Ambient Pollution and Blood Pressure in Cardiac Rehabilitation Patients

Antonella Zanobetti, PhD; Marina Jacobson Canner, MA; Peter H. Stone, MD; Joel Schwartz, PhD; David Sher, BA; Elizabeth Eagan-Bengston, MS; Karen A. Gates, MS; L. Howard Hartley, MD; Helen Suh, PhD; Diane R. Gold, MD, MPH

From the Department of Environmental Health, Harvard School of Public Health (A.Z., J.S., H.S., D.R.G.), and Channing Laboratory (M.J.C., J.S., D.S., E.E.-B., K.A.G., D.R.G.) and Division of Cardiology (P.H.S., L.H.H.), Brigham and Women’s Hospital, Department of Medicine, Harvard Medical School, Boston, Mass.

Correspondence to Antonella Zanobetti, Department of Environmental Health, Exposure Epidemiology and Risk Program, Harvard School of Public Health, 401 Park Dr, Landmark Center, Suite 415, PO Box 15698, Boston, MA 02215. E-mail azanobet@hsph.harvard.edu

Received April 28, 2003; de novo received March 23, 2004; accepted May 20, 2004.

Background—Multiple studies have demonstrated a consistent association between ambient particulate air pollution and increased risk of hospital admissions and deaths for cardiovascular causes. We investigated the associations between fine particulate pollution (PM$_{2.5}$) and blood pressure during 631 repeated visits for cardiac rehabilitation in 62 Boston residents with cardiovascular disease.

Methods and Results—Blood pressure, cardiac risk factor, and exercise data were abstracted from records of rehabilitation visits between 1999 and 2001. We applied mixed-effect models, controlling for body mass index, age, gender, number of visits, hour of day, and weather variables. For an increase from the 10th to the 90th percentile in mean PM$_{2.5}$ level during the 5 days before the visit (10.5 µg/m$^3$), there was a 2.8-mm Hg (95% CI, 0.1 to 5.5) increase in resting systolic, a 2.7-mm Hg (95% CI, 1.2 to 4.3) increase in resting diastolic, and a 2.7-mm Hg (95% CI, 1.0 to 4.5) increase in resting mean arterial blood pressure. The mean PM$_{2.5}$ level during the 2 preceding days (13.9 µg/m$^3$) was associated with a 7.0-mm Hg (95% CI, 2.3 to 12.1) increase in diastolic and a 4.7-mm Hg (95% CI, 0.5 to 9.1) increase in mean arterial blood pressure during exercise in persons with resting heart rate ≥70 bpm, but it was not associated with an increase in blood pressure during exercise in persons with heart rate <70 bpm.

Conclusions—In patients with preexisting cardiac disease, particle pollution may contribute to increased risk of cardiac morbidity and mortality through short-term increases in systemic arterial vascular narrowing, as manifested by increased peripheral blood pressure.

Circulation. 2004;110:2184-2189