



Massachusetts PFAS & Your Health Study



Preliminary findings from the Massachusetts PFAS & Your Health Study

Laurel Schaider, PhD, Senior Scientist

Emily Heckel, MPH, Staff Scientist

Silent Spring Institute



SILENT SPRING INSTITUTE
Researching the Environment and Women's Health

Study team members

Silent Spring Institute

Laurel Schaider – **lead investigator**

Emily Heckel

Abigail Bline

Ruthann Rudel

Aaron Maruzzo

Emma Ryan

Julia Brody

Harvard School of Public Health

Tamarra James-Todd – **study co-lead**

Marlee Quinn

Eastern Research Group

Rebecca DeVries

Naida Gavrelis

Univ. of Southern Denmark

Philippe Grandjean

PACE (Ayer)

Laurie Nehring

Julie Corenzwit

Pat Lynch

MA Breast Cancer Coalition

Cheryl Osimo

Betty Anne Bevis

Kathy Engles

Hydrogeologists

Matt Hodge

Tom Cambareri

Ayer field office

Emily Campbell

Ain Imchen

Bianca Perla

Virginia Martens

Lizzy Reynolds

Hyannis field office

Virginia Liu

Barbara Murphy

Joan Owens

Kaitlyn Smith

Tessa Thomas



Additional thanks

Thank you to the hundreds of local residents who participated in our study!



Special thanks

Town of Ayer: Robert Pontbriand, Dan Van Schalkwyk, Delaney Dionne
State Senator Jamie Eldridge and State Representative Danillo Sena

Ayer Department of Public Works: Dan Van Schalkwyk,
Kimberly Abraham, Mark Wetzel

Ayer Board of Health: Pam Papineau, Patricia Peters, Stephen Slarsky
Select Board members: Shaun Copeland, Scott Houde, Jannice
Livingston, Chris Hillman

Ayer Town Manager Office: Robert Pontbriand, Carly Antonellis

Ayer Shirley Regional School District: Dr. Adam Renda, Superintendent
Principals: Spencer Christie, and Fred Deppe.
Technology Staff: Michael Thibeault, Andrew Pare, Deb
Cutter

Ayer Public Access Channel: Trevor Dillman, Barry Schwarzel, Harry Zane

Ayer Economic Development: Alan Manoian

Ayer Fire Dept: Chief Tim Johnston

Ayer Council of Aging: Katie Petrossi

Nashoba Associated Board of Health: Bridgette Braley, Jenna
Montgomery

PACE Board Members:

Laurie Nehring, Julie Corenzwit, Beth
Suedmeyer, Dale Levandier, Dawn Ives

PACE Friends and supporters:

Pat Lynch, Edith Stephen. Laurie Sabol,
Anna Mayor, Marion Stoddart, Anna
Fadden, Jim Fay, Bill Duston, Jan Duston, Irv
Rockwood

Neil Angus, Devens Enterprise Commission,
Connie Sullivan, Jane Sullivan, Janet Smith,
James O'Connor, Suzanne O'Connor, Perry
Goldstein

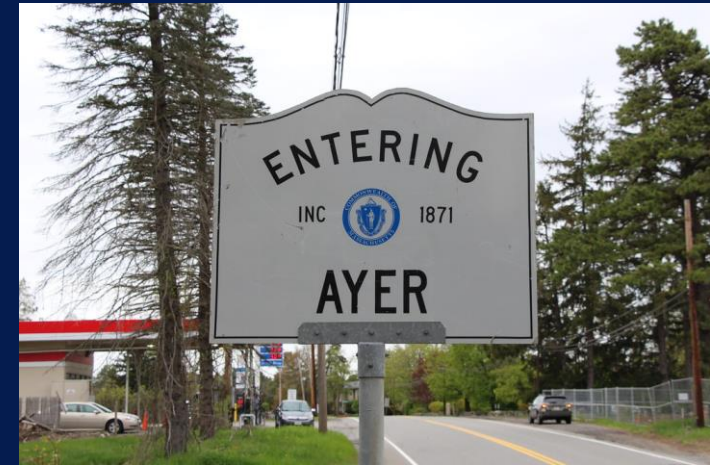
Debra Rivera, owner of Little Bee Book
Shop

Calvin Moore, owner of Billiards Cafe
Jane Morrison, Carolyn McCreary, Susan
Tordella-Williams



Tonight's agenda

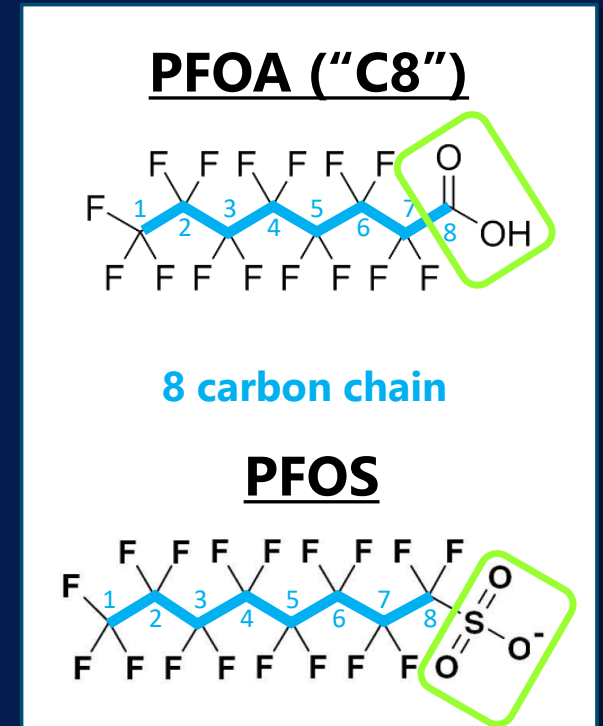
- What are PFAS?
- Study overview and timeline
- Summary of blood PFAS levels in Ayer
- How to interpret your results
- Next steps and key takeaways



PFAS 101

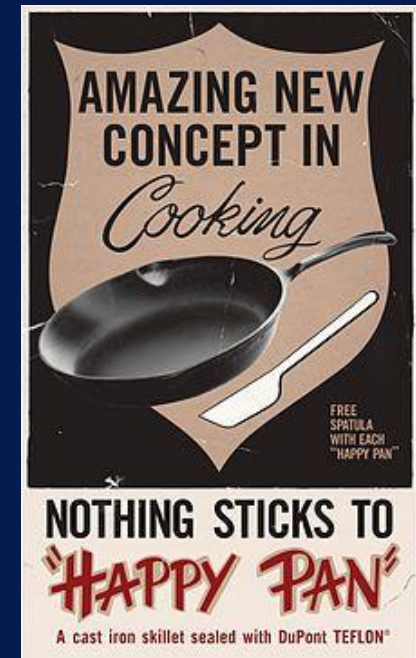
Per- and polyfluoroalkyl substances

- Class of over 14,000 compounds
- “Forever chemicals” - resist degradation
- Mobile in environment
- Used in consumer products since 1950s
- Emerged as common drinking water pollutants around 2010-2015

