

# Research shows air pollution could play role in development of cardiometabolic diseases

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Air pollution is the world's leading environmental risk factor, and causes more than nine million deaths per year. New research published in the *Journal of Clinical Investigation* shows air pollution may play a role in the development of cardiometabolic diseases, such as diabetes. Importantly, the effects were reversible with cessation of exposure.

Researchers found that air [pollution](#) was a "risk factor for a risk factor" that contributed to the common soil of other fatal problems like [heart attack](#) and stroke. Similar to how an unhealthy diet and lack of exercise can lead to disease, exposure to air pollution could be added to this risk factor list as well.

"In this study, we created an environment that mimicked a polluted day in New Delhi or Beijing," said Sanjay Rajagopalan, MD, first author on the study, Chief of Cardiovascular Medicine at University Hospitals Harrington Heart and Vascular Institute, and Director of the Case Western Reserve University Cardiovascular Research Institute. "We concentrated fine particles of air

pollution, called PM<sub>2.5</sub> (particulate matter component human impact on the environment, such as automobile exhaust, power generation and other fossil fuels."

These particles have been strongly connected to [risk factors](#) for disease. For example, cardiovascular effects of air pollution can lead to heart attack and stroke. The research team has shown exposure to air pollution can increase the likelihood of the same risk factors that lead to heart disease, such as insulin resistance and type 2 diabetes.

In the mouse model study, three groups were observed: a [control group](#) receiving clean filtered air, a group exposed to polluted air for 24 weeks, and a group fed a high-fat diet. Interestingly, the researchers found that being exposed to air pollution was comparable to eating a high-fat diet. Both the air pollution and high-fat diet groups showed insulin resistance and abnormal metabolism—just like one would see in a pre-diabetic state.

These changes were associated with changes in the epigenome, a layer of control that can masterfully turn on and turn off thousands of genes, representing a critical buffer in response to environmental factors. This study is the first-of-its-kind to compare genome-wide epigenetic changes in response to air pollution, compare and contrast these changes with that of eating an unhealthy diet, and examine the impact of air pollution cessation on these changes.

"The good news is that these effects were reversible, at least in our experiments" added Dr. Rajagopalan. "Once the air pollution was removed from the environment, the mice appeared healthier and the pre-diabetic state seemed to reverse."

Dr. Rajagopalan explains that if you live in a densely polluted environment, taking actions such

as wearing an N95 mask, using portable indoor air cleaners, utilizing air conditioning, closing car windows while commuting, and changing car air filters frequently could all be helpful in staying healthy and limiting air pollution exposure.

Next steps in this research involve meeting with a panel of experts, as well as the National Institutes of Health, to discuss conducting clinical trials that compare heart health and the level of air pollution in the environment. For example, if someone has a heart attack, should they be wearing an N95 mask or using a portable air filter at home during recovery?

Dr. Rajagopalan and his team believe that it is important to address the environment as a population health risk factor and continue to diligently research these issues. The authors also note that these findings should encourage policymakers to enact measures aimed at reducing [air pollution](#).

**More information:** Sanjay Rajagopalan et al, Metabolic effects of air pollution exposure and reversibility, *Journal of Clinical Investigation* (2020). [DOI: 10.1172/JCI137315](https://doi.org/10.1172/JCI137315)

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