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Study finds air pollution exposure linked to Parkinson's risk, identifies US hot spot

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Living in areas of the United States with higher levels of air pollution is associated with an increased risk of Parkinson's disease, according to a preliminary study released today, February 23, 2023, that will be presented at the American Academy of Neurology's 75th Annual Meeting being held in person in Boston and live online from April 22-27, 2023.

The study looked at fine particulate matter, PM2.5, which is less than 2.5 microns in diameter. Fine particles come from motor vehicle exhaust, the burning of fuels by power plants and other industries and forest and grass fires.

"We used geographic methods to examine the rates of Parkinson's disease across the United States and compared those rates to regional levels of air pollution," said study author Brittany Krzyzanowski, Ph.D., of the Barrow Neurological Institute in Phoenix, Arizona.

"We found a nationwide association between Parkinson's disease and air pollution exposure, with people exposed to the highest levels of fine particulate matter having an increased risk of Parkinson's disease compared to people exposed to the lowest levels. We also identified a Parkinson's disease hot spot in the Mississippi-Ohio River Valley, which is a region that has some of the highest levels of fine particulate matter pollution in the nation."

The study involved more than 22.5 million people enrolled in Medicare in 2009. Of this group, researchers identified 83,674 people with Parkinson's disease. Researchers mapped where study participants lived across the U.S. and calculated the rates of Parkinson's disease for various regions.

Researchers also calculated average air pollution exposure levels for study participants by using the ZIP codes and counties where they lived as well as an air pollution data source on average annual concentrations of fine particulate matter.

Researchers then divided participants into four groups based on average exposure to air pollution. People in the highest exposure group had an average annual exposure of 19 micrograms per cubic meter ($\mu g/m^3$) of fine particulate matter. People in the lowest exposure group had an

average annual exposure of 5 $\mu g/m^3$.

In the highest exposure group, 434 new Parkinson's disease cases developed per every 100,000 people compared to 359 cases in the lowest exposure group.

After adjusting for other factors that could affect the risk of Parkinson's, such as age, smoking, and use of medical care, researchers found an association between Parkinson's disease and average annual exposure to fine particulate matter, with people in the highest exposure group having a 25% increased risk of Parkinson's disease compared to people in the lowest exposure group.

For geographic analysis, researchers divided fine particulate matter exposure into 10 levels.

Researchers found the strongest association between air pollution and Parkinson's disease in the Rocky Mountain region, which includes Lake County, Colorado, which is southwest of Denver, and its surrounding counties. The risk for Parkinson's disease in those counties increased by 16% when moving up from one level of fine particulate matter exposure to the next level.

Air pollution was also associated with higher rates of Parkinson's disease in the Mississippi-Ohio River Valley hot spot, which includes Tennessee and Kentucky, but the association was weaker in these areas, with a 4% increase in risk when moving up one level of fine particulate matter exposure to the next.

"Finding a relatively weaker association where we have some of the highest Parkinson's disease risks and fine particulate matter levels in the nation is consistent with the threshold effect we observed in our data," said Krzyzanowski. "In the Mississippi-Ohio River Valley, for example,

Parkinson's disease risk increases with increasing air pollution exposure until about 15 μg/m^3 of fine particulate matter, where Parkinson's disease risk seems to plateau."

Krzyzanowski said, "By mapping nationwide levels of Parkinson's disease and linking them to air pollution, we hope to create a greater understanding of the regional risks and inspire leaders to take steps to lower risk of disease by reducing levels of air pollution."

A limitation of the study was that it focuses on fine particulate matter, which contains a variety of airborne pollutants, some of which may be more toxic than others. Krzyzanowski noted that air pollution is also associated with a variety of other health risks, including dementia, that might diminish the likelihood of a Parkinson's diagnosis, and this may explain the relatively weaker association between Parkinson's disease and particulate matter in the Mississippi-Ohio River Valley.

Provided by American Academy of Neurology

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