

Long-term exposure to air pollution may pose risk to brain structure, cognitive functions

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Micrograph showing cortical pseudolaminar necrosis, a finding seen in strokes on medical imaging and at autopsy. H&E-LFB stain. Credit: Nephron/Wikipedia

Air pollution, even at moderate levels, has long been recognized as a factor in raising the risk of stroke. A new study led by scientists from Beth Israel Deaconess Medical Center and Boston University School of Medicine suggests that long-term exposure can cause damage to brain structures and impair cognitive function in middle-aged and older adults.



Writing in the May 2015 issue of *Stroke*, researchers who studied more than 900 participants of the Framingham Heart Study found evidence of smaller <u>brain</u> structure and of covert brain infarcts, a type of "silent" ischemic stroke resulting from a blockage in the blood vessels supplying the brain.

The study evaluated how far participants lived from major roadways and used satellite imagery to assess prolonged exposure to ambient fine particulate matter, particles with a diameter of 2.5 millionth 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 admissions for cardiovascular events such as heart attacks and strokes.

"This is one of the first studies to look at the relationship between ambient <u>air pollution</u> and <u>brain structure</u>," says Elissa Wilker, ScD, a researcher in the Cardiovascular Epidemiology Research Unit at Beth Israel Deaconess Medical Center. "Our findings suggest that air pollution is associated with insidious effects on structural brain aging, even in dementia- and stroke-free individuals."

Study participants were at least 60 years old and were free of dementia and stroke. The evaluation included total cerebral brain volume, a marker of age-associated brain atrophy; hippocampal volume, which reflect changes in the area of the brain that controls memory; white matter hyperintensity volume, which can be used as a measure of pathology and aging; and covert brain infarcts.

The study found that an increase of only?2µg per cubic meter in PM2.5, a range commonly observed across metropolitan regions in New England



and New York, was associated with being more likely to have covert brain infarcts and smaller cerebral brain volume, equivalent to approximately one year of brain aging.

"These results are an important step in helping us learn what is going on in the brain," Wilker says. "The mechanisms through which air pollution may affect brain aging remain unclear, but systemic inflammation resulting from the deposit of fine particles in the lungs is likely important."

"This study shows that for a 2 microgram per cubic meter of air (μ g/m3) increase in PM2.5, a range commonly observed across major US cities, on average participants who lived in more polluted areas had the <u>brain</u> <u>volume</u> of someone a year older than participants who lived in less polluted areas. They also had a 46 percent higher risk of silent strokes on MRI," said Sudha Seshadri, MD, a Professor of Neurology at Boston University School of Medicine and Senior Investigator, the Framingham Study.

"This is concerning since we know that <u>silent strokes</u> increase the risk of overt strokes and of developing dementia, walking problems and depression. We now plan to look at more the impact of air pollution over a longer period, its effect on more sensitive MRI measures, on brain shrinkage over time, and other risks including of stroke and dementia."

Provided by Beth Israel Deaconess Medical Center

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