

10-Year Study Links Faster Progression of Atherosclerosis to Air Pollution

MESA Air:

The Multi-Ethnic Study of Atherosclerosis Air Pollution Study (MESA Air) was the first U.S. research study to examine a group of people over a period of 10 years and measure directly how *long-term* exposure to air pollution contributes to the development of heart disease and can lead to heart attacks, abnormal heart rhythms, heart failure and death. This unprecedented prospective epidemiology study was conducted by the University of Washington and funded in 2004 by EPA's Science to Achieve Results (STAR) Program. The study involved 6,800 ethnically diverse participants from across the United States at six locations. This work leveraged the Multi-Ethnic Study of Atherosclerosis (MESA), funded by the National Heart, Lung, and Blood Institute, which follows the development of cardiovascular disease in healthy people by tracking periodic visits to medical centers for checkups and specialized imaging studies that can reveal important changes in the arteries.

MESA Air researchers addressed key questions concerning the effects of air pollutants on the process of the development of heart disease. They include:

- Does long-term exposure to air pollutants increase the progression of cardiovascular disease in a healthy cohort over time?
- Is long-term exposure to air pollutants contributing to the incidence of clinical cardiovascular events such as heart attacks and strokes?
- Are specific subpopulations especially susceptible to the effects of air pollution?

What is Atherosclerosis and Why Is It Important?

Atherosclerosis is the build-up of lipid and calcium deposits along the inner lining of arteries forming plaque. Atherosclerosis is an insidious disease that can begin early in life, is progressive, and is usually irreversible. Over time, the plaque buildup causes arteries to stiffen and narrow, reducing flow of oxygen-rich blood. Additionally, a portion of the plaque may rupture and block the vessel, causing a heart attack and increasing the risk of heart failure and death.

Key Findings

At the launch of MESA Air, the link between air pollution and cardiovascular disease needed more investigation to fully understand the impact of air pollutant exposure on the heart, its blood supply, and the many factors that might affect that relationship. Over the last decade, the study has resulted in close to 100 peer-reviewed journal articles, providing significant contributions to the body of knowledge on the effects of air pollution on cardiovascular disease. Some of the key findings are:

- Through repeated clinical measurements in individuals over time, these results demonstrate the biological processes through which long-term air pollution exposures contribute to cardiovascular disease. This work confirms and strengthens previous studies of the association between air pollution and cardiovascular disease, and the findings support the causal relationship between air pollution and cardiovascular morbidity and mortality.
- Long-term exposure to ambient concentrations of fine particles (PM_{2.5}) and nitrogen oxides (NO_x) is associated with the progression of atherosclerosis as indicated by the accumulation of coronary artery calcium. Increases in air pollution can accelerate the development of atherosclerosis. One way to describe this damage is the premature aging of blood vessels.

- Older adults and those with hypertension are more susceptible to the effects of air pollution. Gender and ethnicity differences were not found in the study.
- Long-term exposure to air pollution is related to increases in markers of inflammation and decreases in markers of fibrinolysis, which is a normal biological process that dissolves blood clots.
- Long-term exposure to PM_{2.5} is associated with dysfunction of the lining of blood vessels.

These results and others from MESA Air's published journal articles support the finding that exposure to PM_{2.5} is associated with premature aging of the cardiovascular system. MESA Air provides a trove of data that will be used to investigate a variety of scientific questions for years to come. This long-term research illustrates the benefits of collaboration between the environmental science and medical research communities to address cardiovascular disease, the number one cause of death in the United States.

www.epa.gov/air-research/multi-ethnic-study-atherosclerosis-mesa-air-study-research

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