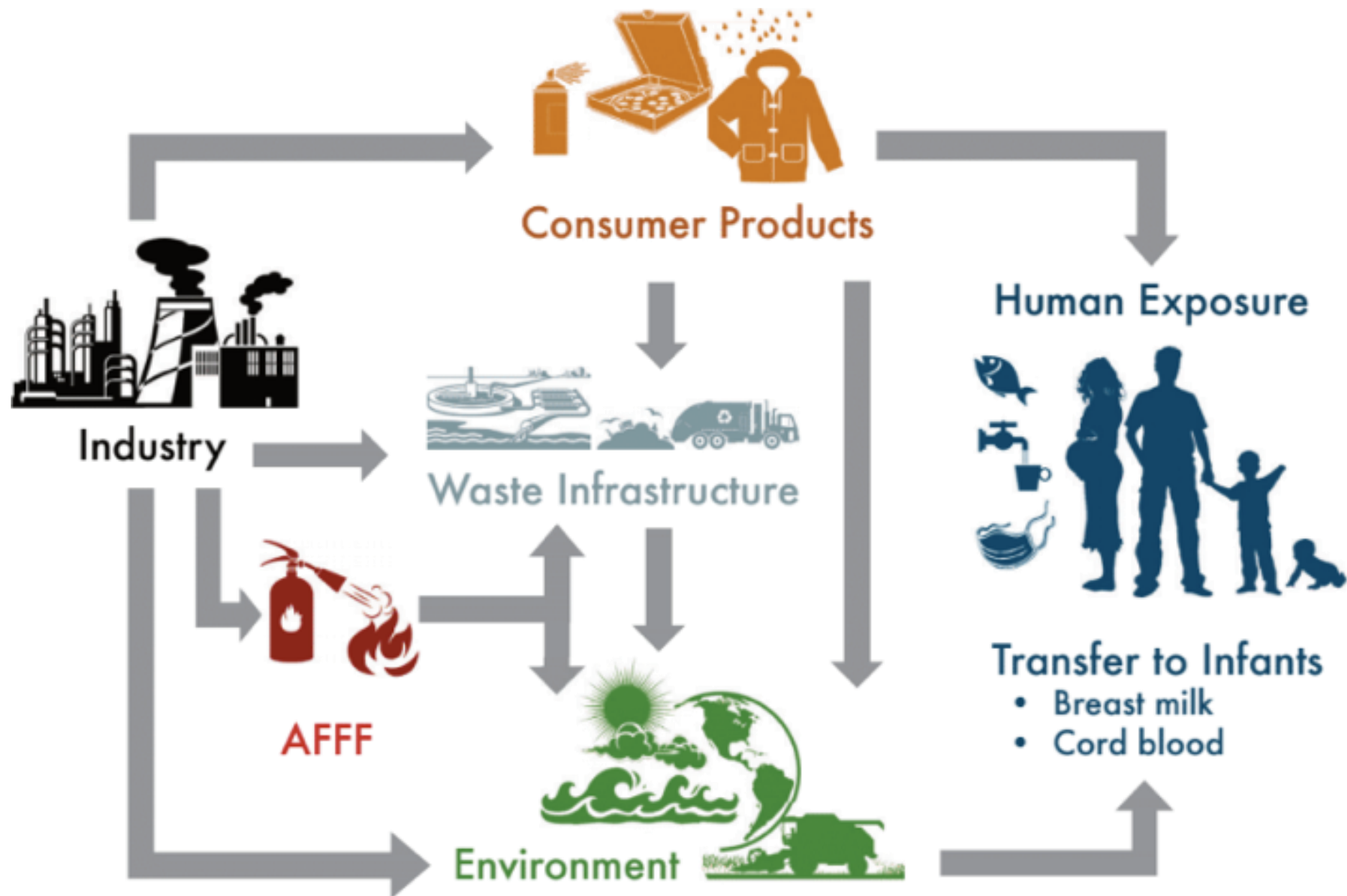


PFAS are used in many everyday products

- Carpets & upholstery
- Waterproof apparel
- Non-stick cookware
- Waxes (floor, skis)
- Grease-proof food packaging
- Cosmetics
- Dental floss
- Paints



How are we exposed to PFAS?



PFAS exposures are widespread



➤ **PFAS found in blood of over 99% of US residents (CDC)**



➤ **Some PFAS are long-lived in the human body**

- Long-chain PFAS: years
- Some newer PFAS: weeks to months
- Many PFAS: not yet studied



➤ **PFAS levels in blood depend on many factors**

- Age
- Sex
- Occupation



Exposures to PFAS have been associated with many harmful health effects

- Increased cholesterol & risk of obesity
- Immune system suppression, including suppressed vaccine response
- Changes in thyroid hormone levels
- Reproductive effects (preeclampsia, decreased fertility)
- Developmental effects (decreases in birth weight, changes in bone density)
- Impaired mammary gland development
- Cancer (kidney, testicular, prostate)



PFAS in Ayer drinking water

- PFAS first discovered in Ayer drinking water in 2016
- Highest levels in Grove Pond wells from use of PFAS-containing firefighting foams at former Ft Devens
- Treatment at Grove Pond wells started in Nov. 2020 and Spectacle Pond wells in July 2022
- All Ayer water is now filtered for PFAS



Tonight's agenda

- What are PFAS?
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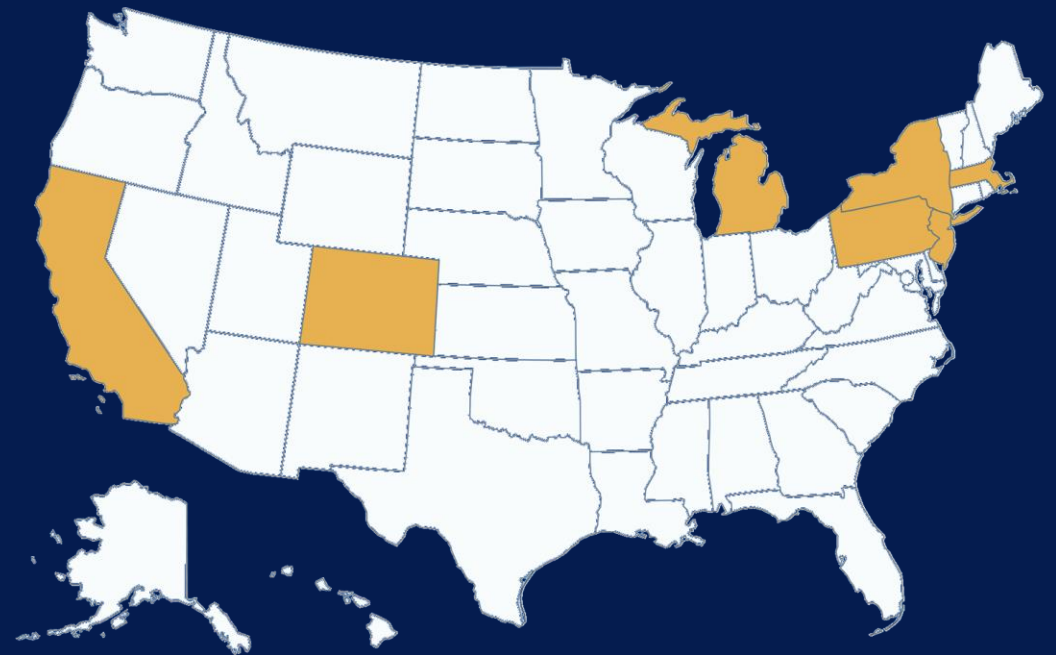
AYER residents - have you seen our postcard in your mail?



CDC PFAS Multi-site Health Study

- Funded by **CDC** and Agency for Toxic Substances and Disease Registry (**ATSDR**)
- Goal: improve understanding of PFAS-related health effects
- Target study population size: 7,000 adults and 2,100 children

**Includes communities in 7 states:
CA, CO, MA, MI, NJ, NY, PA**



MA PFAS & Your Health Study



- Ayer and Hyannis, MA
- Enrollment goal: 1,000 adults and 300 children (ages 4-17) across both communities
- Recruitment included both current and former residents of Ayer

Research partners

Silent Spring Institute (lead)
Harvard School of Public Health
Eastern Research Group

Local partners

People of Ayer Concerned about
the Environment (PACE)
MA Breast Cancer Coalition (MBCC)



MA PFAS & Your Health Study timeline

- Sept. 2019:** Silent Spring awarded grant from CDC/ATSDR
- Sept. 2021:** CDC/ATSDR receives approval for study protocols
- Nov. 2021:** Launch of enrollment in Hyannis
- Nov. 2022:** Launch of enrollment in Ayer
- Sept. 2023:** End of data collection across all sites
- June 2024:** Community meetings with initial PFAS results



Community outreach



Postcards to all Ayer addresses



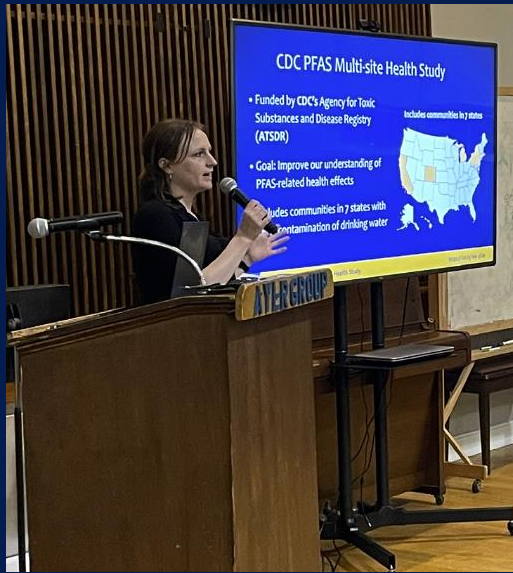
Tabling at Transfer Station and town events



Lawn signs around town



Community outreach



Community events



Social media



MA_PFAS_study



MAPFASHealthStudy



MAPFAS



Who was eligible in Ayer?



- **Adults (ages 18+):**

- Lived in Ayer anytime between May 2006 and February 2018

- **Children (ages 4-17):**

- Lived in Ayer anytime between May 2006 and February 2018 and/or their mothers lived in Ayer during this time prior to child's birth



Who was eligible?

- Former residents were eligible
- Multiple members of the same household could participate
- Firefighters and workers at PFAS industrial facilities were not eligible



Massachusetts PFAS & Your Health Study
in Hyannis and Ayer

Help us learn how PFAS in drinking water can affect the health of children and adults!

Learn more and sign up:
bit.ly/ma-pfas-info

SPOTS AVAILABLE SPRING & SUMMER!

Participants will receive:

- Results from PFAS blood tests and other lab results
- Gift cards: Up to \$50 for adults and up to \$75 for children



What did participants do?

