

Early lead exposure could result in memory issues later in life

Studies presented at the recent Alzheimer's Association International Conference highlighting potential links between lead exposure and cognitive problems



ROBERTA BURKHART ✓
Pittsburgh Post-Gazette
rburkhart@post-gazette.com x

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A new study has found that people who lived in areas with high levels of leaded gasoline emissions in the 1960s and '70s are more likely to report memory problems today — a finding that researchers say could deepen our understanding of environmental risks tied to dementia.

The [study](#) and [others](#) presented in July at the 2025 Alzheimer's Association International Conference used data from more than 600,000 participants from the [U.S. Health and Retirement Study](#) from the University of Michigan's Institute for Social Research.

Participants who lived in areas with higher estimated lead emissions — often tied to dense traffic and industrial zones — were significantly more likely to report poor memory. Although the Michigan study did not include cognitive testing or formal dementia diagnoses, the findings point to a potential long-term connection between environmental exposure and cognitive decline.

“[Research](#) suggests half the U.S. population — more than 170 million people — were exposed to high lead levels in early childhood. This research sheds more light on the toxicity of lead related to brain health in older adults today,” said Maria C. Carrillo, the Alzheimer’s Association chief science officer and medical affairs lead, [per a July 27 news release](#).

Other studies presented at the conference suggested that any lead exposure during one’s lifetime may cause cognitive problems; that certain populations may be disproportionately affected, pointing to social disparities; and that a biological connection exists between lead exposure and Alzheimer’s, Carrillo said.

On the one hand, these conclusions are not all that surprising, said Mark Haut, the director of WVU Rockefeller Neuroscience Institute’s Memory Health Clinic, and Steven Albert, professor of behavioral and community health sciences at the University of Pittsburgh. Neither expert contributed to the studies.

But the conference presentation highlights the need for further study plus continued and expanded long-term collection of data, so that the connection and repercussions of these kinds of toxic exposures can be better understood — from both environmental and treatment perspectives, they said.

Plenty of research, Haut explained, has shown brain development and resilience can be compromised early in life by toxic exposures.

He described the concept of “brain reserve,” comparing it to a cup that starts full and empties over time. Lead exposure — especially in childhood — can siphon off this reserve early. So while lead might not directly cause Alzheimer’s or memory loss, it may set the stage for cognitive decline by weakening the brain’s defenses over time.

Albert noted that while the studies presented at the conference relied on self-reported memory issues rather than clinical diagnoses, the implications are still notable, especially given the scale of the data.

While there's growing concern about historical lead exposure contributing to memory decline, Haut cautioned against overstating the link.

“First, it's an association study, a correlation. It's not cause and effect,” he said.

Still, the evidence that lead is neurotoxic is solid: “Heavy metals, which include lead as well as mercury, are not good for your body or your brain, even at low-level exposure.”

The leaded gasoline study was one of several presented at the conference exploring the role of environmental factors in dementia risk. [Another study](#), with nearly 2,780 California participants, found that even current residence near industrial sources of lead was associated with worse cognitive performance.

“There are many environmental pollutants, airborne toxins, that have been associated with cognitive performance,” Albert said.

He also pointed to a [systematic review](#) published the same week as the conference in Lancet Planetary Health linking long-term air pollution exposure — specifically particulate matter, nitrogen dioxide and black carbon — to increased risk of diagnosed dementia.

“The big implication of all this is that a lot of the dementia that we attribute to old age and ... the accumulation of amyloid and tau and the shrinking of the brain and neuronal debris” may have an environmental source, Albert said, referring to amyloid and tau proteins.

In Alzheimer's patients, brain cell function is disrupted by the accumulation of amyloid plaques and tau tangles, which ultimately leads to brain shrinkage and the buildup of neuronal debris — or remnants and waste products from damaged or dead brain cells, [per the Alzheimer's Therapeutic Research Institute](#) at the Keck School of Medicine of USC.

Why lead matters — and who's at risk

Lead has long been known to affect brain development in children. But research into its long-term effects on aging brains is still emerging.

