

Does air pollution increase women's risk of dementia?

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Older women who live in locations with higher levels of air pollution may have more brain shrinkage, the kind seen in Alzheimer's disease, than women who live in locations with lower levels, according to a new study published in the November 18, 2020, online issue of *Neurology*, the medical journal of the American Academy of Neurology. The study looked at fine particle pollution and found that breathing in high levels of this kind of air pollution was linked to shrinkage in the areas of the brain vulnerable to Alzheimer's disease.

Fine particle pollution consists of microscopic particles of chemicals, smoke, dust and other pollutants suspended in the air. They are no larger than 2.5 micrometers, 30 times smaller than the width of a human hair.

"Smaller [brain](#) volume is a known risk factor for dementia and Alzheimer's [disease](#), but whether air pollution alters [brain structure](#) is still being researched," said study author Diana Younan, Ph.D., of the University of Southern California in Los Angeles. "Our study found that women in their 70s and 80s who were exposed to the higher

levels of air pollution had an increased risk of brain changes linked to Alzheimer's disease over five years. Our research suggests these toxins may disrupt brain structure or connections in the brain's nerve cell network, contributing to the progression toward the disease."

The study involved 712 women with an average age of 78 who did not have dementia at the start of the study. Participants provided health histories as well as information on race/ethnicity, education, employment, alcohol use, smoking and physical activity. All women received MRI brain scans at the start of the study and five years later.

Researchers used the residential addresses of each participant to determine their average exposures to air pollution in the three years before the first MRI scan. They then divided participants into four equal groups. The lowest group was exposed to an average of 7 to 10 micrograms of fine particle pollution per cubic meter of air ($\mu\text{g}/\text{m}^3$). The highest group was exposed to an average of 13 to 19 $\mu\text{g}/\text{m}^3$. The U.S. Environmental Protection Agency (EPA) considers average yearly exposures up to 12 $\mu\text{g}/\text{m}^3$ to be safe.

Researchers used a machine learning tool to measure signs of Alzheimer's disease in the brain, a tool that had been trained to identify patterns of [brain shrinkage](#) specific to an increased risk of Alzheimer's disease by reading the brain scans of people with the disease.

Participants' MRI brain scans at the start of the study and five years later were assigned scores based on how similar they were to Alzheimer's disease patterns identified by the machine learning tool, specifically brain changes in regions found to be vulnerable to Alzheimer's disease. Scores ranged from zero to one, with higher scores showing more brain changes. Overall, the women's scores changed from 0.28 at the start of the study to 0.44 five years later.

For each 3 $\mu\text{g}/\text{m}^3$ increase in air pollution exposure levels, researchers found a broader range of scores between the two scans and an average increase of 0.03, showing a greater extent of brain shrinkage over five years, which was equivalent to a 24% increased risk of Alzheimer's disease. The increases remained the same even after adjusting for age, education, employment, cardiovascular disease, high blood pressure, physical activity and other factors that could affect brain shrinkage.

"Our findings have important public health implications, because not only did we find brain shrinkage in women exposed to higher levels of air pollution, we also found it in women exposed to air pollution levels lower than those the EPA considers safe," said Younan. "While more research is needed, federal efforts to tighten air pollution exposure standards in the future may help reduce the risk of Alzheimer's disease in our older populations."

Limitations of the study include that it only looked at the brains of [older women](#), so results may not be the same for men or younger [women](#). It also examined only regional fine particle pollution, not other sources of pollution such as traffic emissions. Researchers were also not able to estimate participants' exposure to fine particle [pollution](#) in middle-age and young adulthood due to nationwide data not being available for those years.

Provided by American Academy of Neurology

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