- **Office visit**

- Informed consent
- Blood and urine sample
- Body measurements

- **Questionnaire (by phone)**

- Residential and work history
- Water consumption, diet, and consumer product use
- Health history

- **Neurobehavioral tests (children 5-17)**

- Vocabulary exercises, drawing, and puzzles





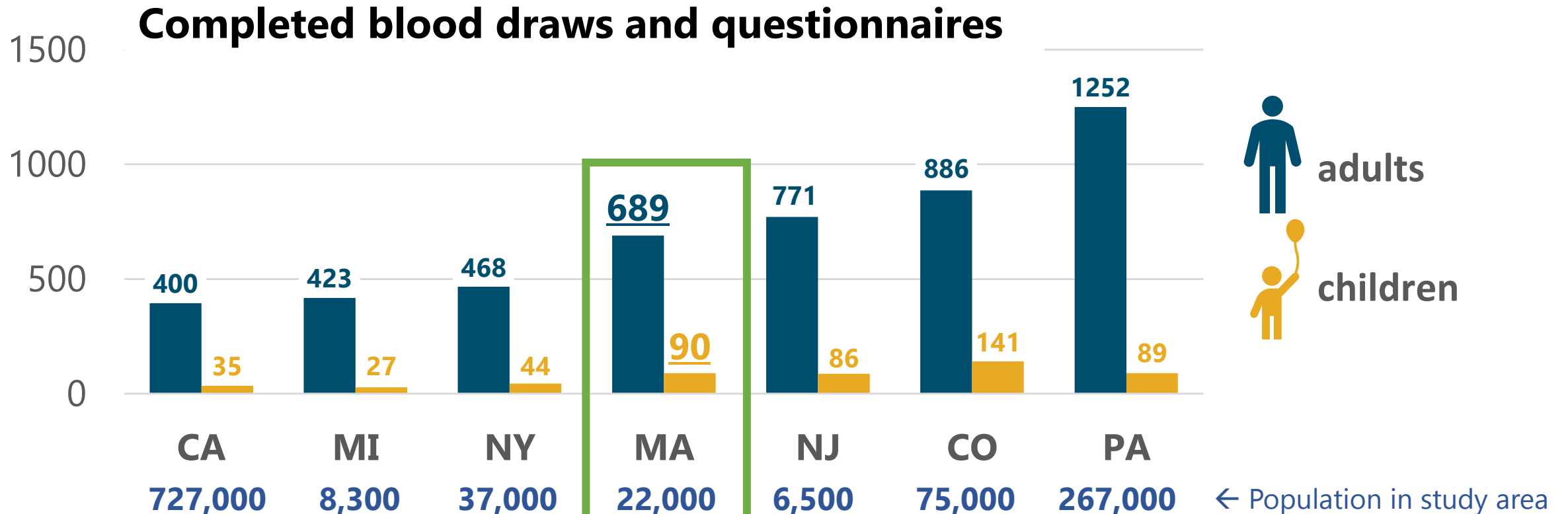
What are we testing for?

- **Levels of 7 PFAS in blood**
 - Indicator of PFAS exposure
- **Routine lab tests**
 - Cholesterol, blood sugar, thyroid hormones, liver enzymes, and others
- **Additional tests (for some samples)**
 - Additional PFAS
 - Changes in biochemical pathways
 - COVID antibodies



MA PFAS & Your Health Study

Enrollment across all sites



Enrollment numbers as of September 2023



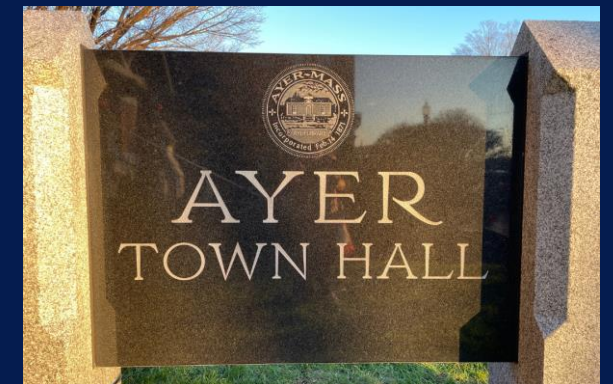
Study enrollment in Ayer and Hyannis

	TOTAL		AYER		HYANNIS	
	<u>18+</u>	<u>4-17</u>	<u>18+</u>	<u>4-17</u>	<u>18+</u>	<u>4-17</u>
Number of adults and children screened	972	156	380	79	592	77
Number of completed blood draws and questionnaires	676	89	291	48	385	41



Tonight's agenda

- What are PFAS?
- Study overview and timeline
- **Summary of blood PFAS levels in Ayer**
- How to interpret your results
- Next steps and key takeaways



Information about Ayer participants

	Adults <i>N</i> = 291	Children <i>N</i> = 48
Median Age	58 years	12 years
Females	63%**	44%
Males	36%	56%
Hispanic	5%	2%
Non-Hispanic Black	2%	0%
Non-Hispanic White	87%	90%
Non-Hispanic Other*	5%	8%
Data not available	1%	0%



Key terms for community data

MEDIAN

50% of people are lower
50% of people are higher

95th PERCENTILE

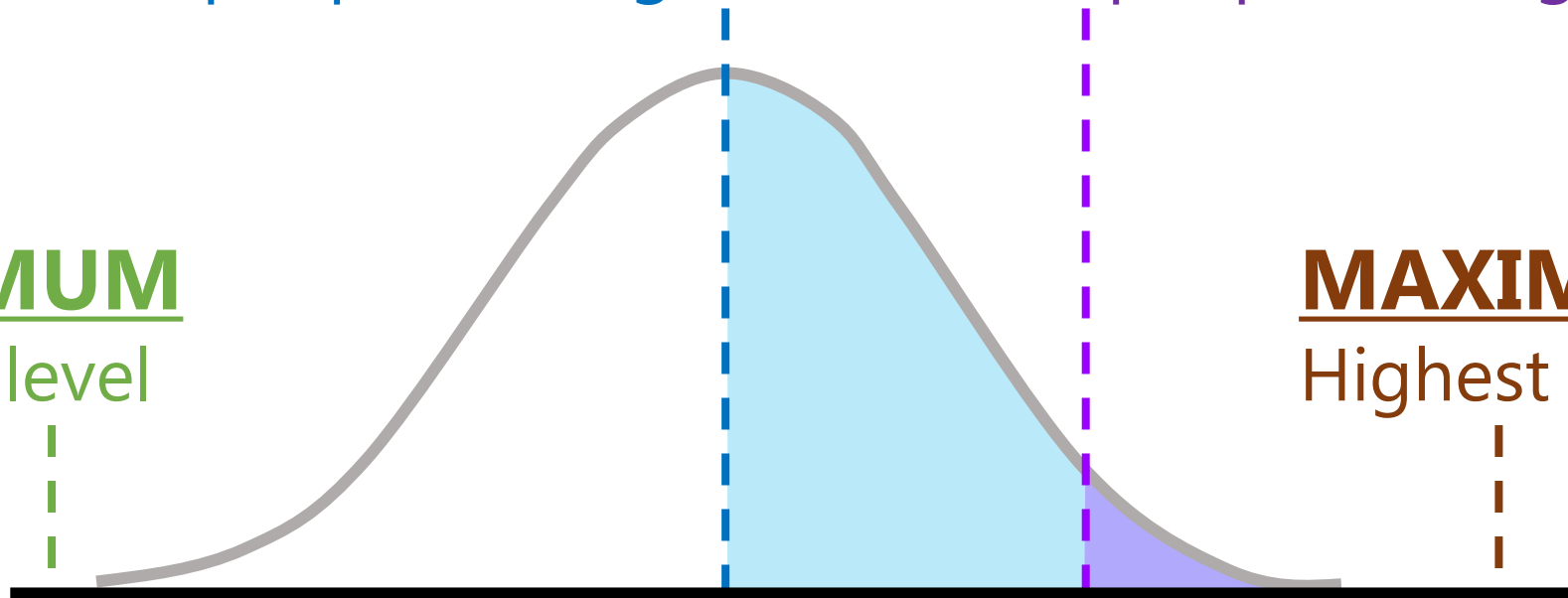
95% of people are lower
5% of people are higher

MINIMUM

Lowest level

MAXIMUM

Highest level



PFAS blood levels



Summary of Ayer adult blood results

Units: micrograms per liter (µg/L)	% of samples with this chemical	Minimum	Median	95 th percentile	Maximum
PFOS	100%	0.17	3.3	8.5	13.7
PFHxS	99.7%	<0.1	1.8	5.7	11.9
PFOA	100%	0.17	1.9	4.0	8.9
PFNA	97%	<0.1	0.4	0.9	2.6
PFDA	55%	<0.1	0.1	0.3	1.6
PFUnDA	41%	<0.1	<0.1	0.3	0.6
MeFOSAA	29%	<0.1	<0.1	0.4	1.4



Summary of Ayer adult blood results

Units: micrograms per liter (µg/L)	% of samples with this chemical	Minimum	Median	95 th percentile	Maximum
PFOS	100%	0.17	3.3	8.5	13.7
PFHxS	99.7%	We tested for 7 PFAS chemicals			
PFOA	100%				
PFNA	97%				
PFDA	55%	<0.1	0.1	0.3	1.6
PFUnDA	41%	<0.1	<0.1	0.3	0.6
MeFOSAA	29%	<0.1	<0.1	0.4	1.4



Summary of Ayer adult blood results

Units: micrograms per liter (µg/L)	% of samples with this chemical	Minimum	Median	95 th percentile	Maximum
PFOS	100%	4 PFAS chemicals were detected in nearly all participants			
PFHxS	99.7%				
PFOA	100%				
PFNA	97%				
PFDA	55%	<0.1	0.1	0.3	1.6
PFUnDA	41%	<0.1	<0.1	0.3	0.6
MeFOSAA	29%	<0.1	<0.1	0.4	1.4



Summary of Ayer adult blood results

Units: micrograms per liter (µg/L)	% of samples with this chemical	Minimum	Median	95 th percentile	Maximum
PFOS	100%	0.17	3.3	8.5	13.7
PFHxS	99.7%	<0.1	1.8	5.7	11.9
PFOA	100%	0.17	1.9	4.0	8.9
PFNA					2.6
PFDA					1.6
PFUnDA					0.6
MeFOSAA					1.4

PFOS and PFHxS are two PFAS typically higher in communities with firefighting foam as a source of contamination



