

Is Wildfire Smoke More Toxic Than General Air Pollution?

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Wildfire-related air pollution in Europe kills more than non-wildfire air pollution. As climate change exacerbates the frequency and violence of wildfires, researchers are studying the health implications of mitigation methods such as prescribed fires.

Presenting at the [European Respiratory Society \(ERS\) 2024 Congress](#), Cathryn Tonne, PhD, an environmental epidemiologist at the Instituto de Salud Global de Barcelona, Barcelona, Spain, said wildfire-related PM_{2.5} is more toxic than general PM_{2.5}, leading to significantly higher mortality rates.



Cathryn Tonne,
PhD

Prescribed, controlled fires have been employed worldwide to reduce the chance of uncontrolled, catastrophic fires. However, researchers wonder whether the techniques reduce the overall fire-related PM_{2.5} or add up to it. "Prescribed fire increases ecosystem resilience and can reduce the risk of catastrophic wildfire," said Jason Sacks, MPH, an epidemiologist in the Center for Public Health and Environmental Assessment in the Office of Research and Development at the US Environmental Protection Agency (EPA), at the congress. "But it also leads to poorer air quality and health impacts, and we still don't know what this means at a regional scale."



Jason Sacks,
MPH

Wildfire Pollution Kills More Than Other Air Pollution

Researchers at the Instituto de Salud Global de Barcelona used a large dataset of daily mortality data from 32 European countries collected through the EARLY-ADAPT project. They utilized the SILAM model to derive daily average concentrations of wildfire-related PM_{2.5}, non-fire PM_{2.5}, and total PM_{2.5} levels. They also employed GEOSTAT population grids at a 1-km resolution to calculate the attributable number of deaths across different regions, specifically focusing on data from 2006, 2011, and 2018.

The data analysis indicated that the relative risk per unit of PM_{2.5} is substantially larger for wildfire-related PM_{2.5} compared with non-fire PM_{2.5}. "We essentially assume that wildfire smoke PM_{2.5} has the same toxicity as total PM_{2.5}, but it's increasingly clear that's likely not the case," Tonne said, presenting the study.

When employing exposure-response functions (ERFs) specific to wildfire smoke, researchers found that the attributable deaths from all causes of wildfire PM_{2.5} were approximately 10 times larger than those calculated using total PM_{2.5} exposure estimates. Tonne explained that this stark difference highlights the critical need for tailored ERFs that accurately reflect the unique health risks posed by wildfire smoke.

"Respiratory mortality usually has the strongest relative risks, and we're seeing that in this study as well," Tonne said. "Wildfire smoke seems to

operate through quite immediate mechanisms, likely through inflammation and oxidative stress."

One significant challenge of the study was the lack of uniform spatial resolution across all countries involved in the analysis. This inconsistency may affect how accurately mortality estimates can be attributed to specific PM_{2.5} sources. Additionally, the study had limited statistical power for generating age- and sex-specific mortality estimates, which could obscure important demographic differences in vulnerability to wildfire smoke exposure. The analysis was also constrained to data available only up to 2020, thereby excluding critical wildfire events from subsequent years, such as those in 2022 and 2023, which may have further elucidated the health impacts of wildfire smoke in Europe.

Fires Prescription

Prescribed fires or controlled burns are intentional fires set by land managers under carefully managed conditions.

Historically, many forested areas have been subjected to fire suppression practices, which allow combustible materials like dry leaves, twigs, and shrubs to accumulate over time. This buildup leads to a higher likelihood of severe, uncontrollable wildfires. Prescribed fires can reduce these fuel loads and improve the health and resilience of ecosystems.

They release fewer pollutants and emissions than the large-scale, unmanageable wildfires they help prevent because they happen at lower temperatures. But they still introduce pollutants in the air that can negatively affect nearby communities' health.

People with preexisting respiratory conditions, such as asthma or chronic obstructive pulmonary disease (COPD), are particularly vulnerable to smoke, which can trigger health issues like breathing difficulties, coughing, and eye irritation. The cumulative impact of increased burns raises concerns about long-term air quality, especially in densely populated areas. "We need to understand if we're actually tipping the scale to having less wildfire smoke or just increasing the total amount of smoke."

Mitigation strategies include accurately picking the right timing and weather conditions to determine when and where to conduct controlled burns and effective and timely communication to inform local communities about upcoming burns, the potential for smoke exposure, and how to protect themselves.

There is a growing need to improve public messaging around prescribed fires, Sacks said, because often the message communicated is oversimplified, such as "there will be smoke, but don't worry," he said. "But that's not the message we want to convey, especially for people with asthma or COPD."

Instead, he said public health agencies should provide clearer, science-based guidance on the risks for smoke exposure and practical steps people can take to reduce their risk.

What Can Doctors Do?

Chris Carlsten, MD, director of the Centre for Lung Health and professor and head of the Respiratory Medicine Division at the University of British Columbia, Vancouver, British Columbia, Canada, told *Medscape Medical News* that determining whether an exacerbation of a respiratory condition is caused by fire exposure or other factors, such as viral infections, is complex because both can trigger similar responses and may complement each other. "It's very difficult for any individual to know whether, when they're having an exacerbation of asthma or COPD, that's due to the fire," he said. Fire smoke also increases infection risks, further complicating diagnosis.



Chris Carlsten,
MD

Carlsten suggested that physicians could recommend preventative use of inhalers for at-risk patients when wildfires occur rather than waiting for symptoms to worsen. "That is a really interesting idea that could be practical." Still, he advises caution, stressing that patients should consult their providers because not all may react well to increased inhaler use.

He also highlighted a significant shift in the healthcare landscape, noting that traditionally, the focus has been on the cardiovascular impacts of pollution, particularly traffic-related pollution. However, as wildfire smoke becomes a growing issue, the focus is shifting back to respiratory problems, with profound implications for healthcare

resources, budgets, and drug approvals based on the burden of respiratory disease.

"Fire smoke is becoming more of a problem. This swing back to respiratory has huge implications for healthcare systems and respiratory disease burden."

Sacks and Carlsten reported no relevant financial relationships.

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Manuela Callari is a freelance science journalist specializing in human and planetary health. Her words have been published in The Medical Republic, Rare Disease Advisor, The Guardian, MIT Technology Review, and others.

Credits

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