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Study: Exposure to air pollution leads to accelerated buildup of calcium in arteries

By *Jonel Aleccia, The Seattle Times (TNS)*Posted: *May 31, 2016*

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SEATTLE — Scientists have known for years that long-term exposure to air pollution raises the risk of heart disease, but a highly anticipated study led by a University of Washington environmental health expert finally explains why.

In a decadeslong analysis involving more than 6,000 people in six states, Dr. Joel Kaufman found that people living in areas with more outdoor pollution built up calcium in the arteries of their hearts faster than those who lived elsewhere — increasing a known risk for heart attack and stroke.

"On average we found a 20 percent acceleration in the rate of the calcium deposits," said Kaufman, 54, director of the UW's occupational and environmental medicine program. "I would say the results are a little more clear-cut and dramatic than I expected when I started this."

The \$30 million study, funded by the U.S. Environmental Protection Agency and the National Institutes of Health, is the largest to measure both metrics of air pollution exposure and health markers over time. Results were published Tuesday in the journal *The Lancet*.

It relied on data collected through the Multi-Ethnic Study of Atherosclerosis and Air Pollution (MESA Air), which studies the effects of pollution in six U.S. metropolitan areas: Baltimore, Chicago, Los Angeles, New York, St. Paul, Minn., and Winston-Salem, N.C.

Through what authors of an accompanying *Lancet* editorial called "meticulous measurements," Kaufman's analysis looked at the exposure of

participants to the fine particulate matter present in pollution, tiny bits less than 2.5 microns in diameter, too small to be seen with the naked eye.

Those fine particles are referred to as PM 2.5.

The study, which tracked air quality in participants' communities and near their homes, also measured exposure to nitrogen oxide and nitrogen dioxide and black carbon or soot, pollutants typically associated with traffic. Participants also visited study clinics multiple times to collect health measurements.

In a complicated conclusion, the researchers found that for every 5 micrograms per cubic meter higher concentration of PM 2.5, or for every 35 parts per billion higher concentration of oxides of nitrogen, participants saw an increase of 4 units per year of a marker for coronary-artery calcium, called the Agatston score.

In plain language, that means the higher the concentrations of pollutants, the faster participants developed atherosclerosis, a condition commonly known as hardening of the arteries.

Overall, the increase from those sources accounted for a 20 percent acceleration in the rate of the calcium deposits, Kaufman said.

"Another way to look at it is this: A move from an area with low pollution to an area with high pollution could be associated with an increased rate of 10 to 20 percent in atherosclerosis," Kaufman explained.

Researchers also analyzed pollution in relation to another potential marker of cardiovascular disease, the thickness of the inner layers of the carotid artery, but found no effect.

The study drew praise from experts in air pollution and heart disease. It answers questions raised by scientists since the 1990s, when research first showed that people who lived in areas with high levels of pollution suffered more heart disease and stroke than those who lived elsewhere.

"The exact mechanism by which pollution has effects on heart and cardiovascular disease has been unknown," said Dr. Russell Luepker, a Mayo professor at the University of Minnesota's School of Public Health. "This is a first attempt from an extremely good study."

Dr. Robert Brook, a cardiologist with the University of Michigan Health System, said the findings of the new study "would be hard to overstate." They mean that air pollution is not just a trigger of heart attacks or strokes

over a few days in high-risk or sick people who would have had such episodes anyway, but it's also a cause of harm over years.

"This is THE study we have all been waiting to see the results of during the past decade," Brook said in an email. "I am in awe of the study."

Kaufman's research has implications for public-health policy in the U.S. and abroad.

During the study period, from 2002 to 2012, air pollution levels actually improved in the U.S., in large part because of reductions in allowed ambient particulate levels. The U.S. now permits an annual average of 12 micrograms per cubic meter of PM 2.5, about half the European standard of 25 micrograms per cubic meter.

"This is a public-health success story," Kaufman said.

But the new evidence also shows that there's no safe level of pollution, no exposure that doesn't increase heart disease risk, he added.

"Even though things are clean and getting better, there's still more work to do."

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