

Particulate Matter Size Tied to Stroke Mortality

— Association stronger among individuals with ischemic strokes

by [Michal Ruprecht](#), Editorial Intern, MedPage Today
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Hospitalized stroke patients living in areas with greater air pollution were more likely to die from their stroke, but the size of ambient particulate matter (PM) and duration of exposure both played a role in the level of risk, an observational study from China indicated.

Effect sizes were greatest for smaller-sized particles (PM₁) and with longer-term exposures to pollution, and the correlation was stronger among individuals with ischemic rather than hemorrhagic strokes, reported Hualiang Lin, PhD, of Sun Yat-sen University in China, and colleagues in *Neurology*.

Examining short-term exposures, each 10 $\mu\text{g}/\text{m}^3$ increase in the 7-day average of ambient PM concentration prior to a stroke hospitalization was associated with a higher risk of in-hospital death, regardless of PM size:

- PM_{10} : OR 1.058 (95% CI 1.047-1.068)
- $\text{PM}_{2.5}$: OR 1.037 (95% CI 1.031-1.043)
- PM_{10} : OR 1.025 (95% CI 1.021-1.029)

Longer-term exposure followed a similar pattern, with each 10 $\mu\text{g}/\text{m}^3$ increase in the annual average of ambient PM concentration leading up to a stroke linked with a higher risk of death across PM sizes:

- PM_{10} : OR 1.240 (95% CI 1.217-1.265)
- $\text{PM}_{2.5}$: OR 1.105 (95% CI 1.094-1.116)
- PM_{10} : OR 1.090 (95% CI 1.082-1.099)

The results support previous studies showing that small particles "exhibit larger toxicity per unit increment," noted Lin and co-authors. Despite this, they argued that reductions in PM_{10} could lead to greater reductions in deaths from stroke: 10% for short-term (95% CI 8.3-11.7) and 21.1% for long-term (95% CI 19.1-23) exposures.

"These seemingly contradictory results are caused by the stark difference in the distribution of PM_{10} , $\text{PM}_{2.5}$, and PM_{10} ," the authors explained. "Compared to a more concentrated distribution of smaller-size PM, the distribution of larger-size PM was more diffuse on the higher end, which led to more potential for reduction in PM in counterfactual scenarios of the 5th percentile."

This result indicates that PM_{10} is correlated with a "larger burden of stroke in-hospital case fatality" compared with smaller-sized PMs, they noted.

"Studies like this that more accurately estimate a reduction in mortality should help regulatory bodies and policy makers contemplating the design and implementation of environmental interventions," noted Enrique Leira, MD, MS, of the University of Iowa in Iowa City, and Julius Latorre, MD, MPH, of Upstate Medical University in Syracuse, New York, writing in an [accompanying editorial](#).

"While this study provides interesting insights regarding the effect of different sizes of particles in stroke mortality, it does not inform about the likely causal mechanism," highlighted Leira and Latorre. "The complex outcome of in-hospital stroke mortality can reflect both neurological and medical complications."

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"While the harmful effect of pollution on in-hospital stroke mortality seems to transcend the different particle sizes and time exposures, long-term exposures to small particles had the most remarkable effect on patients with ischemic stroke," the editorialists continued. "This could support the hypothesis of a preferential effect on inflammatory stress, and its effect on atherosclerosis."


For their study, Lin and colleagues used electric medical records in China, collecting data on 3.1 million patients hospitalized for a stroke from 2013 to 2019, including

32,140 who died in hospital (1.03% fatality rate) during the study period. Most of the strokes were ischemic (71%), the average patient age was 67 years, and 43% were women.

For the PM data, the researchers used the China High Air Pollutants dataset and determined the exposure level for each patient based on their home address. Short-term exposure to PM₁₀ was most common (38%), followed by PM_{2.5} (26%) and PM₁ (17%). Longer-term exposures prior to stroke were present in 18%, 12%, and 8% of cases, respectively.

The study authors emphasized that the correlations found in the study may be different for patients not hospitalized for stroke. A limitation of the study was the inaccessibility of certain data like smoking status and severity of stroke. The researchers also noted that they only examined PM levels at a patient's current address and not at previous residences.



[Michal Ruprecht](#) is a medical student based in Michigan. He is a former reporting intern for MedPage Today. [Follow](#) 

Disclosures

The study authors and editorialists reported having no relevant disclosures.

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Neurology

Source Reference: *Lin H, 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.*

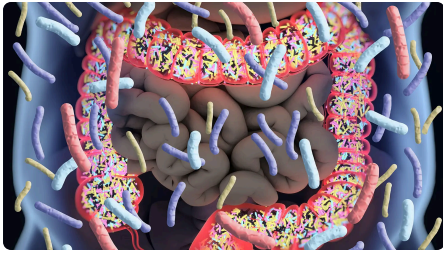
Secondary Source

Neurology

Source Reference: *Leira E, Latorre JG "Ambient pollution and stroke: Time to clear the air on causal mechanisms" Neurology 2022; DOI: 10.1212/WNL.0000000000200801.*

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