

City in a test tube: Researchers simulate urban pollution to show how it damages the heart

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A unique study mimicking city centre pollution levels shows how just two hours of bad air adversely affects the heart and blood vessels for a

whole day. The research is published today in the *European Journal of Preventive Cardiology*, a journal of the European Society of Cardiology (ESC).

"After two hours of breathing polluted air, study participants showed the first steps of cardiovascular disease and the effects lasted for 24 hours," said study author Professor Dimitris Tousoulis of the National and Kapodistrian University of Athens, Greece. "To avoid permanent harm, we had to keep [pollution levels](#) in the study under safe limits, implying that even 'safe' levels may be devastating to health when frequently repeated—as occurs in [city dwellers](#)."

Population studies have documented the adverse connection between air pollutants (of which 50% come from [diesel](#) exhaust fumes) and cardiovascular health. However, the specific effects of diesel emissions on the body, which lead to disease, are not fully understood.

This study clarifies how breathing urban levels of diesel exhaust fumes for a relatively short time has prolonged and multiple effects on the cardiovascular system.

A total of 40 healthy volunteers were randomised to diesel exhaust fumes or filtered air for two hours in a specially designed hermetically sealed (airtight) laboratory. After four weeks, participants then swapped over so that everyone had a pollution session and a clean-air session.

For the pollution session, diesel emissions were produced by a diesel engine. Throughout session, levels of carbon monoxide and other pollutants resembled those in crowded city centres.

To assess the impact of diesel exhaust fumes on the cardiovascular system, the researchers measured blood vessel function and suppleness, heart rate, blood clotting, and inflammation—all of which indicate the

health of the heart and blood vessels. To ensure that any changes in these parameters were due to diesel emissions, participants avoided alcohol, caffeine, smoking and changes in diet during the study period.

Compared to filtered air, polluted air had a prolonged (at least 24 hours) [detrimental effect](#) on all of the measurements.

"We assessed key steps in the process of [blood vessels](#) becoming blocked and eventually causing a heart attack or stroke," explained Professor Tousoulis. "Short-term exposure to diesel exhaust fumes simultaneously impacts these stages, with long-lasting effects."

He concluded: "Our study provides insights into the mechanisms by which diesel exhaust fumes heighten cardiovascular risk. The [damaging effects](#) shown in this research are likely to multiply with repeated—and for some people lifelong—exposure to high levels of [diesel exhaust fumes](#) in cities, heavy traffic, road tunnels, enclosed garages, and on large highways. More efficient public health measures are needed to improve air quality in cities and prevent needless heart attacks and strokes."

More information: Dimitris Tousoulis et al, Acute exposure to diesel affects inflammation and vascular function, *European Journal of Preventive Cardiology* (2020). [DOI: 10.1177/2047487319898020](https://doi.org/10.1177/2047487319898020)

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