

## **U.S. Environmental Protection Agency: Air Quality and Cardiovascular Diseases**

*Older women living in areas with high levels of fine particles or particulate matter (PM) pollution have a greater risk of developing cardiovascular disease and subsequently dying from cardiovascular causes.*

### **Lead Agency:**

U.S. Environmental Protection Agency

### **Agency Mission:**

The mission of the U.S. Environmental Protection Agency (EPA) is to protect public health and safeguard the natural environment.

### **Principal Investigator:**

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### **Partner Agency:**

University of Washington

### **General Description:**

EPA-funded research at the University of Washington found that older women living in areas with high levels of fine particles or particulate matter (PM) pollution have a greater risk of developing cardiovascular disease and subsequently dying from cardiovascular causes. Scientists studied more than 65,000 women, aged 50 to 79, with no history of cardiovascular disease. These postmenopausal women lived in 36 U.S. metropolitan areas throughout the United States and were part of the Women's Health Initiative Observational Study, initiated by the National Institutes of Health. Researchers found that long-term exposure to fine particulate air pollution was strongly associated with cardiovascular disease and death among postmenopausal women. Each 10  $\mu\text{g}/\text{m}^3$  increase in the level of fine particulate matter in ambient air 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. Increased average levels of fine particulate matter were associated with a 24 percent increased risk of cardiovascular disease problems, including stroke and heart attack. Finally, the study found that obese individuals, defined as having a high body mass index or high waist-to-hip ratio, were more susceptible to the health effects linked to increased particulate matter levels. These

are intriguing new findings that have spurred additional research studies to verify and understand the link with obesity.

The people in this study were ideally suited for the investigation of the links between long-term air pollution exposure and cardiovascular disease and mortality. The very large cohort or population was established between 1994 and 1998, and study participants were followed for up to nine years to see who had heart attacks, stroke, coronary bypass surgery, or died from cardiovascular causes. Participants resided in 36 cities throughout the United States, allowing for comparisons of cities with a variety of air pollution levels and with different atmospheric composition. To estimate people's exposure to fine particles or PM<sub>2.5</sub>, the researchers used the average PM<sub>2.5</sub> level recorded in the year 2000 (the midpoint of follow-up in the study) recorded by a monitor located closest to a participant's residence. Most women lived within 6 miles of a monitor. In addition, the investigators were able to explore differences in risk associated with particulate matter concentrations in the cities where participants lived and compare them to between-city effects. For cardiovascular events, the within-city effect was larger than the between-city effect.

***Excellence:***                   What makes this project exceptional?

This is the first study to follow, over time, the development of new cases of cardiovascular disease in a healthy population. Previous studies have relied solely on reviews of death records. The scientists studied air pollution exposure among participants of a longitudinal study established by the National Heart Lung and Blood Institute of NIH which has produced other important research on heart disease, cancers, and osteoporosis. The study was designed to document specific, first, cardiovascular "events" such as heart attacks. Study scientists conducted annual questionnaires to ascertain cardiovascular diagnoses and then reviewed medical records to confirm and classify them. Deaths were identified through family members and the National Death Index.

This is also one of the first studies to look at local air pollution levels within metropolitan areas. 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. In previous studies of the long-term effects of air pollution, scientists averaged pollutant concentrations from monitors located in a city and then compared health effects between cities. The assignment of particulate matter concentrations measured at the monitor closest to the participants' homes probably resulted in more accurate estimates of PM exposure for each individual compared to previous studies.

***Significance:***                   How is this research relevant to older persons, populations and/or an aging society?

This study establishes a stronger association between long-term exposure to fine particulate air pollution and death from coronary heart disease, one of the leading causes of illness and mortality among older adults, than was found in earlier studies. The finding

that health risks associated with within-city differences in pollutant concentrations are higher than risks associated with between-city pollution levels suggests that, as pollution exposure estimates assigned to study participants become more precise, studies may find that health risks associated with fine particulate air pollution are higher than previously estimated.

***Effectiveness:***           What is the impact and/or application of this research to older persons?

This research indicates that older people, especially people with pre-existing health conditions, should be very cautious about their time spent outside on days when the air quality is poor. It reinforces the need for alerts on days with large amounts of fine particle pollution in the air. It also underscores the need to rigorously enforce and periodically re-evaluate the National Ambient Air Quality Standards for particulate matter.

***Innovativeness:***       Why is this research exciting or newsworthy?

This research is the first to look at fine air pollution levels in major metropolitan areas around the U.S. and connect exposure to pollution with the development of new cases of cardiovascular disease in a healthy population.