

# Even moderate air pollution can raise stroke risks

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Air pollution, even at levels generally considered safe by federal regulations, increases the risk of stroke by 34 percent, Beth Israel Deaconess Medical Center researchers have found.

Writing in the Feb. 14, 2012 issue of the [Archives of Internal Medicine](#), researchers who studied more than 1,700 [stroke patients](#) in the Boston area over a 10-year period found exposure to ambient [fine particulate matter](#), generally from vehicle traffic, was associated with a significantly higher risk of [ischemic strokes](#) on days when the EPA's air quality index for particulate matter was yellow instead of green.

Researchers focused on particles with a diameter of 2.5 millionths of a meter, referred to as PM2.5. These particles come from a variety of sources, including power plants, factories, trucks and automobiles and the burning of wood. They can travel deeply into the lungs and have been associated in other studies with increased numbers of hospital visits for cardiovascular diseases such as heart attacks.

"The link between increased [stroke risk](#) and these particulates can be observed within hours of exposure and are most strongly associated with pollution from local or transported traffic emissions," says Murray A. Mittleman, MD, DrPH, the study's senior author, a physician in the CardioVascular Institute at Beth Israel Deaconess Medical Center and an Associate Professor of Medicine at Harvard Medical School. "Any proposed changes in regulated [pollution levels](#) must consider the impact of lower levels on public health."

"Considering that almost everyone is exposed to [air pollution](#) and is at risk for stroke, that's actually a pretty large effect," adds Gregory Wellenius, ScD, the study's lead author and an Assistant Professor of Community Health at Brown University.

Researchers analyzed the medical records of more than 1,700 patients who went to the hospital for treatment of confirmed strokes between 1999 and 2008. They matched the onset of stroke symptoms in each patient to hourly measurements of particulate air pollution taken at the nearby Harvard School of Public Health's environmental monitoring station.

The team was able to estimate the hour the [stroke symptoms](#) first occurred, rather than relying on the more coarse measure of when patients were admitted to the hospital. They also included only strokes confirmed by attending neurologists, rather than relying on more vague insurance billing codes.

Meanwhile, Harvard's hourly measurements of pollution within 13 miles of 90 percent of the stroke patients' homes allowed for close matching in time of exposure and stroke onset.

"We think that this study is novel in that it has high-quality data on both air pollution exposure and stroke diagnosis," Wellenius says.

The team was able to calculate that the peak risk to patients from pollution exposure occurs 12-14 hours before a stroke. That information may be useful to researchers who want to trace how PM2.5 might be working in the body to increase the likelihood of stroke.

They also found that black carbon and nitrogen dioxide, two pollutants associated with vehicle traffic, were closely linked with stroke risk, suggesting that pollution from cars and trucks may be particularly

important.

Stroke is a leading cause of long-term disability and the third leading cause of death in the United States. An estimated 795,000 Americans suffer a new or recurrent stroke every year, resulting in more than 135,000 deaths and 829,000 hospital admissions.

The finding that days of moderate air quality substantially elevate stroke risk compared to days of good air quality suggest that the Environmental Protection Agency may need to strengthen the language it uses to describe the health consequences of moderate air quality, researchers say.

"In partnership with NIEHS, EPA funded this research advancing our understanding of air pollution and health effects," said Dan Costa, ScD, DABT, Interim National Program Director for Air Climate & Energy Research in U.S. Environmental Protection Agency Office of Research and Development Research.

"In 2009, EPA published an Integrated Science Assessment concluding a causal relationship exists between PM<sub>2.5</sub> and cardiovascular impacts, including strokes. Dr. Wellenius and colleagues' study is the first to show that the onset of stroke can occur with less than a day's exposure to fine PM. Highly relevant research such as this informs the PM<sub>2.5</sub> standards and protects human health."

Researchers estimate reducing PM<sub>2.5</sub> pollution by about 20 percent could have prevented 6,100 of the 184,000 stroke hospitalizations in the northeastern United States in 2007.

While researchers acknowledge results need to be replicated in other cities, they note that Boston is considered to have relatively clean air.

"The levels of PM2.5 in Boston are lower than those seen in many in other parts of the country, yet we still find that within these moderate levels the risk of [stroke](#) is higher on days with more particles in the air," Mittleman says.

Provided by Beth Israel Deaconess Medical Center

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