PFAS: A RISK TO HEALTH

PFAS, also known as “forever” chemicals, constitute the "lead" of our time. Like lead, PFAS are ubiquitous, toxic and a threat to public health and health equity. Addressing PFAS contamination using a systematic public health approach -- education, mitigation, prevention and advocacy--will benefit all communities across the Commonwealth.

WHAT ARE PFAS CHEMICALS?

PFAS is an acronym for per- and polyfluoroalkyl substances, a class of over 12,000 chemicals that contain at least one fully fluorinated carbon atom. This bond is exceptionally strong and resistant to degradation. PFAS persist in the environment where they can bioaccumulate. Due to the increased toxicity of some of their degradation products, these chemicals have the potential to become more harmful to health over time.

PFAS: HISTORY

The first perfluorocarbon was produced in the 1930s. The use of PFAS in nuclear weapons development by the Manhattan Project during World War II led to the discovery of a plethora of other applications and wide-scale production.

The negative health effects of PFAS were discovered early but not publicly disclosed: human and animal studies by Dupont in the 1960s revealed adverse health effects, such as increased risk of birth defects and miscarriage. A 2016 New York article and subsequent film discuss the first realization, in the 1990s, of the effects on communities of contamination of

soil and water systems surrounding a Dupont factory in Parkersburg, West Virginia that produced the PFAS chemical PFOA, or C8.

The investigation of the Dupont factory found high levels of contamination amongst factory workers as well as of a nearby farm that lay adjacent to a large landfill that Dupont used to dispose of its PFAS chemicals. The toxic exposure led to the death of hundreds of cattle that grazed near the landfill.

> Before PFAS, "corporations could rely upon the public misperception that if a chemical was dangerous, it was regulated."
> –New York Times, "The Lawyer Who Became Dupont's Worst Nightmare"

The settlement of a years-long lawsuit with Dupont in the early 2000s led to establishment of the C8 health project, a medical monitoring program that correlated blood levels of PFAS in 70,000 patients with associated negative health outcomes. More recently, a community contaminated by newer "GenX" PFAS in Wilmington, North Carolina was found to experience similar negative health effects.

SOURCES OF EXPOSURE TO PFAS

PFAS exposure occurs via food, air and water; the latter is thought to be the most common route of exposure. PFAS chemicals can be inhaled, absorbed through the skin or ingested.

Water, soil and air become contaminated when PFAS leaches out of commonly used products. PFAS are used in thousands of products including weapons, "non-stick" products (e.g., "Teflon"), artificial turf, clothing, leather, carpets, food packaging, firefighting foam, pesticides, petroleum extraction ("fracking") fluids, and "biosolids" that are spread on agricultural crops.

Ingestion of contaminated dust is a significant source of exposure from products like carpets and upholstery. PFAS can also migrate into food from boxes and packaging. In infants, toddlers, and children, hand-to-mouth behavior is a significant source of exposure.

In the medical arena, PFAS are used in a wide array of products including medications, breast prostheses, contact lenses, IV tubing, cannulas and joint spacers.

Today, more than a million tons of PFAS chemicals are produced each year and are used in roughly 900,000 products. Globally, over 600,000 acres of urban and agricultural land are contaminated with PFAS, with a particular concentration near military bases and airports. According to a new study from the US Geologic Service, almost half of US water systems are contaminated with these "forever chemicals". Over 97% of the US population have detectable blood levels of PFAS.

HEALTH RISKS OF EXPOSURE TO PFAS

According to EPA, there is ***no safe level of exposure to PFAS chemicals****.* While the EPA has set health-based guidelines for water at between 0.002 and 0.004 ng/L, the agency notes that health effects can occur at any level.

The scientific community has known for decades that PFAS pose risks to human health. The chemicals bind strongly to albumin, a plasma protein in the blood, and can methylate DNA, impairing gene expression. These chemicals can persist in humans for years following exposure.

The associated health harms are broad: epidemiologic and toxicologic studies have linked PFAS to reproductive, metabolic and neurodevelopmental diseases as well as to some cancers.

Peer-reviewed studies have shown that exposure to PFAS may lead to:

- Endocrine disruption
- Increased cholesterol levels and vascular disease
- Immune suppression
- Hepatotoxicity
- Harms to maternal-infant health, including preeclampsia, low infant birth weight, and compromised organogenesis
- Harms to neurocognitive and behavioral development in children
- Reproductive harms, including impaired fertility and early-onset puberty

- Celiac disease
- Impaired vaccine response in children
- Type 2 diabetes
- Malignancies, including prostate, kidney, and testicular cancers
- Premature death.

