

# 'Forever chemicals' linked to hypertension in middle-aged women

June 13 2022

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Middle-aged women with higher blood concentrations of common synthetic chemicals called per- and polyfluoroalkyl substances (PFAS), also called "forever chemicals" and found in water, soil, air and food,

were at greater risk of developing high blood pressure, compared to their peers who had lower levels of these substances, according to new research published today in *Hypertension*, an American Heart Association journal.

PFAS, are a class of synthetic chemicals and according to the U.S. Environmental Protection Agency, there are thousands of different PFAS that are used in everyday household items, such as certain shampoo, dental floss, cosmetics, non-stick cookware, food packaging, stain-resistant coatings for carpeting, upholstery and clothing. The "forever chemicals" also enter the food system through fish caught in PFAS-contaminated water and [dairy products](#) from cows exposed to PFAS through fertilizers on farms, for example.

Even at low levels in the [blood](#), research has shown PFAS can have detrimental health effects. Some PFAS have been linked to [cardiovascular risk](#), including endothelial dysfunction (impaired blood vessel function), oxidative stress and elevated cholesterol. However, no previous studies have evaluated whether PFAS levels affect [blood pressure control](#) among middle-aged [women](#).

Previously published data from the National Health and Nutrition Examination Survey (NHANES) demonstrates how common PFAS exposure is, as nearly all Americans have detectable concentrations of at least one PFAS in their blood.

"PFAS are known as 'forever chemicals' because they never degrade in the environment and contaminate drinking water, soil, air, food and numerous products we consume or encounter routinely. One study estimated that two of the most common 'forever chemicals' are found in most household drinking water and are consumed by more than two-thirds of Americans," said study lead author Ning Ding, Ph.D., M.P.H., a post-doctoral fellow in the department of epidemiology at the University

of Michigan School of Public Health in Ann Arbor, Michigan.

"Women seem to be particularly vulnerable when exposed to these chemicals," she said. "Our study is the first to examine the association between 'forever chemicals' and hypertension in middle-aged women. Exposure may be an underappreciated risk factor for women's cardiovascular disease risk."

Using data from the Study of Women's Health Across the Nation-Multi-Pollutant Study (SWAN-MPS), a prospective study of women from diverse racial and [ethnic backgrounds](#) at midlife, researchers examined blood concentrations of specific PFAS and the risk of [high blood pressure](#). Data included more than 1,000 women, 45-56-years old who had normal blood pressure when they enrolled in the study. Blood concentrations of PFAS were measured at the start of the study. All participants were followed almost-annually from 1999-2017. Participants were recruited from five institutional sites (Boston; Pittsburgh; Southeast Michigan; Los Angeles; and Oakland, California) across the U.S., and they self-identified as Black (15.2%), Chinese (14.1%), Japanese (16.2%) or white women (54.5%). All sites enrolled non-Hispanic [white women](#) in addition to one additional racial/ethnic group.

The analysis found:

- During 11,722 person-years of follow-up for all study participants, 470 women developed high blood pressure.
- Women with higher concentrations of specific PFAS were more likely to develop high blood pressure: women in the highest one-third concentrations of perfluorooctane [sulfonic acid](#) (PFOS), [perfluorooctanoic acid](#) (PFOA), and 2-(N-ethyl-perfluorooctane sulfonamido) acetic acid (EtFOSAA, a PFOS precursor) had 42%, 47% and 42% higher risks, respectively, of developing high

blood pressure, compared to women in the lowest one-third concentrations of these PFAS.

- Women in the highest one-third concentrations of all seven PFAS examined had a 71% increased risk of developing high blood pressure.

"It's important to note that we examined individual PFAS as well as several PFAS together, and we found that the combined exposure to multiple PFAS had a stronger effect on blood pressure," said study senior author Sung Kyun Park, Sc.D., M.P.H., an associate professor of epidemiology and environmental health sciences at the University of Michigan School of Public Health. "Some states are beginning to ban the use of PFAS in food packaging and cosmetic and personal care products. Our findings make it clear that strategies to limit the widespread use of PFAS in products need to be developed. Switching to alternative options may help reduce the incidence of high blood pressure risk in midlife women."

"We have known for some time that PFAS disrupt metabolism in the body, yet, we didn't expect the strength of the association we found. We hope that these findings alert clinicians about the importance of PFAS and that they need to understand and recognize PFAS as an important potential risk factor for blood pressure control," Park said.

The study was limited in that it only included middle-aged women, so the findings may not translate to men or to younger or older women. The authors note that more research is needed to confirm these associations and to address ways to reduce PFAS exposure.

**More information:** Per- and Polyfluoroalkyl Substances and Incident Hypertension in Multi-Racial/Ethnic Women: The Study of Women's Health Across the Nation, *Hypertension* (2022). [DOI: 10.1161/HYPERTENSIONAHA.121.18809](https://doi.org/10.1161/HYPERTENSIONAHA.121.18809) ,

[www.ahajournals.org/doi/10.116 ... TENSIONAHA.121.18809](http://www.ahajournals.org/doi/10.116... TENSIONAHA.121.18809)

Provided by American Heart Association

Citation: 'Forever chemicals' linked to hypertension in middle-aged women (2022, June 13)  
retrieved 17 July 2023 from <https://medicalxpress.com/news/2022-06-chemicals-linked-hypertension-middle-aged-women.html>

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