

Does the size of air pollution particles affect a person's risk of death from stroke?

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Living in areas with higher air pollution is associated with an increased risk of in-hospital death from stroke, and the risk varies depending on the size of the air pollution particles, according to a new study published in the May 25, 2022, online issue of *Neurology*.

The study looked at three sizes of air pollution particulate matter.

Particulate matter consists of liquids or solids suspended in air. Submicron particulate matter, PM₁, is less than one micron in diameter and includes soot and smog. Fine particulate matter, PM_{2.5}, is less than 2.5 microns in diameter and includes fly ash from coal combustion. Respirable particulate matter, PM₁₀, is less than 10 microns in diameter and includes cement dust.

"Air pollution has been previously linked to a greater risk of [stroke](#), and stroke is a leading cause of death worldwide," said study author Hualiang Lin, Ph.D., of Sun Yat-sen University in Guangzhou, China. "What is lesser known is how the different sizes of particulate matter affect that risk. Our research found that the size of air pollution particles may affect a person's risk of dying from stroke."

For the study, researchers examined [electronic medical records](#) in China to identify over 3.1 million hospitalizations for stroke, both ischemic stroke caused by a blood clot, and hemorrhagic stroke caused by bleeding in the brain. Participants had an average age of 67. Of this group, 32,140 people, or 1%, died of stroke while hospitalized.

Researchers identified individual levels of air pollution exposure for each participant by using their home addresses and an air pollution data source that records daily concentrations of different types of particulate matter. Researchers then calculated seven-day air pollution exposure immediately before hospitalization for stroke, which was 31.38 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) of PM₁, 45.43 $\mu\text{g}/\text{m}^3$ of PM_{2.5} and 78.75 $\mu\text{g}/\text{m}^3$ of PM₁₀. They also calculated a person's average daily exposure to pollution particles in the year before hospitalization, which was 32.98 $\mu\text{g}/\text{m}^3$ of PM₁, 49.08 $\mu\text{g}/\text{m}^3$ of PM_{2.5} and 87.32 $\mu\text{g}/\text{m}^3$ of PM₁₀.

After adjusting for factors such as age, sex, [socioeconomic status](#), diabetes and [high blood pressure](#), researchers found each 10 $\mu\text{g}/\text{m}^3$

increase in annual average exposure to particulate matter was associated with increased risk of dying of stroke while hospitalized, with a 24% greater risk for exposure to PM_1 , a 11% greater risk for exposure to $PM_{2.5}$, and a 9% greater risk for exposure to PM_{10} . The seven-day average exposure to particulate matter included a 6% increased risk for exposure to PM_1 , a 4% increased risk for exposure to $PM_{2.5}$, and a 3% increased risk for exposure to PM_{10} .

The risks were stronger in people with ischemic stroke than in people with [hemorrhagic stroke](#). The greatest risk of death from stroke was in people with [ischemic stroke](#) and exposure to the smallest air pollution particles, PM_1 .

Yet researchers also found that a reduction in PM_{10} would have the largest impact on reducing overall deaths from stroke, reducing the number of hospital deaths by 10% for short-term exposure and 21% for long-term exposure.

Lin said it is important to note that the study results do not prove that air pollution causes stroke deaths, they only show an association.

"Our study includes measurements of PM_1 , which may be small enough to be inhaled deeply into lungs, pass through [lung tissue](#), and circulate in the bloodstream," said Lin. "Obtaining a deeper understanding of the risk factors of all [particulate matter](#) sizes and the magnitude of their possible effects may help reduce the number of deaths and improve the outcomes for people with stroke."

A limitation of the study was that results were not adjusted for a person's smoking status or the severity of stroke. Researchers also examined air pollution exposure only at a person's current residence and not at previous residences.

More information: Miao Cai et al, Association of Ambient Particulate Matter Pollution of Different Sizes With In-Hospital Case Fatality Among Stroke Patients in China, *Neurology* (2022). DOI: [10.1212/WNL.0000000000200546](https://doi.org/10.1212/WNL.0000000000200546). [n.neurology.org/content/early/... WNL.0000000000200546](https://www.n.neurology.org/content/early/2022/05/25/WNL.0000000000200546)

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