TESTING FOR PFAS ("FOREVER CHEMICALS")

GUIDANCE FOR CLINICIANS

By Lyn Patrick, ND

In the fall of 2023, data from the CDC's National Center for Environmental Health, highlighted in the National Report on Human Exposure to Environmental Chemicals, indicated that 98% of people in the U.S. likely have detectable levels of perfluorinated and polyfluorinated substances (known as PFAS, or "forever chemicals") in their blood. Citing known health risks, the CDC in January 2024 released guidance for healthcare providers on how to test patients for these substances.

The CDC recommends that clinicians use patient history in combination with assessment tools for estimating water, food, and other exposures (i.e., occupational exposure) to guide them in deciding whether to order blood-level PFAS testing for their patients. They further recommend that all healthcare providers consider PFAS exposure a health risk. By identifying potential exposure sources and testing PFAS blood levels, healthcare providers can help their patients avoid continued exposure and follow guidelines for managing and minimizing exposure-related health risks.

WHAT ARE PFAS?

Perfluorinated and polyfluorinated substances (PFAS) are a group of approximately 4,700 synthetic chemicals used to make non-stick, non-stain, and water-repellent coatings. They're found in a variety of household and industrial products, from clothing to nonstick pans to furniture and electrical wires. PFAS are considered "forever chemicals" because they don't break down in the environment and can build up in soils and waterways, contaminating fish and wildlife. People are exposed to PFAS when they consume contaminated food and water and when they use products containing PFAS.

The CDC has tested for the presence of 12 different PFAS in the U.S. population, monitoring exposure levels to the 9 PFAS that are most likely to show up in blood serum or plasma testing:

- MeFOSAA
- PFHxS
- PFOA (linear and branched isomers)
- PFDA
- PFUnDA
- PFOS (linear and branched isomers)
- PFNA

One PFAS missing from this list, however, is PFBA, which is sequestered in the lungs. In one Danish study, PFBA was found in significant blood-level concentrations in patients who died as a result of COVID-19, compared to those who were infected with the virus but did not develop a serious case and did not require hospitalization. (PMID: 33382826) PFAS are immunotoxic; PFBA may have contributed to cytokine expression in those who contracted COVID-19.

WHAT ARE THE RISKS ASSOCIATED WITH ELEVATED PFAS BLOOD LEVELS?

High concentrations of PFAS in drinking water have been linked with an increased incidence of diabetes, cerebro-vascular diseases, myocardial infarction, Alzheimer's disease in both sexes, kidney and breast cancer, and Parkinson's disease in females. (PMID: 30503928/33143342)

PFAS have also been associated with elevated cholesterol levels, liver dysfunction, weight gain, reproductive problems, pancreatic cancer, testicular cancer, liver cancer, immune toxicity, and increased risk for heritable prostate cancer. In children, PFAS have been linked to increased risk of otitis media, pneumonia, respiratory syncytial virus infection, varicella, asthma, and, in both children and adolescents, increased IgE levels. Studies have also shown decreased antibody reaction to multiple vaccines in infants and to influenza vaccines in adults. (PMID: 28392064)

PFAS serum levels have consistently been found to be higher in men than women, increasing with age, and have been linked to both obesity and diabetes. (PMIDs: 31679856, 29438414, 29498927) Elevated levels of a specific PFAS, known as PFOS, correlate with lower vitamin D levels in adults. (PMID: 30503928)