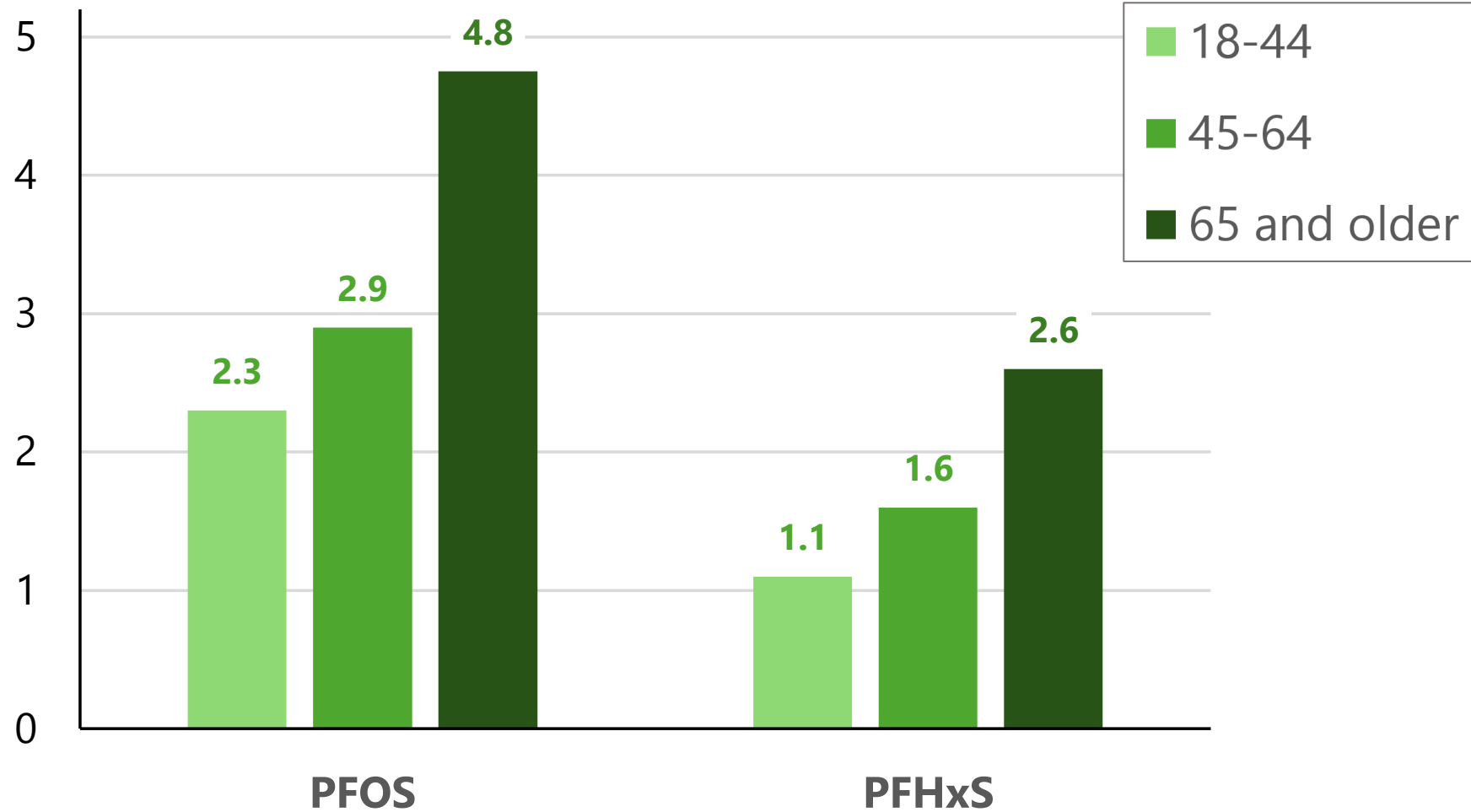
Summary of Ayer adult blood results

Units: micrograms per liter (µg/L)	% of samples with this chemical	Minimum	Median	95 th percentile	Maximum	
PFOS	PFOS, PFHxS, and PFOA were found at the highest levels		3.3	8.5	13.7	
PFHxS			1.8	5.7	11.9	
PFOA			1.9	4.0	8.9	
PFNA			0.4	0.9	2.6	
PFDA		55%	<0.1	0.1	0.3	1.6
PFUnDA		41%	<0.1	<0.1	0.3	0.6
MeFOSAA		29%	<0.1	<0.1	0.4	1.4



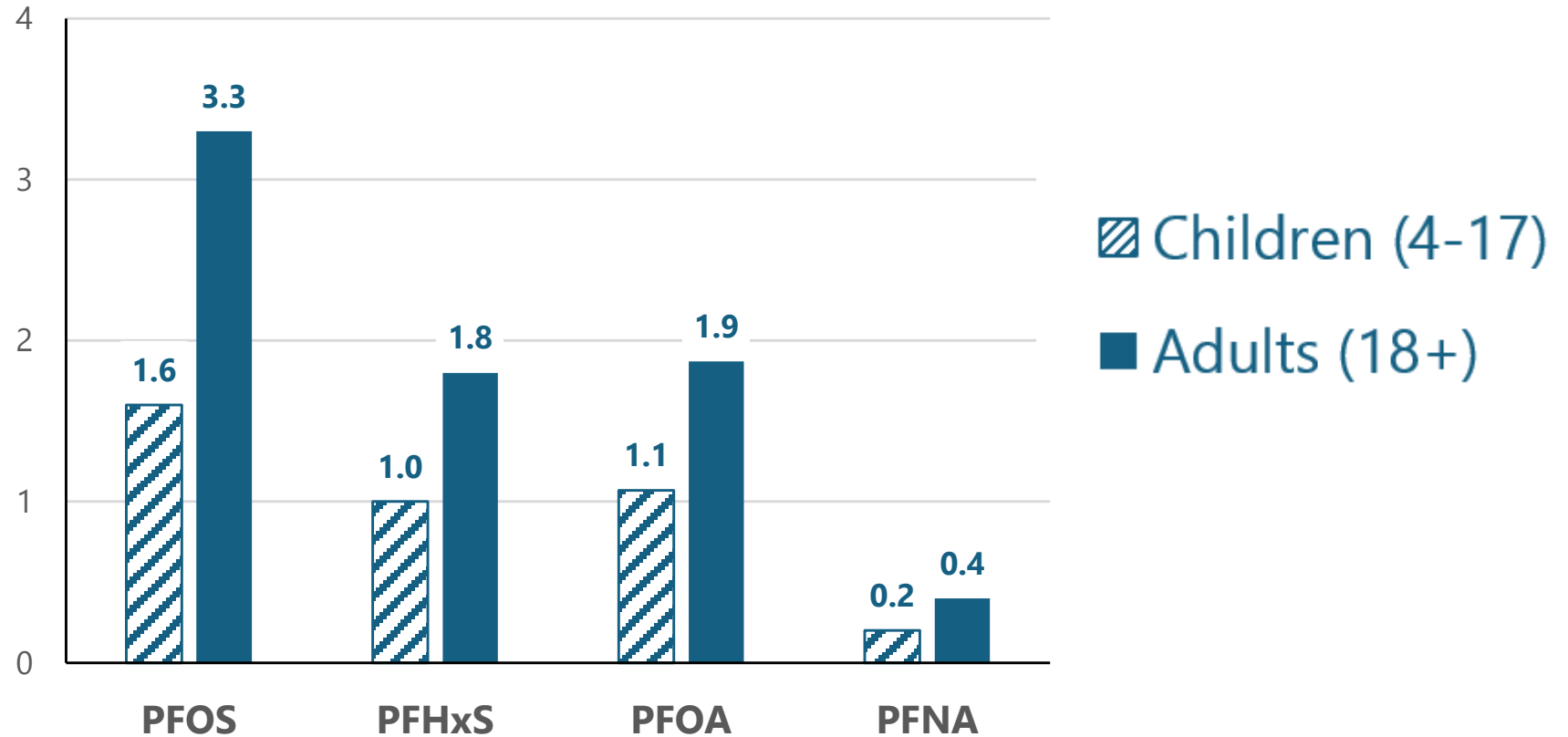
PFAS levels in Ayer adults increase with age

MEDIAN
concentration
micrograms per liter
($\mu\text{g}/\text{L}$)

