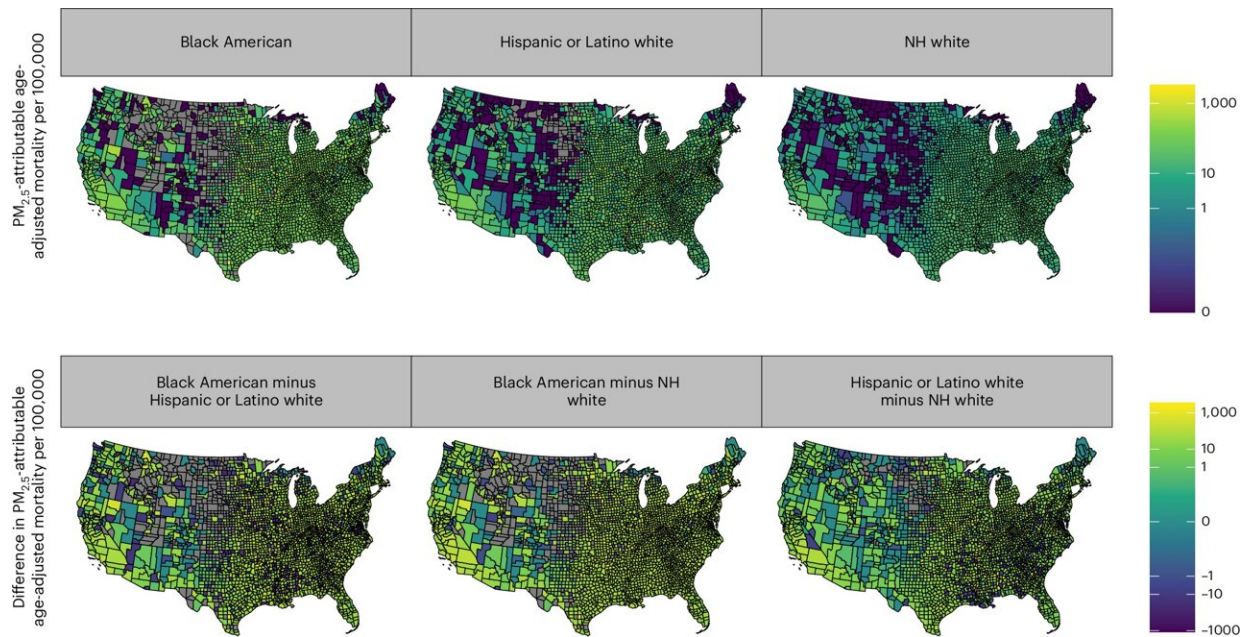


More Black Americans die from effects of air pollution, study shows

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Differences in the age-adjusted PM_{2.5}-attributable mortality rate between race/ethnicities at the county level for the period 2000 to 2016. Credit: *Nature Medicine* (2024). DOI: 10.1038/s41591-024-03117-0

Everyone knows that air pollution is bad for health, but how bad depends a lot on who you are. People of different races and ethnicities, education levels, locations and socioeconomic situations tend to be exposed to different degrees of air pollution. Even at the same exposure levels, people's ability to cope with its effects—by accessing timely health care,

for example—varies.

A new study by Stanford Medicine researchers and collaborators, which takes into account both exposure to air pollution and susceptibility to its harms, found that Black Americans are significantly more likely to die from causes related to air pollution, compared with other racial and ethnic groups.

They face a double jeopardy: more exposure to polluted air along with more susceptibility to its [adverse health effects](#) because of societal disadvantages.

"We see differences across all factors that we examine, such as education, geography and social vulnerability, but what is striking is that the differences between racial-ethnic groups—partially due to our methodology—are substantially larger than for all of these other factors," said Pascal Geldsetzer, MD, Ph.D., assistant professor of medicine and lead author of the study [published](#) July 1 in *Nature Medicine*.

The results demonstrate how air pollution can drive health inequities, contributing a large portion to the difference in [mortality rates](#) among different groups.

Yet, by the same token, the researchers say that reducing air pollution could be a powerful and achievable way to address these inequities.

Fine particles

Air quality throughout the U.S. has improved dramatically over the last few decades, thanks in large part to regulations such as the Clean Air Act, which sets limits on air pollutants emitted by industries and other sources.

