

Air pollution exposure in infancy may limit economic mobility in adulthood

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Higher exposure to fine particulate air pollution (PM_{2.5}) during infancy was associated with lower economic earnings in adulthood in a new study from Harvard T.H. Chan School of Public Health, Harvard John

A. Paulson School of Engineering and Applied Sciences, and European University of Rome. The association was most pronounced in the midwestern and southern U.S.

"This study takes a big step toward filling the knowledge gap on the crucial link between [environmental factors](#) and long-term [economic outcomes](#)," said corresponding author Francesca Dominici, Clarence James Gamble Professor of Biostatistics, Population, and Data Science at Harvard Chan School and faculty director of the Harvard Data Science Initiative.

"The findings suggest that air pollution can have lasting impacts beyond [health effects](#)—and that these impacts vary across regions and populations."

The study is published on September 9 in *The Proceedings of the National Academy of Sciences*.

The study builds upon previous investigations of the relationship between PM_{2.5} exposure and economic opportunity by using more granular data as well as state-of-the-art causal inference methods to adjust for socioeconomic and demographic confounders.

The researchers analyzed data on PM_{2.5} exposure and economic earnings from 86% of all U.S. census tracts—small statistical subdivisions of a county—from 1980 to 2010. They focused on people born from 1978–83, looking at their mean earnings in 2014–15 when they were between the ages of 31–37. To measure [economic mobility](#), they used a statistic called absolute upward mobility (AUM), which is defined as the mean income rank in adulthood of children born to families in the 25th percentile of the national income distribution.

The study found that the higher a person's exposure in infancy to PM_{2.5},

the lower their earnings in adulthood. Nationwide, on average, an increase in PM_{2.5} exposure by one microgram per cubic meter ($\mu\text{g}/\text{m}^3$) in 1982 was associated with a 1.146% lower AUM in 2015. The study also found that PM_{2.5} exposure had an outsized impact on AUM in specific regions of the U.S., particularly in the Midwest and South.

"Our findings underscore the necessity of implementing stringent air quality standards nationally," said co-lead author Luca Merlo, researcher at European University of Rome. "They also suggest the necessity of locally tailored interventions to mitigate air pollution and of integrated policies that address both environmental and economic inequalities."

Sophie-An Kingsbury Lee, a student at Harvard John A. Paulson School of Engineering and Applied Sciences, was a co-lead author.

More information: Dominici, Francesca, Childhood PM_{2.5} exposure and upward mobility in the United States, *Proceedings of the National Academy of Sciences* (2024). [DOI: 10.1073/pnas.2401882121](https://doi.org/10.1073/pnas.2401882121).
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Provided by Harvard T.H. Chan School of Public Health

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