Particularly concerning are the health effects of exposure that occur during gestation or early childhood, many of which may not be obvious until years later.

High risk populations include children, pregnant women, industry workers, and those who live or work near high risk facilities like military bases, shipyards, chemical plants, refineries or airports.

HEALTH EQUITY

PFAS chemicals also pose an important equity issue. While both wealthy and low-income communities are affected, wealthy communities are more likely to be able to afford high cost mitigation measures, such as water filtration. Thus, the health harms of PFAS and the ability to respond to them exacerbate existing health disparities.

PFAS IN MASSACHUSETTS

Firefighters on Nantucket were one of the first groups to sound the alarm about the serious health effects of PFAS contamination in Massachusetts. Other communities have since discovered extensive contamination in compost, landfills, industrial and agricultural runoff, and water systems. In the cities of Cambridge, Westminster, Wayland and Easton, and many other towns across the Commonwealth, PFAS have been found to contaminate drinking water, rivers, lakes and fish. PFAS have recently been shown to be ubiquitous in rainwater and in air samples. Residents of the Commonwealth have also been exposed through aerial spraying of Anvil, a pesticide that was contaminated with several PFAS due to leaching of the chemicals from the polyethylene containers in which they were stored.

Thanks to the state commission assigned to investigate the issue, soil, water and air contamination is now known to affect hundreds of communities

across Massachusetts. Some, like Nantucket, Westminster, Hyannis and Cambridge have been disproportionately affected.

ECONOMIC COSTS OF PFAS CONTAMINATION

PFAS contamination is a VERY costly issue for communities in Massachusetts: Cambridge, for example, spent two million dollars *a month* in 2022 to source its water from MWRA while it installed filters for PFAS due to elevated levels. Hyannis, which had the highest PFAS levels in the state, spent $10 million on a filtration system; Barnstable installed one for $20 million.

Yet the cost of water filtration is dwarfed by the costs of the health consequences of PFAS. Researchers from NYU estimate that the economic costs of the health sequelae in the US, range from 5.5-63 billion dollars annually.

Communities can't shoulder the cost of addressing PFAS water contamination alone. Last year, the Massachusetts Department of Environmental Protection (DEP) testified to the specific need for funding for testing and remodeling private wells. The DEP said that while they are increasing their PFAS budget, stronger legislation is required to address this widespread public health issue.

