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Women in polluted areas at higher risk of cardiovascular disease

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Women living in areas with higher levels of air pollution have a greater risk of developing cardiovascular disease and subsequently dying from cardiovascular causes, according to a University of Washington study appearing in the Feb. 1 issue of *The New England Journal of Medicine*. The study is one of the largest of its kind, involving more than 65,000 Women's Health Initiative Observational Study participants, age 50 to 79, living in 36 cities across the United States.

UW researchers studied women who did not initially have cardiovascular disease, following them for up to nine years to see who went on to have a heart attack, stroke, or coronary bypass surgery, or died from cardiovascular causes. They linked this health information with the average outdoor air pollution levels near each woman's home, and found that higher pollution levels posed a significant hazard -- much higher than previously thought -- for development of cardiovascular disease.

The researchers studied levels of fine particulate matter, which are tiny airborne particles of soot or dust, and can come from a variety of sources, like vehicle exhaust, coal-fired power plants, industrial sources, and wood-burning fireplaces. These particles are less than 2.5 microns in diameter -- about 30 to 40 of them would equal the diameter of a human hair. Particulate matter levels are monitored and regulated by the U.S. Environmental Protection Agency (EPA). They're typically invisible to the human eye once they're in the atmosphere, though they may be visible in dense clouds as they come out of a tailpipe, smokestack or chimney, and are responsible for urban haze.

"These soot particles, which are typically created by fossil-fuel combustion in vehicles and power plants, can contain a complex mix of chemicals," explained Dr. Joel Kaufman, professor of environmental & occupational health sciences, epidemiology, and medicine at the UW, and leader of the study. "The tiny particles -- and the pollutant gases that travel along with them -- cause harmful effects once they are breathed in."

Fine particulate matter is measured in micrograms (or millionths of a gram) per cubic meter; cities in the study had average levels of fine particulate matter ranging from about 4 to nearly 20 micrograms per cubic meter. The researchers found that each 10-unit increase in fine particulate matter level was linked to a 76 percent increase in the risk of death from cardiovascular disease, after taking into account known risk factors such as blood pressure, cholesterol, and smoking. Higher long-term average levels of fine particulate matter also led to a higher overall risk of cardiovascular disease events, including stroke and heart attack.

They also found that local differences in particulate matter levels within a city, as well as exposure differences between cities, translate to a higher or lower risk of cardiovascular disease and related death.

"Our findings show that both what city a woman lived in, and where she lived in that city, affected her exposure level and her disease risk," said Kristin Miller, first author of the study and a doctoral student in epidemiology at the UW.

Previous studies have found apparent links between airborne particulate matter and

cardiovascular disease, but this study was the first to look specifically at new cases of cardiovascular disease in previously healthy subjects and local air pollution levels within metropolitan areas. Researchers used data from the multi-site Women's Health Initiative Observational Study, which is funded by the National Heart Lung and Blood Institute of the National Institutes of Health (NIH), and coordinated through a center based at the Fred Hutchinson Cancer Research Center in Seattle. The EPA and the National Institute of Environmental Health Sciences provided funding for the study of the effects of air pollution.

Scientists don't understand exactly how fine particulate matter may be leading to cardiovascular disease, but some believe that the soot particles are accelerating atherosclerosis, or hardening of the arteries, which is the major precursor of heart disease.

"This could be a cellular and biochemical process that starts in the lung and then proceeds from there into the cardiovascular system," Kaufman explained. "Or it could be that these very small particles actually enter the blood stream through vessels in the lung, and then begin affecting blood vessels throughout the body."

Kaufman is leading a major new EPA-funded study to uncover these mechanisms -- an air-pollution study based on the NIH's Multi-Ethnic Study of Atherosclerosis, or MESA. The MESA Air Pollution Study tackles two key areas for understanding this problem, Kaufman said: investigating the mechanisms through which particulate matter leads to cardiovascular disease, and identifying the sources of pollution that cause the problem. "Preventing these effects requires reducing the pollution at the source," Kaufman said.

The implications of this connection could be very significant.

"More than one out of three deaths in the United States are due to cardiovascular disease -- it's the leading cause of death," Miller said. "If the annual average concentration of fine particulate air pollution can be reduced, it would potentially translate on a national scale to the prevention or delay of thousands and thousands of heart attacks, strokes, and bypass surgeries, not to mention fewer early deaths."

An editorial from researchers at the Harvard School of Public Health and Brigham and Women's Hospital will accompany the study in the Feb. 1 issue of the journal. In that editorial, the authors suggest public health interventions to address this problem, as well as a tightening of the EPA standards regulating fine particulate matter pollution.

In addition to Kaufman and Miller, the study included researchers from the UW School of Medicine and the School of Public Health and Community Medicine, the Fred Hutchinson Cancer Research Center, and Harborview Medical Center, all in Seattle.

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NOTE: To determine the average annual concentration of fine particulate matter for a particular city or county, visit the EPA's Air Trends Web site and look for "PM 2.5 Wtd AM" in the tables provided. The most recent data available from the EPA is from 2005.

<http://www.epa.gov/airtrends/factbook.html>

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