

Recent increase in fine particulate matter associated with more premature deaths in US

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In the United States, annual average levels of fine particulate matter—PM_{2.5}, a measure of solid particles and liquid droplets that are 2.5 micrometers or smaller found in the air—declined 24% from 2009

to 2016, then increased 5% between 2016 to 2018. In a new study, researchers explored how the increase occurred by looking at economic activity, wildfires, and enforcement of the Clean Air Act during this period. They found that the increase was associated with 9,700 additional premature deaths, and that these deaths represent damages of \$89 billion.

The study, by researchers at Carnegie Mellon University and the National Bureau of Economic Research (NBER), is published as an NBER working paper.

"The health implications of this increase are significant," notes Karen Clay, professor of economics and public policy at Carnegie Mellon University's Heinz College, who led the study. "The number of deaths and the damages highlight the importance of air pollution as an important and timely policy issue."

To learn more about the increase, the researchers used data from the Air Quality System database of daily monitored readings provided by the U.S. Environmental Protection Agency (EPA). The EPA maintains a network of air pollution monitors because PM_{2.5} is regulated under the Clean Air Act. In total, the researchers studied 653 counties with monitors for fine particulate matter. They also looked at information from the EPA's enforcement database, as well as vital statistics (population and mortality rates) by county.

Increases in PM_{2.5} from 2016 to 2018 were observed in many U.S. counties. In the West and Midwest Census regions, fine particulate matter rose during this period; in the Northeast and South Census regions, it stayed the same. Every year, the EPA designates each county as having met or failed to meet air pollution standards under the Clean Air Act. Increases in fine particulate matter occurred in counties that met the standards as well as in those that failed to meet them, according

to the study.

The rise in PM_{2.5} increased the number of premature deaths of adults over age 30 by about 9,700 from 2016 to 2018, with 80% of the premature deaths occurring among the elderly and 20% of the [premature deaths](#) among adults ages 30 to 64, the study found. These calculations use the same methods used by the EPA to relate fine particulate matter to mortality. The damages of \$89 billion are calculated by multiplying deaths by the EPA's value of a statistical life. Increases in PM_{2.5} in the air were especially pronounced in California, with 43% of the rise in deaths nationally from 2016 to 2018 occurring in the state.

The researchers present evidence on three possible causes for the national increase:

1. Changes in [economic activity](#): Increased use of natural gas in households and industries, and growth in the number of miles traveled by fossil fuel-powered vehicles likely contributed to the rise in PM_{2.5} in certain counties, while decreases in coal-fired power drove declines in other areas.
2. Increases in wildfires: In parts of the West and Midwest, rising numbers of wildfires during the period studied were associated with increases in fine particulate matter. California experienced numerous wildfires during this period, with the most deadly—the Camp Fire—taking place in November 2018.
3. Decreases in enforcement of the Clean Air Act: Enforcement of this law may influence compliance by firms, and the study found that the most frequent type of enforcement of the Clean Air Act fell from 2009 to 2016 and continued to fall from 2016 to 2018.

"This research demonstrates that recent increases in [fine particulate matter](#) have appreciable effects on risks of premature mortality," explains Nicholas Muller, associate professor of economics, engineering,

and [public policy](#) at Carnegie Mellon University's Tepper School of Business, who coauthored the study. "These increases are worrisome and should persuade policymakers to take the necessary steps to maintain limits on air pollution."

More information: Karen Clay, Nicholas Z. Muller. Recent Increases in Air Pollution: Evidence and Implications for Mortality. NBER Working Paper No. 26381
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