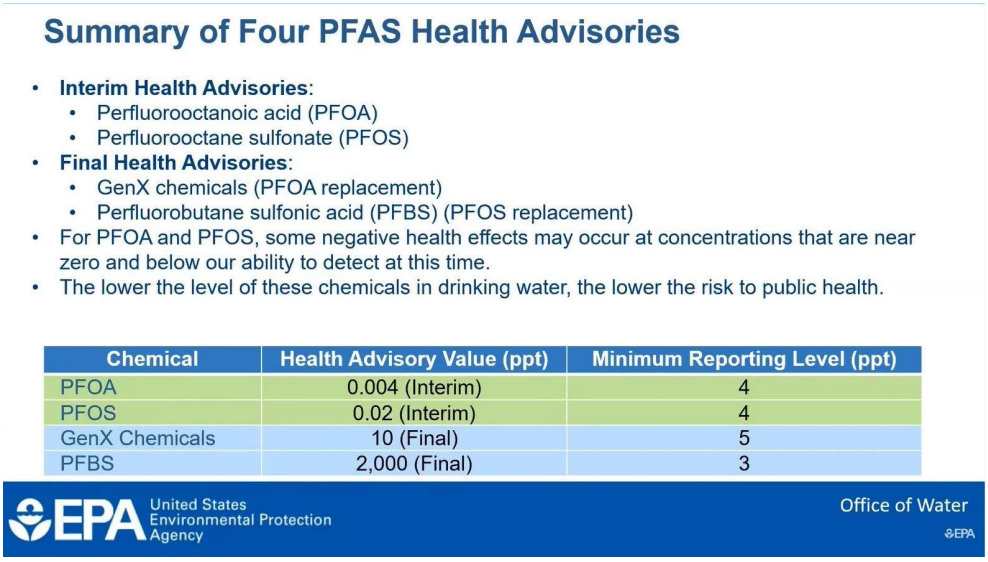
METABOLISM AND ELIMINATION OF PFAS

PFAS are found mainly in the blood but can perfuse all tissues. They have been detected in all parts of the human body, including hair, tissues, and organs, and in secretions such as breast milk. PFAS have been shown to accumulate in and negatively impact the bone marrow, spleen, skin, thymus, and small intestine where they alter the microbiome and damage the gut lining. (PMID: 34780734)

They are called "forever chemicals" because their half-lives (the time it takes for 50% of a known chemical to leave the body) can be very long. In one prospective trial in China, half-lives for PFHxS, PFOS, and PFOA in reproductive-age females were shown to be 7.7, 6.2, and 2.1 years, respectively. Half-lives differed significantly for males and menopausal females at 35, 27, and 2.6 years, respectively, for each compound. It may take as long as five half-lives for PFAS to leave the body completely.

WHO SHOULD GET TESTED?

The important aspect of testing is knowing exposure levels in your patients. The most important exposure source is drinking water. Fortunately, the Environmental Working Group created a reliable tool for tracking PFAS contamination in drinking water systems across the U.S. Based on EPA data, the tool's searchable map currently identifies over 5,000 locations where significant levels of PFAS in drinking water have been detected.



The EPA measures and regulates 4 PFAS compounds in drinking water and uses the Health Advisory Values to identify levels of concern. (See summary chart above.)

Potential contamination sources for local drinking water include nearby production facilities that use or have used fluorochemicals: commercial airports, military bases, wastewater treatment plants, farms where sewage sludge may have been applied to soil, and landfills or incinerators that have received PFAS-containing waste. Potential occupational exposures to PFAS exist for those who have worked with fluorochemicals, such as firefighters and military personnel who use fire-fighting foams.

Water supplies can be tested for PFAS using a number of laboratory tests, either those provided by state public health agencies or private laboratories that test for water contamination.

HOW CAN HEALTHCARE PROVIDERS TEST PATIENTS FOR PFAS?

Most studies measure PFAS in serum, which is likely the best source for measuring PFAS with long biological half-lives. Tests using whole blood or urine are more likely to detect PFAS with short biological half-lives, which are not among the most commonly studied PFAS (such as PFOA and PFOS) that have long half-lives in the body.

While urine, breast milk, and hair samples can be used to measure PFAS, biomonitoring efforts in the U.S. have focused largely on blood serum, where reference ranges are well-documented. In their guidance documents, the National Academy of Sciences and the CDC recommend serum or plasma for testing for PFAS. Both organizations strongly advise against using urine to test for PFAS as their data show that the long-chain PFAS can be missed in urine.

