Wildfires and farming activities may be top sources of air pollution linked to increased risk, cases of dementia

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Wildfires and farming may pose threats to cognitive health, according to new research from the University of Michigan.

Increasingly, evidence shows exposure to air pollution makes the brain susceptible to dementia. And now the findings of Boya Zhang and Sara Adar, environmental epidemiology researchers in U-M's School of Public Health, point to a strong likelihood that agriculture and wildfires, with their release of a range of harmful emissions at high concentrations, need to be more closely studied and monitored for their risks to public health, specifically dementia.

"We saw in our research that all airborne particles increased the risk of dementia but those generated by agricultural settings and wildfires seemed to be especially toxic for the brain," said Adar, associate chair of the Department of Epidemiology in the School of Public Health. She currently leads several large cohort studies on the impacts of exposures on cognitive aging and dementia.

"Our findings indicate that lowering levels of particulate matter air pollution, even in a relatively clean country like the United States, may reduce the number of people developing dementia in late life," Adar said.

Adar and Zhang's paper, "Comparison of Particulate Air Pollution From Different Emission Sources and Incident Dementia in the U.S.," appears in the *JAMA Internal Medicine*.

Zhang, a research fellow who focuses on the effects of air pollution on cardiopulmonary disease and cognitive aging, said, "This work suggests that particulate matter air pollution from agriculture and wildfires might be more neurotoxic compared with other sources. However, more research is needed to confirm these effects, especially for these two sources which have received less attention in prior research."

"Given that the development of dementia could take a long time, this study mainly aimed to provide evidence for policymakers to reduce

exposures to these sources of emissions," Zhang said.

The findings come as unusually poor air quality is regularly triggering alerts in the U.S. The alerts are aimed at protecting the public from the unseen, swirling mix of microscopic toxins in air pollution, specifically fine particulate matter or PM2.5. It is one of the most concerning elements of air pollution.

At less than 2.5 microns in size, PM2.5 is less than the width of a human hair. Because it's so small, it can enter the brain through the nose directly or cross the blood-brain barrier in other ways. PM2.5 is also known to affect the lungs, heart, and in emerging research, the brain and cognitive function.

"These findings are quite timely given the increasing frequency of wildfire smoke in our communities," Adar said. "Our data suggest that in addition to some of the more obvious health impacts of wildfire smoke like irritation to our throats and eyes along with breathing difficulties, high smoke days might also be taking a toll on our brains."

The record number of air quality alerts in the U.S. this year are due in large part to smoke from wildfires burning in Canada since May. The effect of wildfire is not new in the U.S., especially given the fires in the western part of the country.

Adar, a long-time environmental epidemiologist, said that wildfire smoke is becoming a more widespread stressor with many cities experiencing 30-plus days each year impacted by smoke. Given the extremely high levels of exposure to the public, wildfires are thought to contribute up to 25% of fine particulate matter exposures over a year across the U.S. and as much as 50% in some western regions of the country, Adar said.

"While individual wildfires may be short-lived, these events are becoming more frequent in our communities due to warmer temperatures, drier conditions, and longer fire seasons. As we've seen, wildfire smoke can also travel very far distances," Adar said.

Their findings are based on research into the development of dementia among nearly 30,000 adults from across the U.S. over an 18-year period. The data comes from the Health and Retirement Study, a nationally-representative collection of cohorts of older adults who have been followed since 1992. Pollution estimates in Adar and Zhang's study were based on home addresses of participants. Participants have been interviewed biennially about their cognition, overall health, and health behaviors until death or loss of contact for the survey.

They observed that higher levels of particulate matter air pollution, especially from agriculture and wildfires, were associated with greater risks of dementia. The findings could not be explained by other factors such as individual, neighborhood, socioeconomic status, occupation, or hometown or region of the country.

"With the knowledge of which sources are more toxic than others, it may be possible to design interventions for specific sources as a more effective way to decrease the burden of dementia," Zhang said.

Dementia is currently the seventh leading cause of death and one of the major causes of disability and dependency for older people, according to the World Health Organization.

The research specifically sought to test the hypothesis that a variation in emission sources could explain which are most toxic, but measuring the emissions with their distinct physical and chemical characteristics is challenging.

Past studies analyzing exposures to source specific fine particulate matter meant researchers mainly investigated relationships with the total mass of fine particulate matter in the air.

"In our study, we used a sophisticated prediction model that includes information about the chemical transformations and dispersion of pollution from different sources to estimate the levels of source-specific particulate matter air pollution at participants' residential addresses," Zhang said. "This approach is beneficial because it not only accounts for pollution directly emitted by a source but also pollution generated through reactions with other chemicals in the air."

Since the average level of exposure to PM2.5 for the people studied was less than the National Ambient Air Quality Standard, this is not just an issue of extreme pollution events, the researchers say, though it's clear that the air quality from wildfire events is worsening. This research suggests that it's not just sending people with respiratory ailments to the hospitals but there may also be longer lasting effects to the body. With the changing climate, it's likely that these threats to health will increase.

More information: Boya Zhang et al, Comparison of Particulate Air Pollution From Different Emission Sources and Incident Dementia in the US, *JAMA Internal Medicine* (2023). DOI: 10.1001/jamainternmed.2023.3300 , jamanetwork.com/journals/jamai … /fullarticle/2808088

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