Among the pollutants most linked to health, and the focus of the new study, is [fine particulate matter](#), referred to as PM_{2.5} because it includes particles less than 2.5 micrometers in diameter. These particles are small enough to enter the bloodstream and affect vital organs.

"It's very well recognized that PM_{2.5} is the biggest environmental killer globally," said Tarik Benmarhnia, Ph.D., associate professor at the University of California, San Diego's Scripps Institution of Oceanography and the senior author of the study.

Exposure to these fine particles can exacerbate asthma and [chronic obstructive pulmonary disease](#) in the short term, and in the long term contribute to heart disease, dementia, stroke and cancer.

In 1990, 85.9% of the U.S. population was exposed to average PM_{2.5} levels above 12 micrograms per cubic meter—the threshold set by the Environmental Protection Agency. In 2016, only 0.9% of the population was exposed to average levels above the threshold. (In February, the agency lowered the limit to 9 micrograms per cubic meter.)

Despite these significant improvements, not all communities have benefitted equally.

Benefits may vary

In the new study, the researchers wanted to see just how much PM_{2.5} levels contributed to mortality in people of different races and ethnicities, education, location (metropolitan or rural) and socioeconomic status.

They used existing county-level data on mortality along with census-tract-level data on PM_{2.5} air pollution and population from 1990 to 2016. They employed models derived from previous epidemiological studies,

known as concentration-response functions, that linked certain deaths to air pollution levels. They chose a model that accounted for differences in susceptibility among racial and ethnic groups.

"Concentration-response functions are essentially saying, if you get exposed to this much more air pollution, then you would expect, on average, this much more risk of death," Geldsetzer said.

Though deaths related to $PM_{2.5}$ levels fell overall, some groups remained more affected than others. The researchers found higher rates of $PM_{2.5}$ -attributable mortality in people with less education; those living in large metropolitan areas; and those who were more socially vulnerable due to housing, poverty and other factors. People in the Mountain West states were less likely to die from $PM_{2.5}$ pollution than people in other regions.

But the starkest disparities appeared when researchers sorted the data by race and ethnicity.

In 1990, the $PM_{2.5}$ -attributable mortality rate for Black Americans was roughly 350 deaths per 100,000 people, compared with less than 100 deaths per 100,000 people for each of the other races. By 2016, $PM_{2.5}$ -attributable mortality had fallen for all groups. Black Americans experienced the largest decline, to about 50 deaths per 100,000 people, yet were still the highest among all groups.

These relative trends were consistent throughout the country. In 96.6% of counties, Black Americans had the highest $PM_{2.5}$ -attributable mortality.

Among all the factors the researchers considered, race was the most influential in determining mortality risk from air pollution. They found that Black Americans have more exposure to air pollution, and its effects

on mortality are amplified by factors such as poverty, existing medical conditions, more hazardous jobs, and lack of access to housing and health care.

Race and racism play into many of these amplifying factors, the researchers noted.

"Racism is an upstream driver of all these components of social inequality," Benmarhnia said.

Taking action

"Air pollution is increasingly being recognized in public health as a cause of adverse health consequences that's larger than people initially thought," Geldsetzer said.

Harmful levels of PM_{2.5} can be imperceptible, but experienced day after day, year after year, they contribute to disease. And [climate change](#) means more wildfires (which produce particularly toxic fine particles) combined with extreme heat, increasing health risks.

"Even today there is a lot of resistance toward trying to reduce air pollution," Benmarhnia said, citing the recent Supreme Court ruling against a plan to limit air pollution drifting across state lines.

Environmental policies should reduce air pollutants as much as possible, the researchers said, but also need to address the fact that some communities are more susceptible—something that major environmental organizations are not yet doing.

The silver lining is that the groups who suffer more from increasing air pollution would also benefit more from decreasing air pollution.

For every unit of reduction in PM_{2.5}, for example, the associated mortality risk would decrease more for Black Americans than for other groups, helping close the racial gap.

"We want to emphasize how air pollution is a very good way to reduce health disparities, because it's actionable," Benmarhnia said. "We know we can do something about [air pollution](#)."

More information: Pascal Geldsetzer et al, Disparities in air pollution attributable mortality in the US population by race/ethnicity and sociodemographic factors, *Nature Medicine* (2024). [DOI: 10.1038/s41591-024-03117-0](#)

Provided by Stanford University Medical Center

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