were sensitive to the completeness of daily sampling and the selection of sampling days.

Acknowledgement: This work was supported by the NIEHS research grant R01 ES010197
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