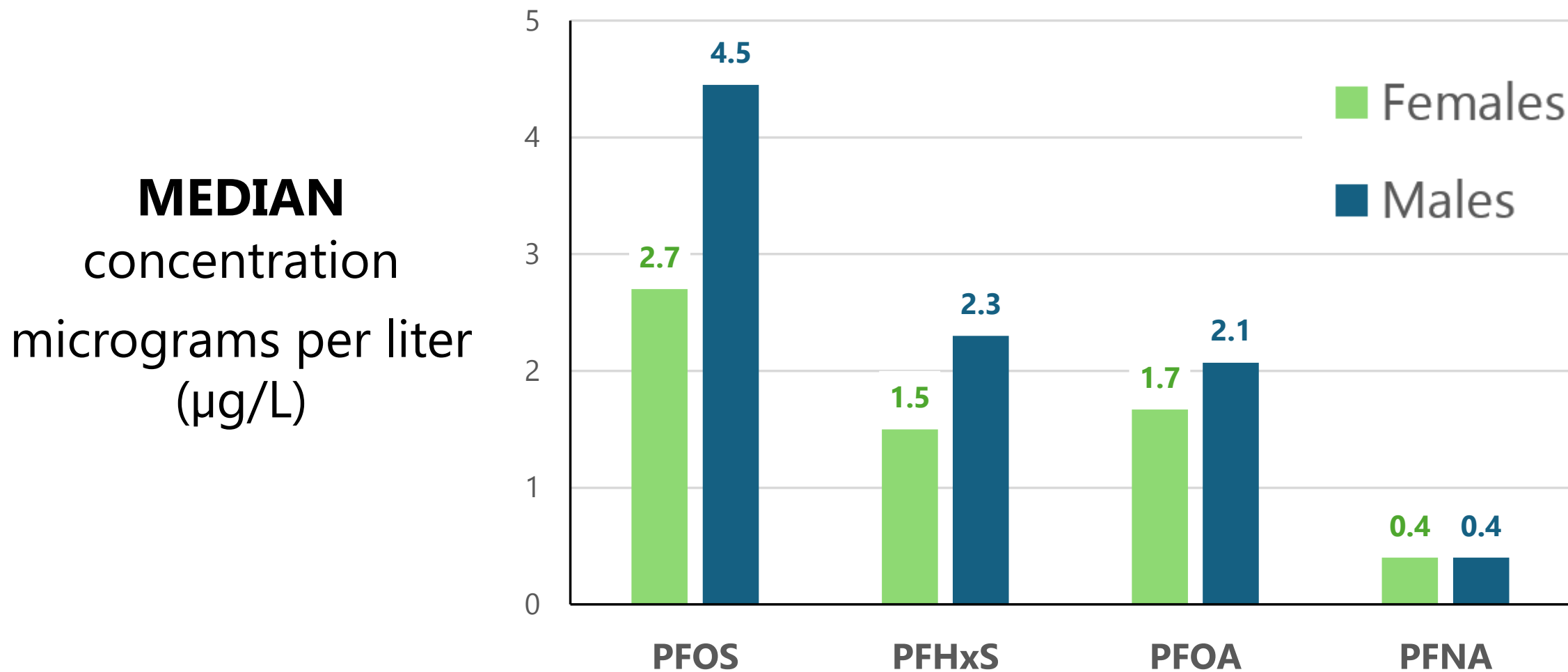


Median PFAS blood levels were lower in children than adults in Ayer

MEDIAN
concentration
micrograms per liter
($\mu\text{g}/\text{L}$)



PFAS levels were higher in men than women for some PFAS in Ayer



Learning about PFAS in the general population

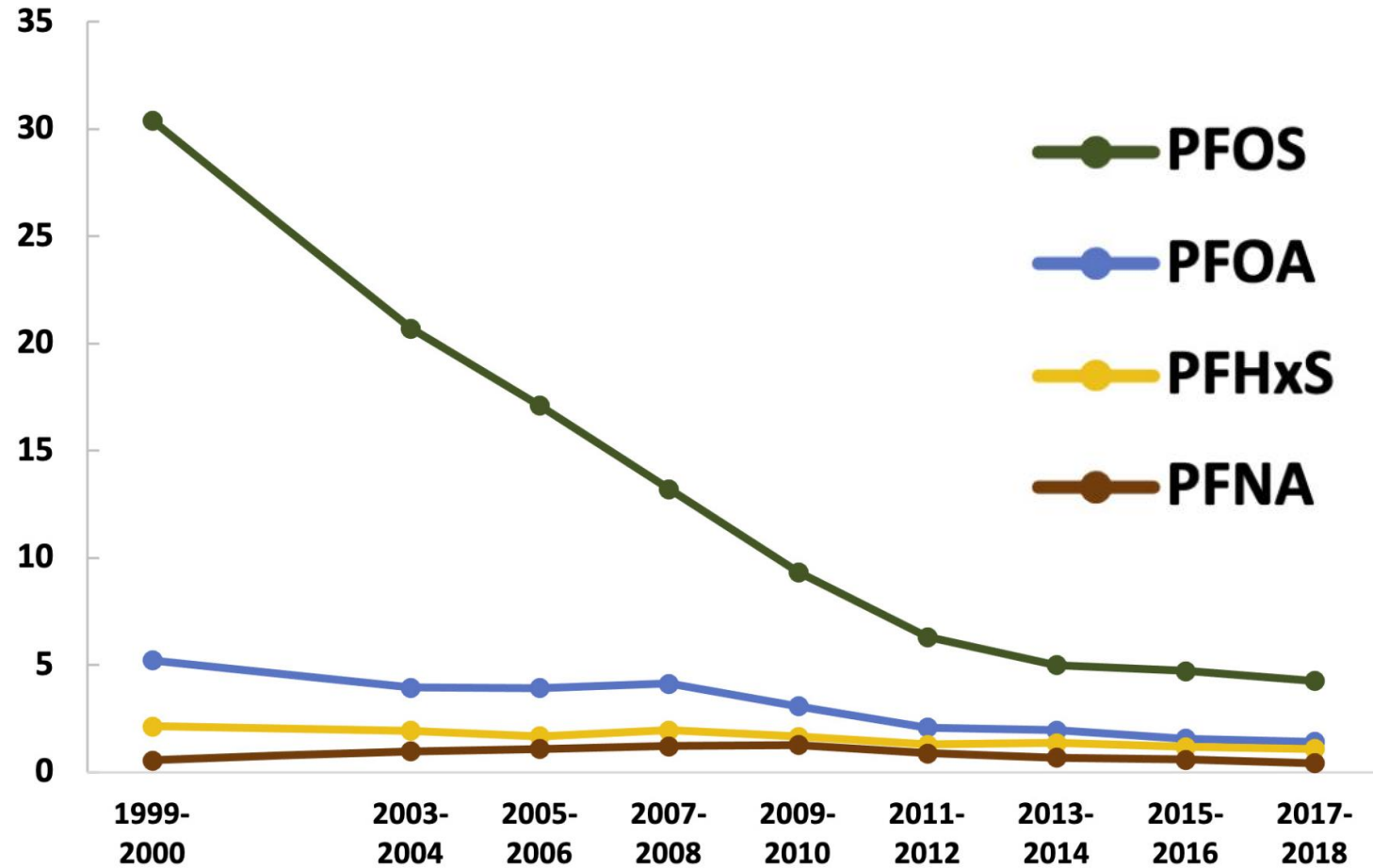
NHANES: National Health and Nutrition Examination Survey

- Representative sampling of around 5,000 U.S. residents every 2 years by the CDC
- PFAS blood levels were measured in around 2,000 people in 2017-2018



Levels of some PFAS have declined in the general US population since 1999

Geometric mean
blood PFAS level
micrograms per liter
($\mu\text{g/L}$)



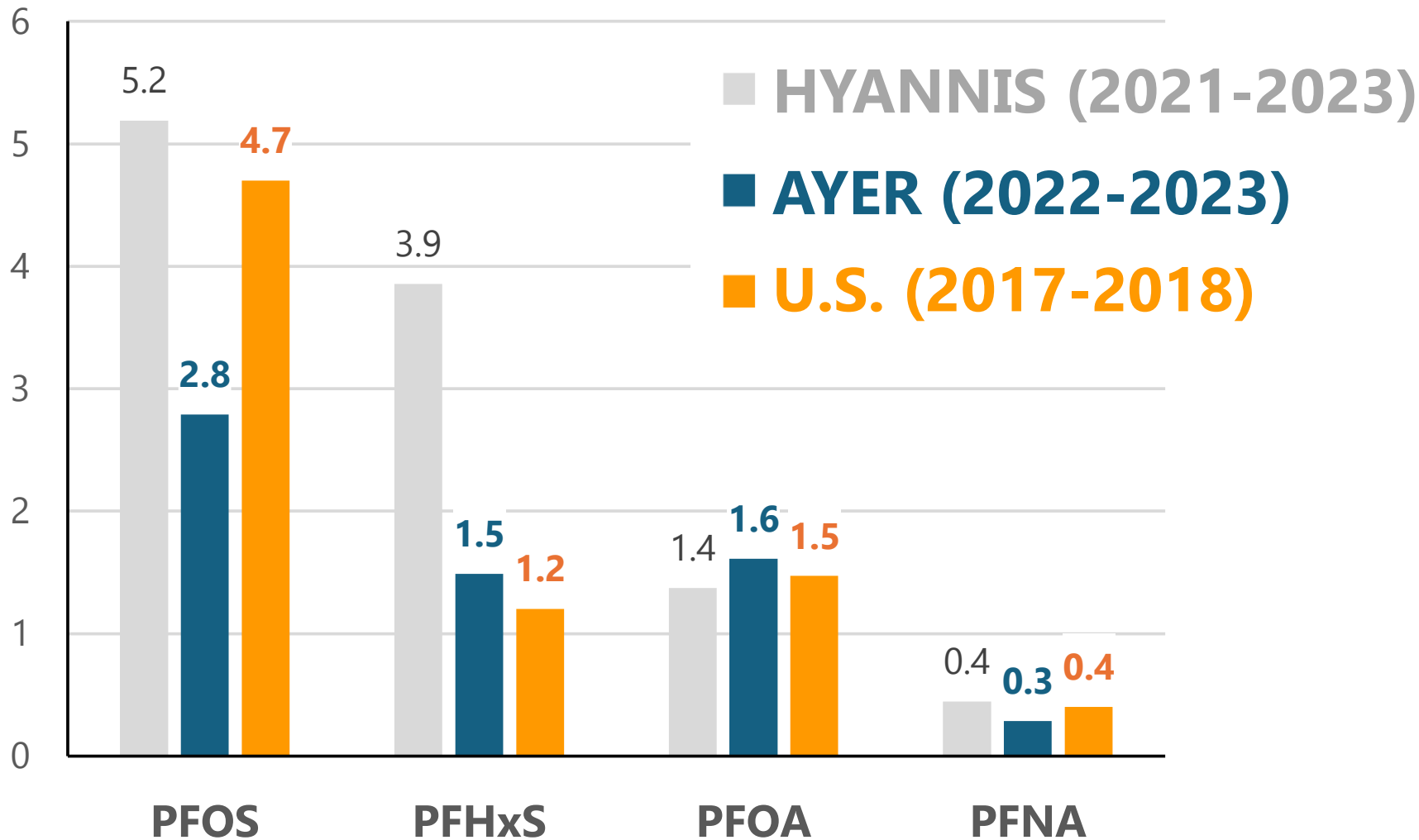
Data and graph from NHANES:
<https://www.atsdr.cdc.gov/pfas/images/pfas-blood-levels-usa-chart.jpg>



