

ARIES: SUMMARY OF CURRENT FINDINGS

Many of the ARIES results utilizing the 25-month dataset have been published or are in press (Klemm et al., 2004; Metzger et al., 2004; Peel et al., 2005; Sinclair and Tolsma, 2004). Findings based on 53 months of data have been presented at several scientific meetings, including the International Society of Environmental Epidemiology (ISEE) 2004 meeting (August 2004, New York City, NY) and the American Association of Aerosol Research (AAAR) 2004 meeting (October 2004, Atlanta, GA). [Click here for publication and presentation list]

To preclude “data mining” to support preconceived ideas, the primary analyses were conducted using *a priori* models based on a review of the literature as to what was most supportable at the time. *A priori* pollutants were limited to PM₁₀, coarse PM, PM_{2.5}, PM_{2.5} components (elemental carbon, organic carbon, sulfates, total soluble metals), ultrafine PM, O₃ (8-hour max), NO₂ (1-hour max), CO (1-hour max), SO₂ (1-hour max), and oxygenated hydrocarbons (OHC). The *a priori* lag structure was a 2-day moving average (lag 0, 1) for mortality and a 3-day moving average for morbidity measures. Cubic splines were used for time trends (monthly knots), mean temperature, and mean dewpoint. Additional analyses were carried out which considered alternative means of adjusting for time trends and which considered alternative lags.

Current (53-month) findings are summarized below. Results reflect *a priori* models except where otherwise noted.

- Detailed characterization of PM_{2.5} demonstrates that both carbonaceous matter and sulfate are the major components.
- PM_{2.5} composition varies hour-to-hour, day-to-day, and season-to-season. Sulfate comprises the largest fraction of PM_{2.5} in summer, while carbonaceous matter comprises the largest fraction in the spring, fall, and winter.
- There are discrete episodes of elevated ultrafine particle numbers that are believed to be related to anthropogenic emissions. There are several distinct types of these episodes.
- Daily mortality results show that the best model fits for all-cause mortality in those aged 65 and older are observed for PM_{2.5}. Within this category, “other PM_{2.5}” (non-sulfate, non-carbon) is most highly statistically significant. CO is significantly associated with cardiovascular mortality for those over 65.
- Emergency department (ED) visits for all cardiovascular diseases combined are significantly associated with NO₂, CO, elemental carbon (EC), and organic carbon (OC). Disease-specific results are also available.
- ED visits for all respiratory diseases combined are significantly associated with PM₁₀, PM_{2.5}, PM_{2.5} water-soluble metals, ozone, NO₂, CO, and SO₂.
- Associations with all cardiovascular disease ED visits are generally stronger in the cold months (October 15-April 14).
- Associations with all respiratory disease ED visits, especially asthma, are generally stronger in the warm months (April 15-October 14).
- In the warm months, asthma-related ED visits are significantly positively associated with PM₁₀, O₃, NO₂, PM_{2.5}, water soluble metals, EC, and OC. In the cold months, there are no significant positive associations, but metals and EC showed significant negative associations.

- Adverse cardiac events in defibrillator patients are significantly associated with same-day coarse PM.
- Ambulatory care visits for child asthma are associated with EC and water-soluble metals; upper respiratory infections with SO₂; and lower respiratory infections with oxygenated hydrocarbons. There are statistically significant but negative associations between adult asthma and PM_{2.5} water-soluble metals (6-8 day lag), and upper respiratory infections and sulfate (3-5 day and 6-8 day lags). These alternate lag structures consider pollution levels 3-5 or 6-8 days before the ambulatory care visit.
- To date, we see more consistency (health endpoint vs. pollutant) across the health studies in the cardiovascular results, while respiratory results are more varied. Among the pollutants considered, CO is most consistently associated with cardiovascular endpoints.
- Some analytical results are highly sensitive to the models used to analyze the data. The results above are by and large consistent across the set of models analyzed.

Ongoing/secondary analyses currently being performed include multi-pollutant models, source apportionment, spatial analyses, alternative lag structures, additional pollutants, and assessment of measurement error. In particular, specific metals and organic fractions/components are being examined in more detail.