LABS THAT TEST FOR PFAS:

- EMPower DX (Framingham, Massachusetts), a subsidiary of Eurofins Scientific (Luxembourg City, Luxembourg), recently began offering direct-to-consumer testing for more than 40 PFAS via self-collected finger prick sample at a cost of $399.
- Quest Laboratory initiated a PFAS Panel in February 2024 that includes the 9 PFAS identified for testing by the NAS Report. The direct-to-consumer cost is $249.00. A physician's order is not necessary.
- Quest Diagnostics also offers a physician-ordered, insurance-reimbursable panel, identified as the PFASure TM/ Serum/Plasma assay (Test Code: 12789/CPT Code 82542). The panel tests for 16 different PFAS compounds, including PFBS and others recommended by NASEM (National Academies of Sciences, Engineering, & Medicine), and provides computed totals for all tested compounds:
    - ADONA
    - Branched PFOA Isomers
    - Branched PFOS Isomers
    - Linear PFOA Isomer
    - Linear PFOS Isomer
    - MeFOSAA
    - NASEM Summation Value
    - PFBS
    - PFDA
    - PFDoDA
    - PFHpA
    - PFHpS
    - PFHxA
    - PFHxS
    - PFNA
    - PFOSA
    - PFUnDA
    - Total PFOA Isomers
    - Total PFOS Isomers

HOW TO INTERPRET PFAS TEST RESULTS – NASEM REPORT RECOMMENDATIONS

- Using total serum or plasma concentrations of the 9 PFAS in the CDC list, patients whose tests show a cumulative PFAS blood concentration below 2 nanograms per milliliter (ng/mL) are not expected to have adverse health effects.
- Patients with test results between 2 and 20 ng/mL may face the potential for adverse effects, especially in sensitive populations (such as pregnant women). Clinicians should encourage reducing PFAS exposure for these patients. Following the usual standard of care, clinicians should also prioritize screening for dyslipidemia, hypertensive disorders of pregnancy, and breast cancer based on age and other risk factors.
- Patients with test results above 20 ng/mL may face a higher risk of adverse effects. Clinicians should encourage exposure reduction and prioritize screening for dyslipidemia in accordance with guidance for patients with increased risk. In addition to the care recommended for patients who test between 2 and 20 ng/ml, clinicians should also conduct thyroid function testing and assess for signs of kidney and testicular cancer and ulcerative colitis during wellness visits.

AVOIDING PFAS EXPOSURE

The majority of non-occupational PFAS exposure comes from drinking water. Bottled water and fish harvested from PFAS-polluted waterways (such as inland lakes, streams, and rivers) can also be significant exposure sources. Affordable water filtration units can safely remove 100% of PFAS from drinking water. The Environmental Working Group has identified several pour-through water filtering units for this purpose.

REDUCING PFAS LEVELS IN THE BODY

Currently, the only evidence-supported method for effectively lowering blood levels of PFAS is blood or plasma donation. A study of 285 firefighters with baseline PFOS levels of 5 ng/mL or more measured the effectiveness of this intervention. Firefighters in the study were randomly assigned to one of three groups that either donated plasma every 6 weeks for 12 months, donated blood every 12 weeks for 12 months, or served as a control group with no intervention. The study found that levels of PFOS were significantly reduced in firefighters who donated plasma or blood. Plasma donation was more effective at lowering PFOS than blood donation. Plasma donation also significantly reduced blood levels of a commonly measured PFAS compound known as PFHxS, whereas blood donation did not. (PMID: 35394514)

Contributing to the PFAS burden in donated blood limits the widespread use of this strategy. However, the study's findings support its potential effectiveness for individuals who may be at risk for serious health complications due to high levels of occupational or environmental exposure.

REFERENCES

National Academies of Sciences, Engineering, and Medicine; Health and Medicine Division; Division on Earth and Life Studies; Board on Population Health and Public Health Practice; Board on Environmental Studies and Toxicology; Committee on the Guidance on PFAS Testing and Health Outcomes. Guidance on PFAS Exposure, Testing, and Clinical Follow-Up. Washington (DC): National Academies Press (US); 2022. doi:10.17226/26156 (http://nap.nationalacademies.org/26156 Accessed Feb. 15,2024)

ATSDR PFAS Information for Clinicians 2024 – CDC guidance for clinicians that includes patient recommendations for food and water contamination. https://www.atsdr.cdc.gov/pfas/resources/pfas-information-for-clinicians.html

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