Median levels of 4 PFAS in blood (Ayer adults) compared to Hyannis and the general population

MEDIAN
concentration
micrograms per liter
($\mu\text{g/L}$)

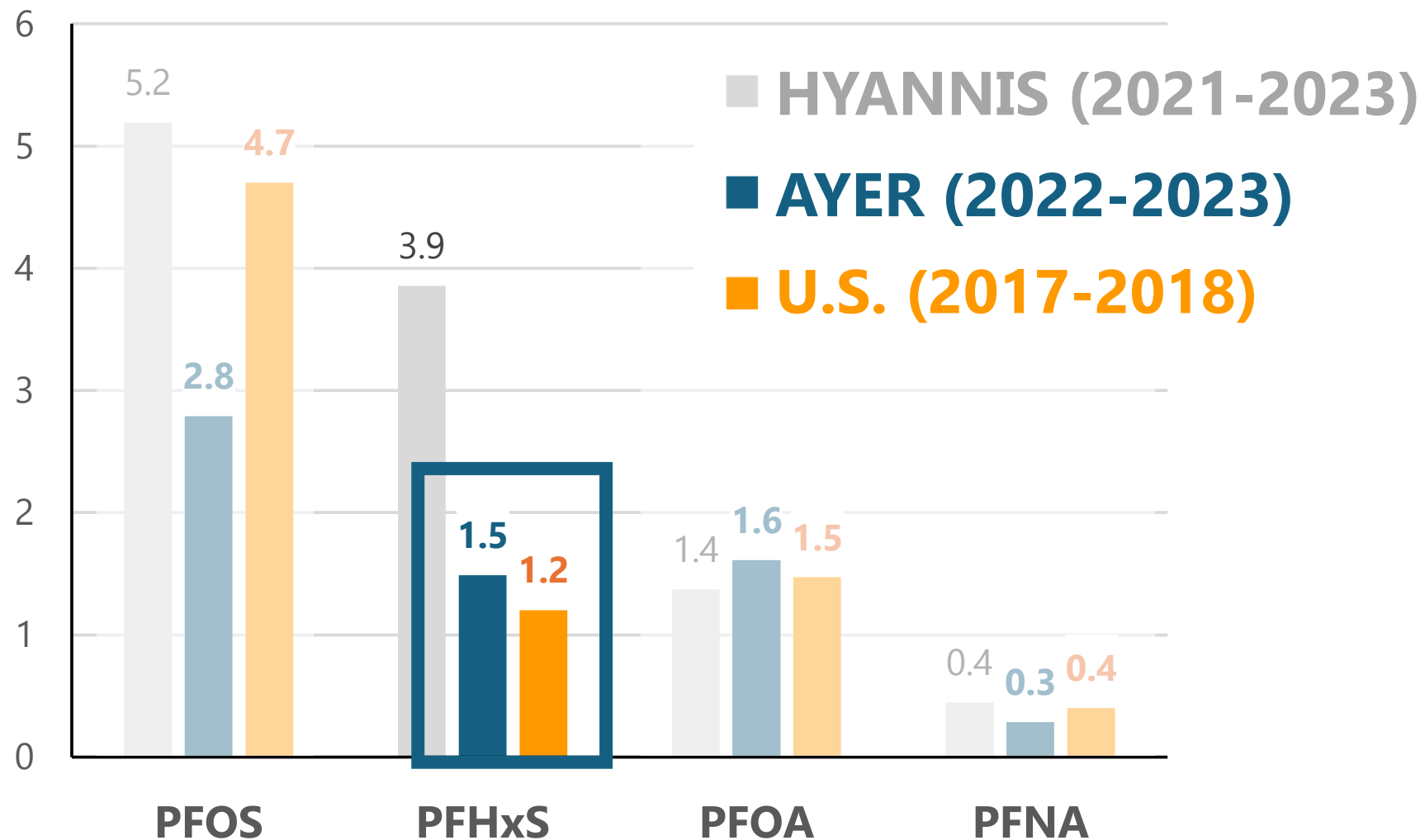
Note: These medians are adjusted for age distribution of participants



Ayer median for PFHxS was 24% higher than the general U.S. population

MEDIAN
concentration
micrograms per liter
($\mu\text{g/L}$)

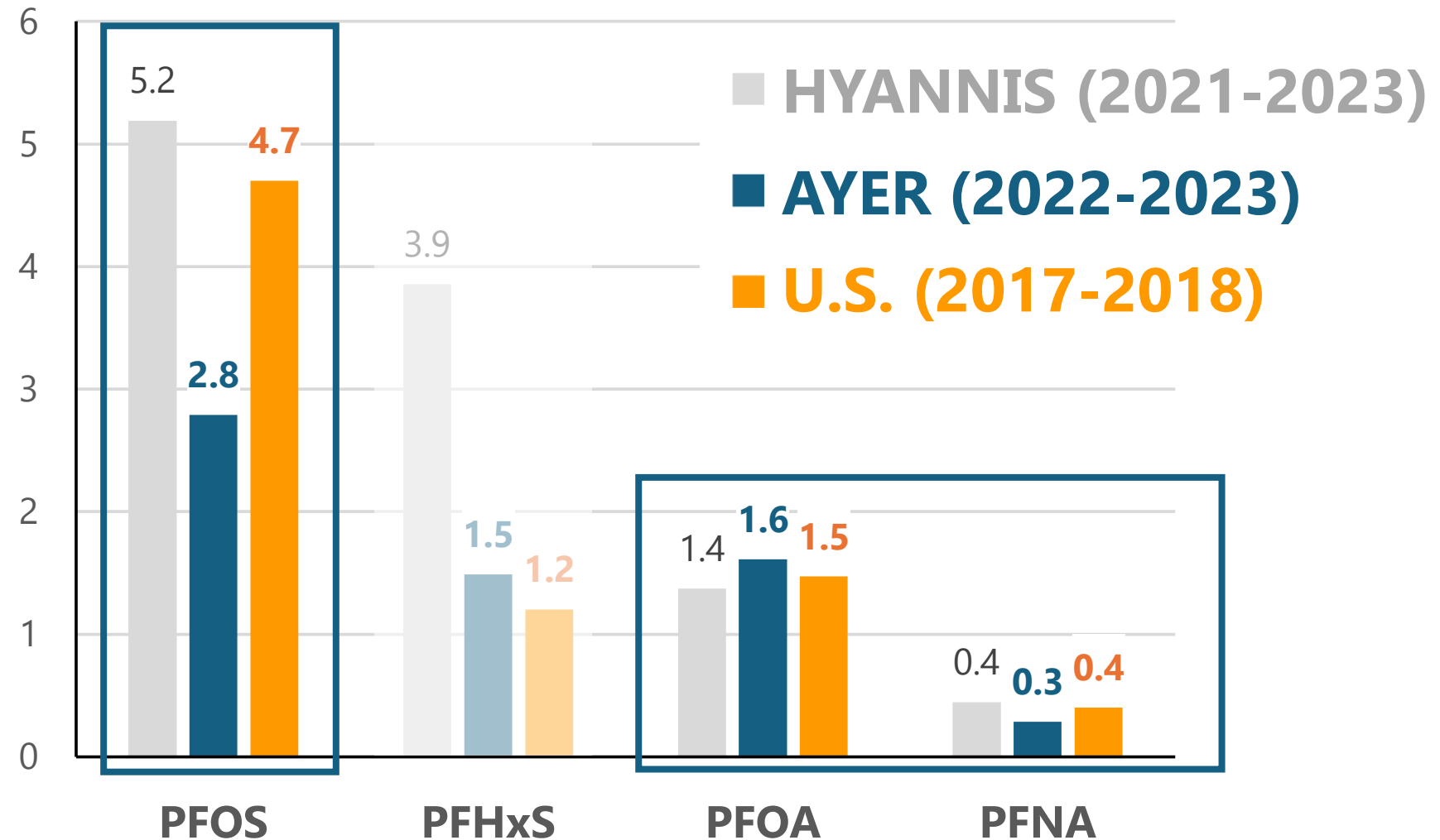
Note: Hyannis and Ayer medians are adjusted to the age distribution of NHANES



Ayer median for other PFAS were similar to or lower than the general U.S. population

