Editorial: Special Issue of Environmental Health Perspectives for Air Pollution and Health: Bridging the Gap from Sources-to-Health Outcomes

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The Conference

EPA has established National Ambient Air Quality Standards for six principal air pollutants, "criteria" pollutants that include carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter in two size ranges (less than 2.5 μm (PM2.5) and less than 10 μm (PM10)), ozone, and sulfur dioxide (http://www.epa.gov/air/criteria.html). While associations have been identified between these pollutants and adverse health effects, considerable uncertainty remains with regards to methods and approaches to understanding relationships between air pollution and health effects, which components (gas and or aerosol)/sources are most toxic, the mechanisms of actions of the pollutants and causal relationships, effect of confounding factors, and who are susceptible populations, especially for particulate matter since it is composed of many components (EPA Criteria Documents and Integrated Science Assessments). Air pollution and health research continues to reduce these uncertainties across the source-to-health effects paradigm as described by the National Research Council (NRC, Research Priorities for Airborne Particulate Matter, vol. I-IV, 1998, 1999, 2001, 2004) and EPA (EPA Criteria Documents and Integrated Science Assessments).

Linking air pollution and adverse health effects is complicated and requires expertise across a range of scientific disciplines from atmospheric to exposure to health sciences as well as inclusion of air quality managers and policy makers who implement and develop policy to reduce risk from air pollution. Interaction among these groups at different points in time helps to identify gaps in knowledge and suggest future research directions. March 2010 provided one such opportunity through "***Air Pollution and Health: Bridging the Gap from Sources to Health Outcomes***" an international specialty conference by the American Association for Aerosol Research (AAAR) (http://aaar.2010specialty.org/). The Conference was chaired by Drs. Paul A. Solomon (U.S. EPA) and Maria Costantini (HEI) and was designed to help disseminate and integrate results from scientific studies that cut across the range of air pollution and health related disciplines of the source-to-health effects continuum. The conference addressed the science of air pollution and health within a multipollutant framework, focusing across five key science areas: sources, atmospheric sciences, exposure, dose, and health effects as identified by the NRC (1998). Eight key policy-relevant science questions that integrated across various parts of these science areas formed the basis of the meeting. A ninth question addressed the policy implications of the findings. The science questions are listed below. Additional information, including the conference objectives and abstracts can be found at http://aaar.2010specialty.org.

This was AAAR's third international specialty conference and extends the findings presented at AAAR's first specialty conference "Particulate Matter: Atmospheric Sciences, Exposure, and the Fourth Colloquium on PM and Human Health," Pittsburgh, PA, 2003 (Davidson et al. Airborne Particulate Matter and Human Health: A Review; AS&T 39:737–749).

Results from the 2010 AAAR Air Pollution and Health conference are being published in six special journal issues (Environmental Health Perspectives – this issue; Air Quality, Atmosphere and Health (including a second addressing the science questions directly); Aerosol Science and Technology; Atmospheric Environment; and Inhalation Toxicology – 22[S2], 2010). All six special issues will be published by spring 2011.

This issue includes selected papers from the Conference that align with the goals and objectives of Environmental Health Perspectives. Results presented indicate the importance of a multipollutant approach and the further importance of including components of particulate matter to understanding the linkages between sources and adverse health outcomes, including respiratory and/or cardiovascular (Rohr et al.; Ito et al.; Lall et al.; Zhou et al.), associated effects, such as inflammation (Alexeeff et al.), and birth effects associated with exposures to traffic related pollution during gestation (Malmqvist et al.). Several air pollution components and sources were associated with these health effects including elemental carbon and secondary organic aerosol, traffic, local industrial sources, and residential oil and wood burning. Where studied some effects varied by season and location (specifically, Detroit, Seattle, New York City), likely due to the influence of different source impacts. Most of the above papers were based on epidemiological studies, except one toxicological study using CAPs exposure to mice (Rohr et al.). One paper identified characteristics of populations related to susceptibility – Who's Susceptible? – and developed a comprehensive definition of susceptibility (Sacks et al.). One accountability study (Lobdell et al.) was conducted showing the advantages to hybrid regional-local modeling to assess health improvements in small communities (New Haven, CT).

Acknowledgements

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committee members as listed at http://aaar.2010specialty.org/ and in the Conference program (http://aaar.2010specialty.org/pdfs/2010_Specialty_Conf_Final_Program.pdf), and to those who attended and participated in the meeting.

Declaration of interest

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Policy Relevant Science Questions

SQ1. How does our understanding of the health effects of air pollutants (singly or in mixtures) help identify pollutants that can be linked to sources the control of which would provide maximal health benefits? (Overarching Theme)

SQ2. How reliable are methods (measurements and models) and approaches (epidemiological and toxicological) for studying and quantifying the links between air pollutants (species and or sources) and adverse health effects?

SQ3. How do relevant pollutant properties vary in space and time from sources and in ambient air; what are the implications of these variations for population exposure?

SQ4. What advances have been made in understanding the relationships between exposure, both spatially and temporally, and estimates of dose that tie to health outcomes?

SQ5. Are patterns emerging that relate component(s) of air pollution and/or source types to mechanisms? What is the status of identifying and measuring biomarkers of exposure and/or adverse health effects from air pollution?

SQ6. Who are the susceptible populations, what drives different susceptibilities to the same or different air pollutants, and are there susceptibility traits associated with specific health outcomes that are common among the subpopulations?

SQ7. What roles do confounding or other factors have in increasing, decreasing, or obscuring attribution of the true health effects from ambient air pollutants?

SQ8. Do actions taken to improve air quality result in reduced ambient concentrations of relevant pollutants, exposure, and health effects, and have we encountered unintended consequences?

SQ9. What are the policy implications of our improved understanding of the source to health effect paradigm?