WHAT PHYSICIANS NEED TO KNOW

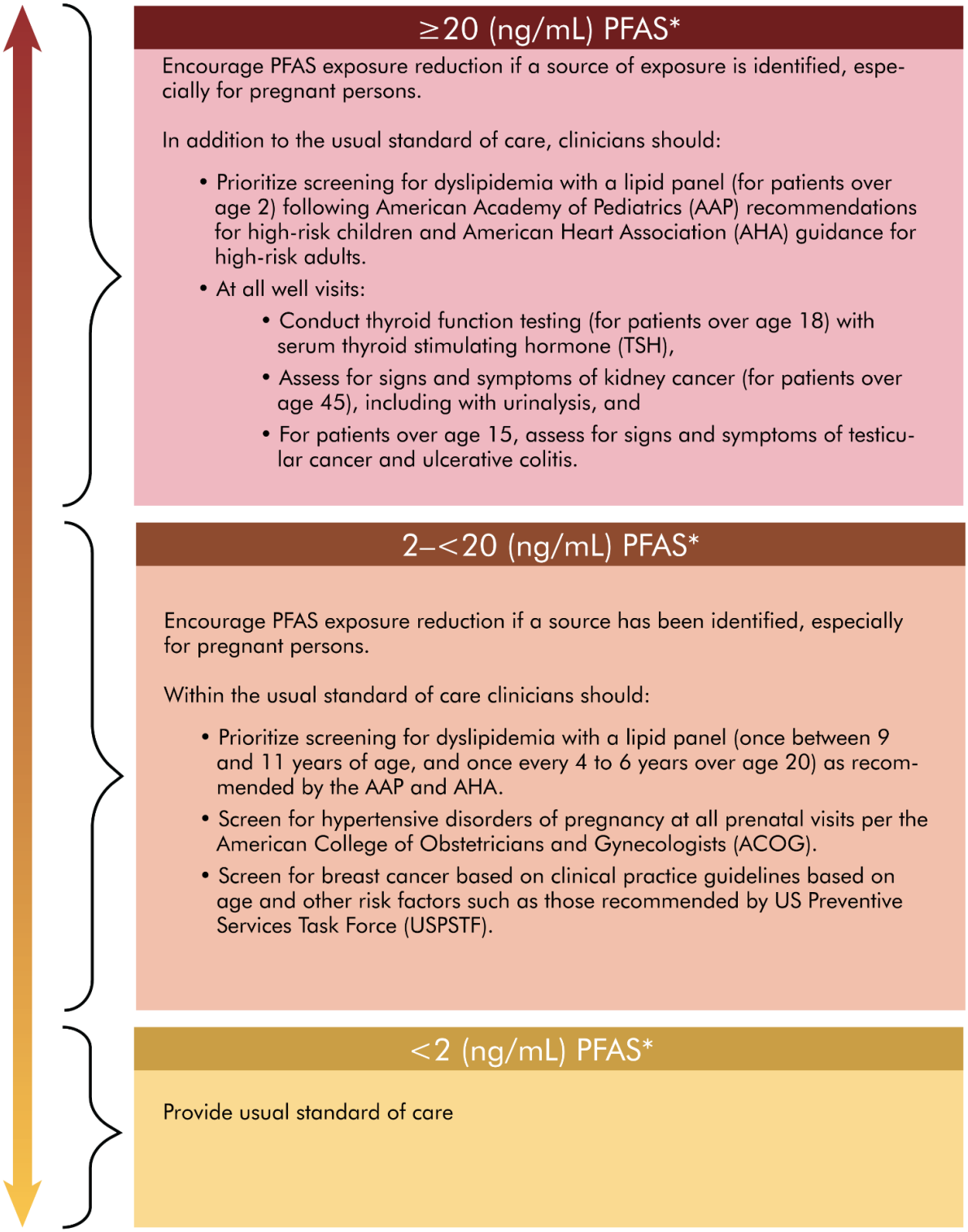
Testing for PFAS, though expensive, offers an opportunity to identify people who may need to reduce PFAS exposure and who are at increased risk for negative health outcomes. PFAS blood tests are now commercially available. Unfortunately, PFAS blood testing is not currently covered by insurance in Massachusetts, exacerbating the potential for these chemicals to disproportionately harm low-income communities.

It is also important to note that current testing only identifies legacy PFAS, not the newer GenX PFAS chemicals. Tests that better determine the full scope of this public health crisis are needed.

EVALUATING AND ADDRESSING PFAS EXPOSURE

Information on reliable companies offering PFAS blood testing and how to interpret results is available on the PFAS-REACH website, a joint collaboration between the Silent Spring Institute, Northeastern University and Michigan State University.

An excellent schematic on interpreting blood tests is described in the schematic below, excerpted from the 2022 National Academies of Science and Medicine (NASEM) report:



* Simple additive sum of MeFOSAA, PFHxS, PFOA (linear and branched isomers), PFDA, PFUnDA, PFOS (linear and branched isomers), and PFNA in serum or plasma

See the above schematic for specific recommendations for actions to take based on testing.

PFAS WATER TESTING

Massachusetts is one of the first states in the country to require testing for PFAS in water. In 2020, MassDEP published standards for PFAS in drinking and ground water; however, this rule only covers a subgroup of six legacy PFAS chemicals. The Massachusetts DEP has set a PFAS limit of **20 parts per trillion (ppt)** in municipal water systems. Massachusetts does not provide for testing of private wells.

HOW HUMANS ELIMINATE PFAS

While some PFAS may be eliminated via renal excretion, PFAS may also be eliminated from the body via menstrual blood loss, donating blood, and nursing (however, PFAS then can bioaccumulate in the nursing infant) .

HOW TO ELIMINATE PFAS FROM WATER SYSTEMS

Activated carbon filters are used by water utilities and individuals to remove PFAS from drinking water. Ion exchange systems can also effectively reduce PFAS but are more expensive.

HEALTH BENEFITS OF FILTRATION

One clinical study in Minnesota found that reducing PFAS chemicals in the water supply had measurable positive health effects: PFAS blood concentrations were substantially reduced in the population and there were significant improvements in infant birth weights and the number of full-term pregnancies.

US EPA TO SET REGULATORY LIMITS

PFAS have recently been designated by the US EPA as hazardous substances that can be regulated under Superfund statutes.

EPA has recently proposed new national standards that would limit the concentrations of six PFAS in public drinking water supplies. But many scientists feel that this is not sufficiently protective of health: i.e., that it is

necessary to regulate not just six PFAS, but to regulate PFAS as a class, which includes thousands of chemicals.