“Lead is bad for lots of things,” Albert said. “There’s been some studies that suggest it’s related to IQ generally, and also aggression and lots of other things in animal model studies.”

A [study](#) published in the journal PNAS in 2022, which found 170 million Americans alive today were exposed to high lead levels in early childhood, also indicated that many of those individuals were exposed to levels five or more times higher than what’s considered safe today. It estimated that lead exposure is responsible for the loss of more than 800 million collective IQ points among those 170 million Americans, as of 2015.

IQ is not the only area where lead exposure damages us, Albert noted. Instead, it often overlaps with other social determinants of health, like poverty and poor housing, making it difficult to isolate one factor.

Higher levels of exposure and living near environmental pollutants often correlate to those with lower incomes, he said.

Haut agreed, pointing out that many exposures are geographically and economically determined.

“The other interesting thing about this data is it also points to the neighborhood that you grow up in,” he said, referring to the data presented at the conference. He noted that areas near former industrial sites or lead sources tend to lack resources and have more pollution.

He discussed the concept of “neighborhood disparity” and added, “whether it’s lead by itself or with all these other factors, or lack of access to health care, and poor nutrition ... all those kinds of factors kind of figure into this.”

These compounding variables, he said, make it difficult to isolate lead as the sole cause of cognitive decline.

Haut underscored the difficulty of drawing firm conclusions about toxic exposure and cognitive outcomes without long-term, consistent data collection.

He pointed to research systems in other countries, such as Britain's [UK Biobank](#), which follows the lifelong health journeys of a half-million volunteers.

He said these types of studies take decades — “I'm talking 60 years” — but are necessary to build a clearer picture.

What can be done now?

While the exposures in question may have occurred decades ago, Albert said there are still meaningful steps people can take — especially in places like Pittsburgh, where aging housing may contribute to continued risk.

“Something as simple as dehumidifiers, air purifiers or even opening up the window or scrubbing fungal moisture in the basement — all of these things probably can make a difference for the quality of indoor air,” he said. “And maybe that would have important health consequences.”

Albert recently led a study through the Healthy Home Lab at Pitt, funded by the U.S. Department of Housing and Urban Development, that examined indoor air quality and its links to health. The study's findings are under review and are not yet published.

“We looked at indoor air quality, which is one of these also less well investigated things — to look at particulate matter and carbon dioxide and also fungal species that you can actually measure in dust,” he said. “There probably is a lot of work to be done for the home.”

Even without a clear cause-and-effect link to Alzheimer's, Haut emphasized the importance of protecting brain health through lifestyle choices.

“Diet actually is really important” in addition to one's general health, he said, recommending lean protein, fewer processed foods, more fruits and vegetables and lower sugar intake. “Pairing that with daily exercise is really important.”

But perhaps the most powerful tool is interpersonal connection.

Haut said socialization is something he consistently recommends. “That's the best brain exercise, right?”

He explained that human social interactions engage the entire brain and vary constantly, making them more neurologically stimulating than something like repetitive brain games.

A preventable piece of the puzzle

Ultimately, Albert sees the lead findings as part of a broader conversation about preventable risks for dementia — and one that should lead to greater public health investment.

He pointed out that the Lancet Commission has identified up to [14 different factors](#) that affect cognitive health in old age, including high cholesterol, traumatic brain injury, hearing loss, Type 2 diabetes, smoking, obesity and high blood pressure.

“The estimate is that if you reduced those or eliminated those, you could cut the dementia incidence by about 40 or 45%,” he said. “And lead is a good one because we know a lot about its biological effects on the nervous system.”

Even as research continues, he said the public health message remains clear.

“With age, the ‘whips and scorns of time,’ as Shakespeare called it, you will see increases in dementia,” Albert said. “But the way we live and what we expose ourselves to probably increases our risks.”

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Roberta Burkhart is a Post-Gazette health and wellness reporter. A Penn State graduate, she previously covered breaking news, lifestyles and arts & entertainment in Pittsburgh, Williamsport, and Morristown, N.J.

✉ rburkhart@post-gazette.com

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