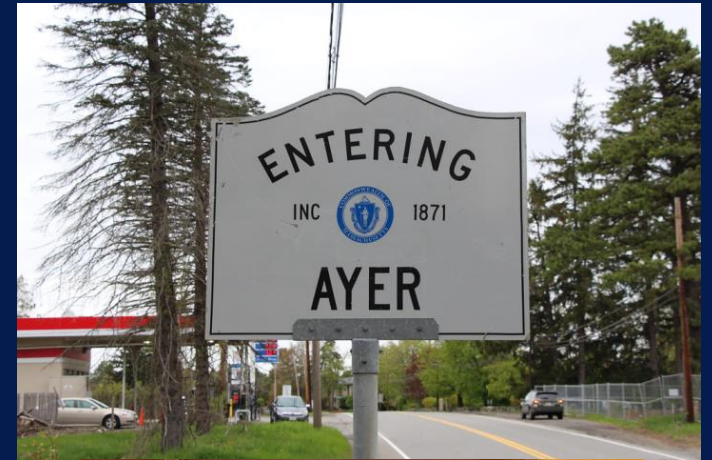
MEDIAN
concentration
micrograms per liter
($\mu\text{g}/\text{L}$)

Note: Hyannis and Ayer medians are adjusted to the age distribution of NHANES



Tonight's agenda

- What are PFAS?
- Study overview and timeline
- Summary of blood PFAS levels in Ayer
- **How to interpret your results**
- Next steps and key takeaways



Sample report-back letters sent to participants

Name of chemical	Your result (µg/L)	2017-2018 NHANES results (µg/L)		
		Age group (years)	Median	95 th percentile
<i>PFOA - perfluorooctanoic acid (total)</i>	3.0	20+	1.47	3.87
• <i>n-PFOA - linear isomer of PFOA</i>	2.9	20+	1.40	3.80
• <i>Sb-PFOA - branched isomer of PFOA</i>	<0.1	20+	<0.1	0.20
<i>PFOS - perfluorooctane sulfonic acid (total)</i>	8.6	20+	4.70	15.1
• <i>n-PFOS - linear isomer of PFOS</i>	6.6	20+	3.20	11.0
• <i>Sm-PFOS - branched isomer of PFOS</i>	2.0	20+	1.40	4.60
<i>PFHxS - perfluorohexane sulfonic acid</i>	12.5	20+	1.20	3.80
<i>MeFOSAA - 2-(N-methyl-perfluorooctane sulfonamido) acetic acid</i>	<0.1	20+	0.10	0.60
<i>PFNA - perfluorononanoic acid</i>	0.7	20+	0.40	1.40
<i>PFDA - perfluorodecanoic acid</i>	0.1	20+	0.20	0.60
<i>PFUnDA - perfluoroundecanoic acid</i>	0.1	20+	0.10	0.40
Sum of 7 PFAS commonly found in blood: PFOS, PFOA, PFHxS, PFNA, PFDA, PFUnDA, and MeFOSAA				
	25	See next page for interpretation		



Results for 7 PFAS chemicals

Name of chemical	Your result (µg/L)	2017-2018 NHANES results (µg/L)		
		Age group (years)	Median	95 th percentile
PFOA - perfluorooctanoic acid (total)	3.0	20+	1.47	3.87
• <i>n-PFOA - linear isomer of PFOA</i>	2.9	20+	1.40	3.80
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Sum of 7 PFAS commonly found in blood: PFOS, PFOA, PFHxS, PFNA, PFDA, PFUnDA, and MeFOSAA	25	See next page for interpretation		



Compare to general U.S. population

Name of chemical	Your result (µg/L)	2017-2018 NHANES results (µg/L)		
		Age group (years)	Median	95 th percentile
PFOA - perfluorooctanoic acid (total)	3.0	20+	1.47	3.87
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Sum of 7 PFAS commonly found in blood: PFOS, PFOA, PFHxS, PFNA, PFDA, PFUnDA, and MeFOSAA	25	See next page for interpretation		



**Bolded values
are above
95th
percentile for
the general
population**

Name of chemical	Your result (µg/L)	2017-2018 NHANES results (µg/L)		
		Age group (years)	Median	95 th percentile
<i>PFOA - perfluorooctanoic acid (total)</i>	3.0	20+	1.47	3.87
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<i>Sum of 7 PFAS commonly found in blood: PFOS, PFOA, PFHxS, PFNA, PFDA, PFUnDA, and MeFOSAA</i>	25	See next page for interpretation		



Sum of 7 PFAS can be compared to screening benchmarks from National Academies report

Name of chemical	Your result (µg/L)	2017-2018 NHANES results (µg/L)		
		Age group (years)	Median	95 th percentile
PFOA - perfluorooctanoic acid (total)	3.0	20+	1.47	3.87
• n-PFOA - linear isomer of PFOA	2.9	20+	1.40	3.80
• Sb-PFOA - branched isomer of PFOA	<0.1	20+	<0.1	0.20
PFOS - perfluorooctane sulfonic acid (total)	8.6	20+	4.70	15.1
• n-PFOS - linear isomer of PFOS	6.6	20+	3.20	11.0
• Sm-PFOS - branched isomer of PFOS	2.0	20+	1.40	4.60
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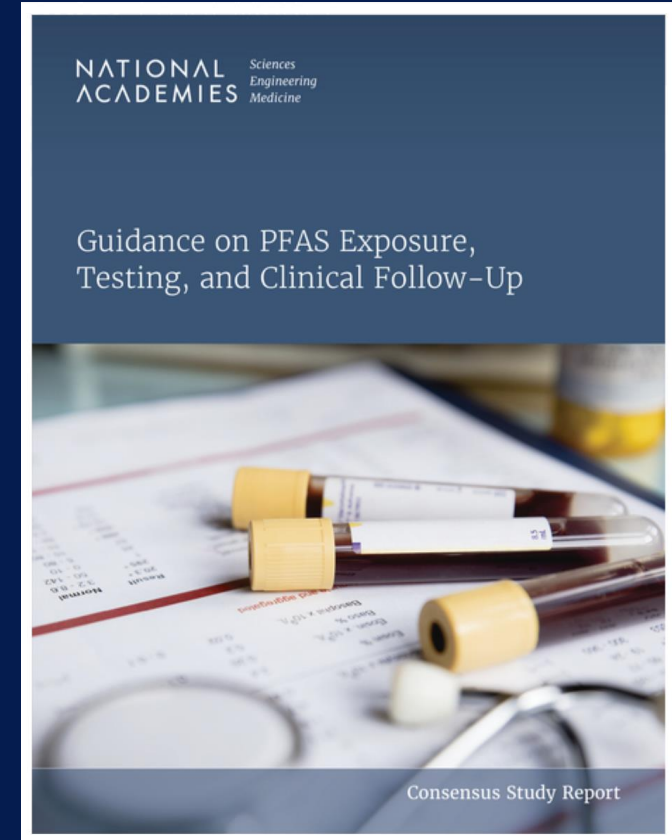


National Academies report (2022)

Guidance on PFAS Exposure, Testing, and Clinical Follow-Up

- "Clinicians should offer PFAS testing to patients likely to have a history of elevated exposure."
- Recommends additional clinical screenings and lab tests, depending on PFAS blood levels

Scan for resources ►



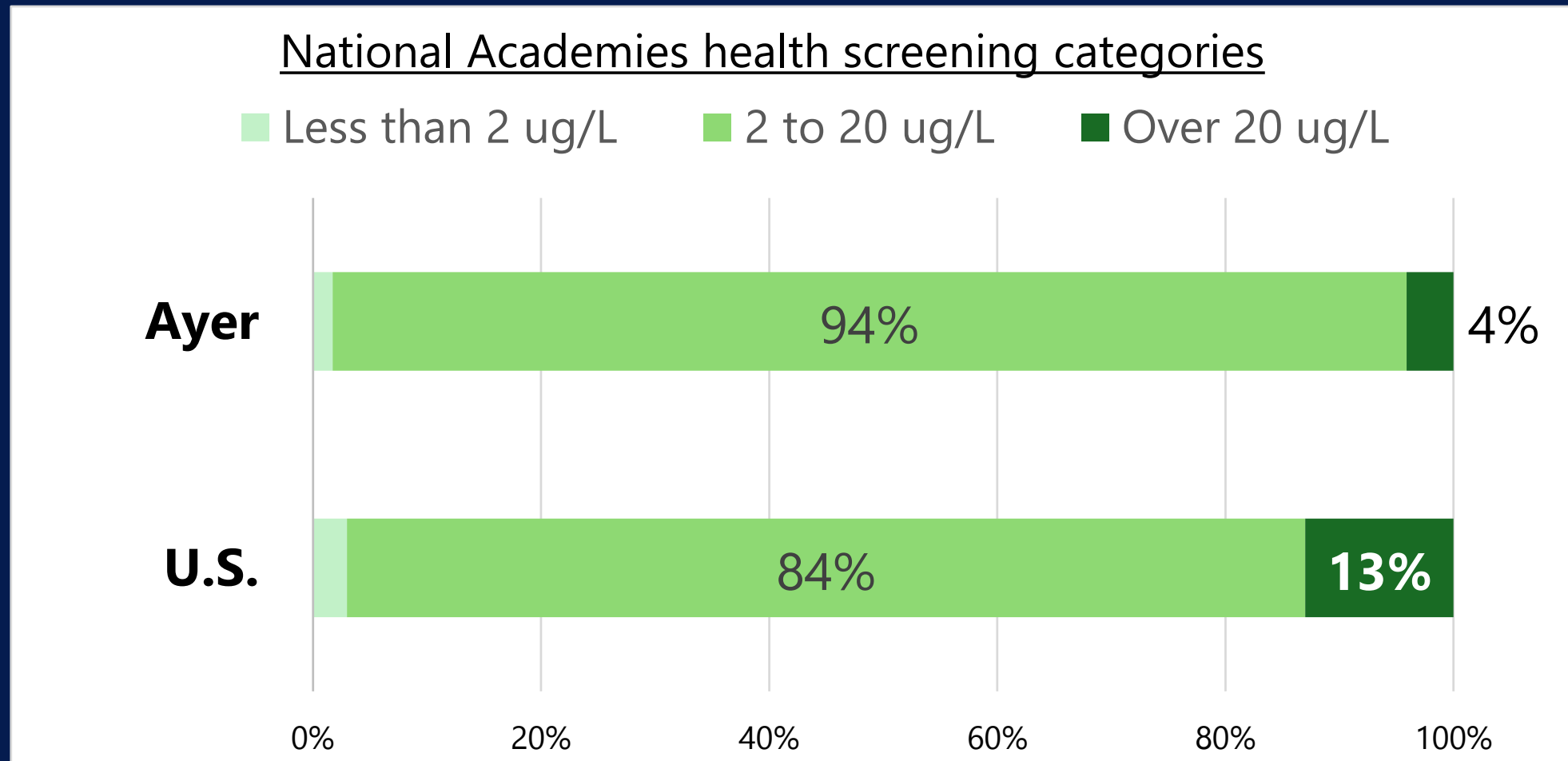
<https://nap.nationalacademies.org/resource/26156/interactive/>