While industry has retired many legacy PFAS, newer fluorocarbons contaminate the environment via the same routes and are associated with similar health hazards.

The European Chemicals Agency has proposed a ban on the production, use and sale of about 10,000 PFAS chemicals in the European Union.

SOLUTIONS: PREVENTION, MITIGATION, TREATMENT AND INCREASING PUBLIC AWARENESS

Increased public education around this issue is critical as is advocacy for more stringent regulations on PFAS-containing products. Regulating PFAS as a class would better mitigate adverse health effects since the latter derive from many different PFAS, not just the legacy ones targeted by EPA. Stronger policy would also help ensure that the companies responsible for pollution would bear the cost of clean up.

Legislative action on PFAS is urgently needed given the tremendous health and economic costs of this issue. The health and economic costs are immense, and the disabilities can be life-long.

Decreasing toxic exposure to PFAS will increase the ability of those who live and work in the Commonwealth to contribute to society and live meaningful, rewarding lives.

GBPSR advocates that:

Massachusetts safeguard health, promote social justice, and protect our common home, as other states have done, by:

- Banning non-essential PFAS use in Massachusetts;
- Regulating PFAS as a class;
- Establishing a fund for drinking water remediation, including private well remediation;
- Requiring that the MA Department of Environmental Protection (DEP) restrict industry discharges of PFAS to groundwater and surface water;

- Engaging in critical public outreach program on the dangers of PFAS
- Giving the state Attorney General the authority to enforce violations of PFAS laws
- Requiring that MassHealth and state insurance companies cover PFAS blood testing.

WHAT DOCTORS CAN DO

- Provide information about sources of exposure to PFAS and PFAS health effects in doctors' offices and at medical facilities. Comprehensive medical information and guidance that can be shared with patients can be found on the PFAS-REACH project's website (https://pfas-exchange.org/);

- Advocate to the state legislature to reduce future community exposure through regulations to curb the continued production and use of PFAS. This includes banning the use of PFAS in common consumer products (e.g., food packaging, textiles, personal care products, and pesticides) and products that can lead to discharges into water systems (e.g., biosolid fertilizer and artificial turf).

- Screen patients for environmental exposures from contaminated drinking water or food and occupational exposures from products like firefighting foam and gear.

- Advocate for water filtration systems to be installed to remove PFAS in homes and public water supplies where elevated PFAS levels are detected.

- Advocate that the Commonwealth of Massachusetts follow New Hampshire's lead in requiring that robust blood tests for PFAS be covered by insurance so that clinicians and patients can assess exposure and monitor for related health outcomes.

CME courses for medical professionals on PFAS are available from Kansas City Children's Mercy Hospital and from the University of Cincinnati.

WHAT INDIVIDUALS CAN DO

- Ask their local health department for results of water testing for PFAS; For those with private wells, test wells for PFAS;
- For parents of young infants: consult with your doctor to make an informed decision on whether it is safe to nurse and/or use the local water supply for infant formula preparation based on the results of local water supply testing;
- Limit use and exposure to PFAS-containing pesticides and food packaging;
- Follow preventive precautions to protect children from exposure to PFAS-containing artificial turf fields
- Support the ban on aerial pesticide application

WHAT THE FEDERAL GOVERNMENT CAN DO

The federal government can and should take the lead in prevention of PFAS chemical contamination via existing regulations such as the Safe Drinking Water Act, the Emergency Planning and Community Right to Know Act and the Toxic Substances Chemical Data Rules.

Most importantly, clean-up of PFAS contamination and, eventually, the health costs should be shouldered by the polluters.

WHAT MASSACHUSETTS CAN DO

Massachusetts can play a leadership role in addressing this global problem by banning nonessential PFAS production as well as imports and exports of nonessential PFAS containing products. Several U.S. medical societies, including the Massachusetts Medical Society, and US state legislatures have already called for a ban on non-essential PFAS chemicals.

References

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From Children's Mercy Hospital: **https://www.youtube.com/watch?v=j--XNvXubU8**

From University of Cincinnati: **https://uc.cloud-cme.com/course/courseoverview?P=3000&EID=29137**

General:

https://www.epa.gov/pfas

https://www.epa.gov/sdwa/drinking-water-health-advisories-pfoa-and-pfos

See GBPSR testimony on PFAS here: **https://gbpsr.org/resources/pfas-testimony/**

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Why PFAS must be regulated as a class:

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https://www.wbur.org/news/2021/10/29/pfas-chemicals-massachusetts-water-sources-report

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