

Air Pollution and Heart Disease Research

Air pollution is known to cause a variety of health problems, including effects on the heart, nervous, and vascular system. A significant body of research has shown that long-term exposure to fine particulate matter, known as PM_{2.5}, can impact heart disease. These particles can adversely affect the heart if it is weakened by disease.

Air pollution particles are emitted year-round from motor vehicles, power plants, industries, and forest fires and are created when sunlight interacts with vapor and gaseous pollutants. Evidence is also mounting that other air pollutants may affect the heart alone or in concert with particulate matter.

Research continues to focus on the relationship between air pollutants such as PM_{2.5}, ozone and pollutant mixtures, and long-term and short-term effects on the cardiovascular system. The discoveries provide the scientific foundation to review the National Ambient Air Quality Standards and protect the health of the American people.

Health effects

Researchers are studying air pollutants like ozone, PM, and mixtures to further understand the impacts on the heart and blood vessels and the potential impacts on underlying conditions, including hypertension, diabetes, and obesity.



- **CATHGEN.** Using the CATHGEN database developed by Duke University School of Medicine researchers, EPA is exploring how health factors in individuals affect responses to air pollution. The research investigates the acute and chronic health effects of pollutant mixtures as well as individual effects on the cardiovascular system.
- **Multi-pollutants.** Since we are often exposed to more than one air pollutant at a time, air pollutant mixtures are being studied in human populations and in experimental animals to determine how they may interact with one another to cause health effects. Scientists are also studying selected mixtures where the effect of one pollutant may be modified by one or more in combination.
- **Vulnerable people.** Some groups of people may be more susceptible to the negative effects of air pollution, including those with heart disease. Through close examination of at-risk groups—such as asthmatics, elderly people, or others with genetic markers for disease—as well as healthy people, scientists are identifying risk factors and genes that may cause a person to be more sensitive to air pollution.
- **Atherosclerosis.** An EPA-funded study called the Multi-Ethnic Study of Atherosclerosis (MESA) Air Pollution Study is aimed at examining the development and progression of atherosclerosis, also known as hardening of the arteries, and other health effects of long-term exposure to fine particles and multi-pollutants in different cities and ethnic groups.
- **Clean Air Research Centers (CLARCs).** EPA's CLARCs are studying various health effects including cardiovascular risks from exposure to air pollutants. The centers are focused on mixtures of pollutants rather than any single pollutant.
- **Health Effects Institute (HEI).** With partial funding by EPA, HEI is conducting research and assembling reports on exposure to mixtures of pollutants and very small particles, called ultrafine particles. Using models, researchers are working to analyze the health effects of these mixtures, including cardiovascular problems.

Sources of air pollution

In order to understand the impacts of air pollution on the heart and cardiovascular system, researchers are studying combustion sources that emit particles and their precursors. Air pollution comes from a variety of natural and man-made sources, including wildfires, power plants, industry, and motor vehicles.

- Using recent advances in molecular biology, researchers are working to determine the health risks to certain groups of people. Real-time monitoring is used to assess linkages between exposures to air pollution mixtures and their related health effects.
- To better understand the impact of major emission sources near communities, EPA is assessing the pollutant exposure levels near known air pollution sources such as ports and rail yards, roadways, and wildfires.
- Wildfire research is providing important information on the toxic effects of smoke exposure by individuals living near wildfires, including people in lower socioeconomic groups. Findings of a peat bog fire in North Carolina in 2008 show smoke from wildfires increases emergency room use because of lung and heart problems. Studies in experimental animals are being used to assess how different types of wildfires can carry varied risk of health effects due to varied emission components.

Intervention strategies

EPA is evaluating tools and methods to help communities, states, and policy makers control and reduce air pollution's health risks, including those to the heart.

- Scientists are studying intervention strategies such as roadway barriers (walls or tree lines) to minimize pollutant exposure and health risks of roadway-related air pollutants.
- Various modeling approaches that incorporate social and economic factors are being developed to assist communities with urban development and land use planning.
- Potential personal intervention strategies are also being investigated. One EPA study found that dietary additions of omega-3 fatty acids, found in fish, can reduce some biochemical and physiological responses after exposure to air pollution.

Key links

CATHGEN

<http://dmpi.duke.edu/cathgen>

MESA Air Study

University of Washington
grantee web page:

<http://depts.washington.edu/mesaair>

EPA web page:

www2.epa.gov/air-research/multi-ethnic-study-atherosclerosis-mesa-air-study-research

Clean Air Research Centers

<http://www2.epa.gov/air-research/clean-air-research-center-grants>

Health Effects Institute

<http://cfpub.epa.gov/ncer/abstracts/index.cfm/fuseaction/outlinks.centers/center/214>

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