

# Diesel exhaust associated with higher heart attack, stroke risk in men

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Increased roadway pollution produced by diesel fuel in vehicles is leading to a cascade of conditions that could result in heart attack or stroke, researchers suggested in the report of a small study presented at the American Heart Association's Scientific Sessions 2007.

United Kingdom and Swedish researchers found that diesel exhaust increased clot formation and blood platelet activity in healthy volunteers — which could lead to heart attack and stroke.

“The study results are closely tied with previous observational and epidemiological studies showing that shortly after exposure to traffic air pollution, individuals are more likely to suffer a heart attack,” said Andrew Lucking, M.D., lead author of the study and a cardiology fellow at the University of Edinburgh in the United Kingdom. “This study shows that when a person is exposed to relatively high levels of diesel exhaust for a short time, the blood is more likely to clot. This could lead to a blocked vessel resulting in heart attack or stroke.”

The double-blind, randomized, cross-over study included 20 healthy men, 21 to 44 years old. They were separately exposed to filtered air (serving as a control) and to diluted diesel exhaust at 300 micrograms per meter cubed (mcg/m<sup>3</sup>), a level comparable to curbside exposure on a busy street.

Researchers performed the exposures in a specially built diesel exposure chamber. At two hours and at six hours after exposure, researchers

allowed a small amount of participants' blood to flow through a perfusion chamber. They measured clot formation, coagulation, platelet activation and inflammatory markers after each exposure.

To measure clot formation, researchers used low and high shear rates, recreating flow conditions inside the body's blood vessels. Compared to filtered air, breathing air with diluted diesel exhaust increased clot formation in the low shear chamber by 24.2 percent and the high shear chamber by 19.1 percent. This was seen at both two and six hours after diesel exposure.

The researchers also found an increase in platelet activation, assessed by measuring the number of platelets associated with white blood cells. Platelets play a central role in blood clotting, and when they are activated, they associate with white blood cells such as neutrophils and monocytes, Lucking said. Diluted diesel exhaust inhalation increased platelet-neutrophil aggregates from 6.5 percent to 9.2 percent and platelet-monocyte aggregates from 21 percent to 25 percent at two hours after exposure. At six hours, researchers found a trend toward platelet activation, but it was not statistically significant.

"After exposure to diesel exhaust, the participants had increased levels of activated platelets that became attached to white blood cells," he said. "When activated, the platelets can stick together and form a clot.

"High levels of traffic pollution are known to increase the risk of heart attack in the immediate hours or days after exposure. These findings provide a potential mechanism that could link exposure to traffic-derived air pollution with acute heart attack." It's unclear whether these findings would apply to gasoline-powered engines, Lucking said. Diesel engines generate many times more fine pollutant particles than comparable-sized gasoline engines.

“Diesel engines are becoming very popular because of increased fuel economy,” Lucking said. “While diesel engines burn more efficiently, they also put more fine particulate matter into the air.”

Lucking encourages physical activity but suggested that people with existing cardiovascular disease try to exercise away from traffic congestion.

The researchers plan to collaborate again with researchers at the University of Umea, Sweden, to test particle traps retrofitted on diesel engines to determine whether these devices are effective in reducing diesel particles.

“Exposure to air pollution clearly is detrimental and we must look at ways to reduce pollution in the environment,” Lucking said. The U.S. Environmental Protection Agency (EPA) introduced its 1997 National Ambient Air Quality Standards (NAAQS) to educate the public about daily air quality levels, including information about ozone and particulate matter levels. These daily updates can be found on the EPA Web site at [www.epa.gov/airnow](http://www.epa.gov/airnow) and in many newspapers across the country.

Source: American Heart Association

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