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Wildfire Smoke Is Even More Dangerous Than Anyone Knew

Smoke exposure, researchers have found, raises the risk of dementia, poor mental health, fertility problems, and neurodegenerative diseases.



A mix of rain and smoke from the nearby Line Fire creates a heavy stew of air pollution this September over San Bernardino, California. Photograph: David McNew/Getty Images

This story originally *appeared on [High Country News](#) and is part of the [Climate Desk](#) collaboration.*

The more researchers learn about wildfire smoke, the more worrisome the picture gets. Smoke contains microscopic particles known as [PM 2.5](#) because the PM (particulate matter) measures 2.5 microns or less—small enough to easily wiggle its way into our lungs and then into our bloodstreams. Researchers have already connected the particulate matter in wildfire smoke to a higher [risk](#) of strokes, heart disease, respiratory disease, lung cancer, and other serious conditions.

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And the harmful effects don't stop there. 2024 was a banner year for research on wildfire smoke and its impact on health, from brain functioning to fertility. While there's still a lot more to learn, wildfire smoke is thought to be especially insidious [compared](#) to other sources of air pollution; its smaller particle size, intermittent spikes, and higher concentration of inflammatory compounds make it more [dangerous](#).

[Inside the Lab That Starts Fires For Science](#)

This year's new findings are disturbing. But the more we learn about smoke, the better we can protect ourselves from it, whether we live hundreds of miles away from a fire or confront it directly the way wildland firefighters do. Research underscores the need for some changes, including better indoor air filtration systems in our homes, hospitals, [schools](#), and [nursing homes](#), and [clean air centers](#) for people with nowhere else to breathe healthy air. Meanwhile, [respirators](#) for wildland firefighters are currently being tested by the federal government. We also need to reduce smoke pollution at the source by taking measures to reduce wildfire risk and intensity, like prescribed burns.

Here are some of the biggest advancements in scientists' understanding of wildfire smoke in 2024:

New Estimates Predict 125 Million Americans Will Face Unhealthy Air from Wildfires by 2054

Wildfire smoke has [erased](#) improvements in air quality in recent years, a trend that is expected to continue. Millions more people will be exposed to unhealthy air in the coming years, according to [models](#) released by the First Street Foundation in February. It's estimated that by 2054, over 125 million Americans each year will be exposed to "red" air quality, considered an [unhealthy](#) level by the Environmental Protection Agency—a 50 percent increase from 2024. California's Central Valley will see the worst of it, with Fresno and Tulare County likely facing three months a year of unhealthy air, according to the study.

Smoke Can Hamper Fertility Treatments

The fires that started over Labor Day weekend in 2020 blanketed Oregon with some of the [worst air quality](#) in the world at the time. Those 10 or so days of smoky air affected

everyone, especially patients undergoing in vitro fertilization treatments, or IVF. Researchers at Oregon Health & Science University studied 69 patients who received ovarian stimulation and IVF treatment in the six weeks following the wildfires. Their study, published in the journal *Fertility and Sterility* in May, [found](#) that patients exposed to wildfire smoke produced fewer blastocysts—clusters of cells that can develop into embryos—than those who weren't exposed. Most of the patients still got pregnant, but the study's lead author said she is worried about how smoke may affect fertility treatments. She told the [Idaho Capital Sun](#) that, as an extra precaution, fertility providers may want to delay IVF or embryo transfer for higher-risk patients during times of poor air quality.



Eva Sunderlin and her granddaughter Aurora Sunderlin, of Scottsdale, Arizona, observe the Bridal Falls in Yosemite National Park in Yosemite, California, as smoke from the Washburn Fire covers the valley on July 11, 2022.

Photograph: Getty Images

Wildfire Smoke Is Prematurely Killing People

Thousands more have died due to wildfire smoke than previously realized, according to a study from the University of California, Los Angeles. New [research](#) published in the journal *Science Advances* in June found that the fine particulate matter in smoke resulted in from 52,500 to 55,700 premature deaths from 2008 to 2018 in California. According to its authors, this is the first long-term study to assess deaths caused by years of increasing

exposure to wildfire smoke in a state that, like other Western states, is seeing more frequent and more severe wildfires.

Smoke Exposure Is Bad for Adolescent Mental Health

Researchers at the [University of Colorado Boulder](#) found that wildfire smoke increases the risk of mental health challenges in adolescents. The [study](#), published in the journal *Environmental Health Perspectives* in September, analyzed data from 10,000 preteens who participated in the largest long-term study of brain development and child health in the United States, according to the university. Each additional day that the children were exposed to “unsafe” air quality readings in 2016 boosted the likelihood that they would experience symptoms of depression and anxiety—even up to one year later.

Years of Firefighting Could Lead to Neurodegenerative Diseases

Lab rats aren’t people, of course. But in a controlled setting, they can offer useful insight into human health consequences. Researchers who exposed mice to an amount of smoke equivalent to what a wildland firefighter would breathe over a 15- to 30-year career [found](#) that they were more likely to develop brain disease than mice that weren’t exposed. The profiles of the animals’ genes fit a pattern that suggests long-term damage akin to the effects of Alzheimer’s, Parkinson’s, Huntington’s, and other neurodegenerative diseases. While researchers can’t prove that smoke is the direct cause of the heightened disease risk, lead author Adam Schuller told [Boise State Public Radio](#) that wildland firefighters need to be aware of the impact a long career in firefighting can have on the human brain.

Wildfire Smoke Is Linked to Dementia

Breathing in the particulate matter in air pollution has already been linked to an increased risk of dementia. Now, researchers say, wildfire smoke may pose an even greater risk than other pollution sources. Analysis of more than 1.2 million people in Southern California [found](#) that exposure to wildfire smoke over a long period—three years, in this study—was associated with a higher risk of a dementia diagnosis. According to the study, published in the journal *JAMA Neurology*, the odds of a dementia diagnosis rose by 18 percent for every microgram per cubic meter increase in wildfire pollution over three years, a relatively small amount. For [comparison](#), the average PM 2.5 exposure for a census tract near the 2018 Camp Fire in California was 1.2 micrograms per cubic meter between 2006 and 2020, spiking to an exposure of 310 micrograms per cubic meter during the actual fire.