FACTS

Danger in the Air

Air Pollution and Cardiovascular Disease

OVERVIEW

The air we breathe shouldn't pose a serious threat to our health, but unfortunately the polluted air in the U.S. is doing just that. Air pollution, which contains tiny particles and invisible gases, comes from sources such as power plant and vehicle emissions, fires, and even windblown dust.[1] These particles and gases can cause an array of health problems, including acute and chronic cardiovascular conditions.[2]

Cardiovascular disease (CVD) is the number one killer of Americans, accounting for one in every three deaths, and sadly the state of our air is directly contributing to the problem.[2] Air pollution levels across the U.S., particularly in cities, are periodically high enough to trigger potentially life-threatening heart problems.[3] That's the bad news. However, reducing exposure to dangerous polluted air can decrease the risk of cardiovascular events. The American Heart Association advocates for measures that reduce Americans' exposure to air pollution, and for more research on the impact of air pollution on the public's health. The American Heart Association further recommends that physicians and other health care practitioners talk to their patients about the CVD risks from exposure to polluted air.

FINE PARTICULATE MATTER

Particulate matter, or PM, is a significant source of heart-damaging air pollution. PM is a combination of tiny particles and liquid droplets that contain ingredients such as acids, chemicals, metals, and organic matter.[1] Of greatest concern is fine particulate matter, also known as $PM_{2.5}$, which is less than 2.5 micrometers (μm) in diameter. Because $PM_{2.5}$ is so small, when inhaled, it can reach deep inside the lungs, leading to a wide range of health problems.[4]

Fossil fuel emissions are a major source of air pollution, including fine particulate matter that may contain arsenic, selenium, and sulfates from sulfur dioxide.[2] These types of $PM_{2.5}$ are generated from burning materials such as coal, oil, diesel, and gasoline, and from high-temperature industrial processes at steel mills and power plants.[1]

Because $PM_{2.5}$ can remain in the atmosphere for long periods of time and travel hundreds or even thousands of miles from its source, the majority of the U.S. population may be exposed to $PM_{2.5}$.[1] Exposure is of particular concern for individuals who are already at risk for CVD or its complications, such as the elderly or those with a preexisting heart condition.[2] In sensitive populations, exposure to $PM_{2.5}$ for even a few hours or days can trigger cardiovascular disease-related deaths from heart attack, stroke, arrhythmia, sudden cardiac arrest, and heart failure.[2,5,6] Short-term increases in $PM_{2.5}$ levels lead to the early death of tens of thousands of Americans every year.[7] Longer-term exposure over a few years further increases the risk of cardiovascular mortality and decreases life expectancy by months to years.[2]

Short-Term PM Exposure

Cause of Death	% of Total Deaths	Cause-specific ↑ per 10 μg/m³ ↑ in $PM_{2.5}$	Approximate % of excess deaths due to PM exposure
All cause	100%	1.0%	100%
Respiratory	8%	0.5-1.5%	12%
Cardiovascular	45%	0.5-1.5%	68%

Long-term Exposures: CV-mortality RR ↑ by 10-76%

Source: C. Arden Pope III, as quoted by Robert D. Brook, *Air pollution and cardiovascular disease*. Available at http://www.epa.gov/agingepa/pdfs/press/AHA_PMtalk_Brook_12_11.pdf

Fortunately, reducing exposure to fine particulate matter can decrease the risk of cardiovascular events within a few years. A recent large-scale study found that reductions in particulate matter air pollution over a two-decade period was associated with increased life expectancy, even after controlling for variables such as demographics, socioeconomic status, and smoking exposure.[8]

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OZONE

Ground-level ozone, the major component of smog, is an invisible gas that forms when pollutants such as hydrocarbon vapors, nitrogen oxides, and carbon monoxide undergo a chemical reaction in the presence of heat and sunlight.[9] These pollutants come from sources such as vehicle emissions, refineries, factories, power plants, and industrial boilers.[7] Ozone remains in the atmosphere for a long time, sometimes long enough to cross continents.[7] It is commonly found downwind of pollutant sources, placing large groups of people at risk of exposure.[7]

Recent studies have increasingly shown a connection between ozone exposure and risk of CVD. Ozone reacts with tissues in the human body and can cause inflammation and changes in heart rate in only a few hours.[6,7,8] These cardiovascular changes may cause heart attacks and sudden cardiac arrest in sensitive populations, such as those with a preexisting heart condition, children, and the elderly.[6,7,10]

THE ASSOCIATION ADVOCATES

Everyone in the U.S. would benefit from improved air quality, whether they currently have CVD or not. The American Heart Association therefore advocates for a comprehensive approach to clean air, including:

- Supporting the full implementation of the Clean Air Act.
- Tightening regulations on sources of particulate matter and ozone to improve the quality of our air.
- Configuring and designing cities and communities to provide greater separation between residents and pollution sources such as highways and power plants.
- Encouraging physicians and other health care professionals to talk to their patients about the cardiovascular risks of exposure to significant air pollution and provide tips for reducing this exposure, such as avoiding prolonged or heavy outdoor exertion during times when the air quality may be dangerous.
- More research into the impacts of various types of air pollutants on health, including those found in indoor air pollution.

References:

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