Publication

Mortality and morbidity effects of long-term exposure to low-level PM2.5, BC, NO2, and O3: an analysis of European cohorts in the ELAPSE project

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Epidemiological cohort studies have consistently found associations between long-term exposure to outdoor air pollution and a range of morbidity and mortality endpoints. Recent evaluations by the World Health Organization and the Global Burden of Disease study have suggested that these associations may be nonlinear and may persist at very low concentrations. Studies conducted in North America in particular have suggested that associations with mortality persisted at concentrations of particulate matter with an aerodynamic diameter of less than 2.5 μm (PM; 2.5;) well below current air quality standards and guidelines. The uncertainty about the shape of the concentration-response function at the low end of the concentration distribution, related to the scarcity of observations in the lowest range, was the basis of the current project. Previous studies have focused on PM; 2.5; , but increasingly associations with nitrogen dioxide (NO; 2;) are being reported, particularly in studies that accounted for the fine spatial scale variation of NO; 2; . Very few studies have evaluated the effects of long-term exposure to low concentrations of ozone (O; 3;). Health effects of black carbon (BC), representing primary combustion particles, have not been studied in most large cohort studies of PM; 2.5; . Cohort studies assessing health effects of particle composition, including elements from nontailpipe traffic emissions (iron, copper, and zinc) and secondary aerosol (sulfur) have been few in number and reported inconsistent results. The overall objective of our study was to investigate the shape of the relationship between long-term exposure to four pollutants (PM; 2.5; , NO; 2; , BC, and O; 3;) and four broad health effect categories using a number of different methods to characterize the concentration-response function (i.e., linear, nonlinear, or threshold). The four health effect categories were (1) natural- and cause-specific mortality including cardiovascular and nonmalignant as well as malignant respiratory and diabetes mortality; and morbidity measured as (2) coronary and cerebrovascular events; (3) lung cancer incidence; and (4) asthma and

chronic obstructive pulmonary disease (COPD) incidence. We additionally assessed health effects of PM; 2.5; composition, specifically the copper, iron, zinc, and sulfur content of PM; 2,5; .; We focused on analyses of health effects of air pollutants at low concentrations, defined as less than current European Union (EU) Limit Values, U.S. Environmental Protection Agency (U.S. EPA), National Ambient Air Quality Standards (NAAQS), and/or World Health Organization (WHO) Air Quality Guideline values for PM; 2.5; , NO; 2; , and O; 3; .

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