

PFAS exposure linked to decreased bone health in adolescents and young adults

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Per- and polyfluoroalkyl substances (PFAS), manufactured chemicals used in products such as food packaging and cosmetics, can lead to reproductive problems, increased cancer risk and other health issues. A growing body of research has also linked the chemicals to lower bone mineral density, which can lead to osteoporosis and other bone diseases. But most of those studies have focused on older, non-Hispanic white

participants and only collected data at a single point in time.

Now, researchers from the Keck School of Medicine of USC have replicated those results in a [longitudinal study](#) of two groups of young participants, primarily Hispanics, a group that faces a heightened risk of [bone](#) disease in adulthood.

"This is a population completely understudied in this area of research, despite having an increased risk for bone disease and osteoporosis," said Vaia Lida Chatzi, MD, Ph.D., a professor of population and public health sciences at the Keck School of Medicine and the study's senior author.

In a group of 304 adolescents, exposure to PFAS was linked to a decrease in bone [mineral density](#) over time. In a group of 137 young adults, PFAS exposure was also linked to lower baseline bone density, but no differences were observed over time. The results were just published in the journal [Environmental Research](#).

"Many existing studies haven't included participants this young, but we're now able to see that this association is already happening at a time when bones are supposed to be developing," said Emily Beglarian, MPH, a doctoral student in the Keck School of Medicine's Department of Population and Public Health Sciences and lead author of the study.

The researchers say the findings highlight the need for stricter regulation of PFAS, which have contaminated public drinking water, food and soil across the United States.

"PFAS are ubiquitous—we are all exposed to them," Chatzi said. "We need to eliminate that exposure to allow our youth to reach their full potential in terms of bone development to help them avoid osteoporosis later in life."

Implications across the lifespan

Bone mineral density increases during adolescence, peaks between the ages of 20 and 30, then slowly decreases throughout adulthood. Peak bone mineral density helps predict whether a person will get osteoporosis later in life, prompting the researchers to investigate how PFAS can affect [young people](#).

"We want to make sure we're not exposing ourselves to things that harm our bone development, because it has implications over the rest of our lives," Beglarian said.

The researchers studied 304 Hispanic adolescents, with an average age of 11 years, from the "Study of Latino adolescents at risk of type 2 diabetes." They collected blood samples to measure PFAS levels and a special kind of X-ray known as a dual X-ray absorptiometry (DXA) scan to measure bone density, then followed up after about one and a half years to check for a change over time.

For each doubling of baseline perfluorooctanesulfonic acid (PFOS), one type of PFAS, participants had an average decrease in bone mineral density of 0.003 g/cm² per year at follow-up.

They also studied 137 [young adults](#), who were 58.4% Hispanic and had an average age of 19 years, from the Southern California Children's Health Study. They collected [blood samples](#) and DXA scans at baseline, then followed up about four years later. When baseline levels of PFOS doubled, participants had an average of 0.032 g/cm² lower baseline bone mineral density, though no significant change was observed over time.

Limiting exposure to PFAS

The researchers say stricter regulations are needed for PFAS, especially to protect high-risk communities such as Hispanics who also face increased exposures to other types of pollutants.

"It's important to regulate PFAS as a class, because we are not just exposed to one chemical, we are exposed to thousands of chemicals," Chatzi said.

While the burden of reducing PFAS should not fall to individuals, the researchers are planning outreach efforts to help people learn how to limit their personal exposure. Tips include avoiding nonstick pans and [personal care products](#) known to include PFAS.

Chatzi, Beglarian and their colleagues are also expanding their research to confirm the findings across the lifespan and in other communities throughout the U.S., with a continued focus on Hispanics. They also plan to study the biological mechanisms behind the effects of PFAS on bone health, including looking for biomarkers that could indicate bone health is at risk before osteoporosis sets in.

More information: Vaia Lida Chatzi et al, Exposure to perfluoroalkyl substances and longitudinal changes in bone F mineral density in adolescents and young adults: A multi-cohort study, *Environmental Research* (2023). [DOI: 10.1016/j.envres.2023.117611](https://doi.org/10.1016/j.envres.2023.117611)

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