

# Pinpointing air pollution's effects on the heart

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Scientists are untangling how the tiniest pollution particles – which we take in with every breath we breathe – affect our health, making people more vulnerable to cardiovascular and respiratory problems. While scientists know that air pollution can aggravate heart problems, showing exactly how it does so has been challenging.

In a study published recently in the journal *Environmental Health Perspectives*, scientists showed that in people with diabetes, breathing ultrafine particles can activate platelets, cells in the blood that normally reduce bleeding from a wound, but can contribute to cardiovascular disease.

The investigators from the University of Rochester Medical Center studied people with Type 2 diabetes so they could track changes in the blood in response to breathing ultrafine particles, specifically in a group of people who are prone to heart disease. Just last week, other scientists announced in the *New England Journal of Medicine* that diabetes doubles the risk that a person will die of cardiovascular disease. For the Rochester study, for safety reasons, participants in the study had no clinical evidence of heart or vascular disease.

"What's interesting about our new results is not so much what it shows about people with diabetes," said first author Judith Stewart, M.A.

"Rather, it gives us details more generally about how the body's vascular system responds to exposure to ultrafine particles. It's such a complex process to understand – it's as if someone gave you a haystack and told

you to look for something tiny, but you had no idea what you were actually looking for."

In the study, Stewart and corresponding author Mark Frampton, M.D., tried to tease out some of the details about how air pollution makes bad things happen in the body. It's an area that Frampton, a pulmonary specialist who does research and who treats patients with lung disease, has studied for more than 25 years.

The team looked at ultrafine particles, which are almost unimaginably small. If a human hair were the width of a football field, the largest ultrafine particles would be about the size of a baseball. While cars and trucks are the most common source, they also come from cooking on a stove or running household devices like vacuum cleaners. Coal-burning power plants are another common source, releasing chemicals into the air that can lead to particle formation.

The team studied 19 people with diabetes, measuring how their bodies adjusted to breathing in either highly purified air or air that included ultrafine particles.

Scientists found that after exposure to the particles, participants had higher levels of two well known markers of cardiovascular risk, activated platelets and von Willebrand factor. Both play a major role in the series of events that lead to heart attacks. Platelets, for instance, can stick to fatty buildups or plaques within the blood vessels and cause a clot, blocking blood flow to heart muscle.

"Platelets are the critical actor at the actual moment of a heart attack," said Frampton. "When a plaque ruptures, platelets glom onto it, forming a large clot. Normally, of course, platelets do not block blood flow and aren't a problem. Our findings indicate that when someone is exposed to air pollution, the platelets become activated, which would make them

more likely to trigger a heart attack."

The particles used in the study were relatively "clean" ultrafine particles, made of pure carbon. Scientists have done other studies looking at the effects of ultrafine particles in people, but those studies usually have included other materials, such as gases and other particles, and have often been done with higher concentrations. Frampton and Stewart studied a concentration of particles that was 50 micrograms per cubic meter, which is lower than most studies though still higher than what most people are normally exposed to while breathing everyday air.

"More than anything else, our study offers some direction about where to look for the molecular mechanism or link between [air pollution](#) and cardiovascular problems," said Frampton, who is professor in the Pulmonary and Critical Care Division of the Department of Medicine and a professor in the Department of Environmental Medicine.

"The risk of these particles to healthy individuals is really not much," he added. "Most people wouldn't be affected at all. But people with diabetes or other chronic conditions like asthma should heed the advice to stay inside when air quality is poor. These patients really need to control many factors, and one of them is their exposure to pollution."

Provided by University of Rochester Medical Center

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