Sum of 7 common PFAS ($\mu\text{g/L}$)	National Academies suggested patient follow-up
Less than 2 $\mu\text{g/L}$	Clinicians should provide usual standard of care
2 up to 20 $\mu\text{g/L}$	<p>Within usual standard of care, clinicians should:</p> <ul style="list-style-type: none"> • Prioritize screening for dyslipidemia with a lipid panel (once between ages 9 and 11, once every 4-6 years over age 20) • Screen for hypertensive disorders of pregnancy at all prenatal visits • Screen for breast cancer based on clinical practice guidelines based on age and other risk factors
20 $\mu\text{g/L}$ or higher	<p>In addition to usual standard of care, clinicians should:</p> <ul style="list-style-type: none"> • Prioritize screening for dyslipidemia with a lipid panel (for patients over age 2) • At all well visits: <ul style="list-style-type: none"> ○ Conduct thyroid function testing (for patients over age 18) ○ Assess for signs and symptoms of kidney cancer (for patients over age 45), including urinalysis ○ Assess for signs and symptoms of testicular cancer and ulcerative colitis (for patients over age 15)



Ayer had a lower proportion of adults above 20 $\mu\text{g}/\text{L}$ than the general population



Resources for clinicians and blood testing

PFAS-REACH documents on PFAS Exchange

Medical screening guidance documents for clinicians and patients

Information about PFAS blood testing

Website: www.pfas-exchange.org/resources/

Scan for resources ▶



PFAS-REACH
PFAS Research, Education,
and Action for Community Health

PFAS Exposure: Information for patients and guidance for clinicians to inform patient and clinician decision making

For clinicians

About this guidance document

This guidance is intended to inform discussion and decision making for physicians and their patients. Many of these tests and screenings are part of basic primary care annual appointments. In 2019, the American Medical Association (AMA) resolved to support research and policy to address the effects of PFAS exposure. The following suggestions for medical screening tests are based on those previously developed and

PFAS-REACH
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and Action for Community Health

PFAS blood testing: What you need to know

For people in PFAS-impacted communities and occupations

Purpose

This document is intended as a guide for individuals who are seeking PFAS blood testing. Residents of communities with local sources of contamination and people who may have been exposed to high levels of PFAS at their workplace may seek a PFAS blood test to learn more about their exposure. This document provides information about what you can and can't learn from a PFAS blood test, how to find a lab to conduct the testing, questions to ask a lab about their services, and tools to help you with interpretation and action.

What can I learn from a PFAS blood test?

A PFAS blood test measures the levels of certain PFAS chemicals in a person's blood at the time of the test. The results provide an indication of how much PFAS has entered your body over time. You can compare your results to levels found in other groups of people to determine whether your levels are elevated. Results can also provide a baseline so you can monitor changes over time, and they can support actions by agencies to reduce community exposures.

Results can be shared with your doctor for consideration as a risk factor for associated health outcomes and can inform conversations about reducing PFAS exposure and monitoring your health.

What won't a PFAS blood test tell me?

A PFAS blood test can't tell you where the PFAS in your body came from or how long you've been exposed. PFAS can come from many different sources including drinking water, food, and consumer products. Nearly everyone has some measurable amount of PFAS in their blood.

A blood test also doesn't directly indicate whether any health conditions you are experiencing were caused by PFAS exposure or definitively predict whether you are likely to develop certain health problems in the future.

How do I get a PFAS blood test?

Your doctor may be able to order a PFAS blood test. Providers should use ICD-10 diagnosis code Z13.88, and if ordering a test through Quest, they should use Test Code 39307 and CPT code 82542. Let your provider know you prefer a lab that measures both linear and branched isomers and a comprehensive panel that includes many compounds (see explanation on next page).

If your doctor cannot order the test, ask if they can help with a blood draw. Either way, you can contact a lab directly to request the test.

How do I find a lab?

Several labs in North America currently offer PFAS blood testing to individuals: **AXYS Analytical**, **EmpowerDX**, and **Eurofins**. **AXYS Analytical** and **Eurofins** measure PFAS in blood serum, and **EmpowerDX** offers a home finger-prick test. **LIMS Labs** does not offer tests to directly to individuals, but does provide blood testing to other entities, including Quest and LabCorp that do offer testing to individuals through clinicians.

For information about price, specific chemicals tested, and lab requirements, see our online guide (bit.ly/pfas-blood-test).

A note about litigation

If you are considering legal action, consult a lawyer before testing your blood. Discovery of PFAS in blood may start the clock on a statute of limitations that could prevent you from litigating in the future. Note that certain documentation may be required in legal settings, so you may need a blood draw (rather than a finger-prick) by a phlebotomist who can serve as a documented witness.

This fact sheet is a product of the **PFAS-REACH** (Research, Education, and Action for Community Health) study. PFAS-REACH is funded by the National Institute of Environmental Health Sciences (Grant No. R01ES028311). May 2022

Blood draw vs. finger-prick tool

- Most labs require a **blood draw** by a phlebotomist so they can test a large amount of your blood. This has been preferred for many years, is well studied, and may have legal benefits.
- **EmpowerDX** (part of Eurofins) offers a **finger-prick tool** that allows you to collect a sample at home and will test your whole blood. Note that if PFAS levels in your blood are low, this test may be less likely to detect the PFAS.

Limitations you may encounter

- Health insurance may not cover costs.
- The maximum number of PFAS that can be tested is around 40. This is a small number compared to the thousands of PFAS that exist.

Interventions

Drinking water: If you live in a community with contaminated water or are concerned about your water, you can use bottled water or filtered water. These interventions may reduce your exposure to PFAS.

Food: Some people who likely had exposure to PFAS through food. The PFAS-REACH study is currently testing the effectiveness of interventions such as drinking water filtration, PFAS water filters, and other interventions to reduce exposure to PFAS.

Other: PFAS can be found in many consumer products, including higher total and LDL cholesterol, kidney and liver function tests, and other health conditions. PFAS exposure has been associated with increased risk of liver disease, kidney disease, and other health conditions. There is also evidence that PFAS exposure is associated with increased risk of ulcerative colitis, and other health conditions. There is also evidence that PFAS exposure is associated with increased risk of pregnancy loss and other health conditions. However, there is still more research needed to understand the health effects of PFAS. PFAS also accumulate in breast milk, so breastfeeding in communities with high levels of PFAS in breast milk may increase exposure to PFAS in breast milk.



What if I want to get my blood tested?

- Some clinicians can order blood tests
- Some labs offer PFAS blood testing to individuals
 - Options for testing at clinics or at home
- Insurance may not cover the cost of testing
- Visit PFAS Exchange for more info

Blood test information at:
bit.ly/pfas-blood-test or scan



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How can I reduce my exposure to PFAS?

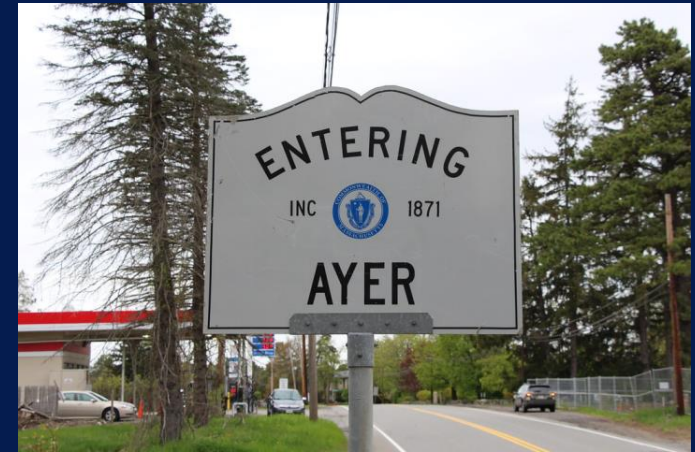
- Select products without stain- and water-resistance
- Avoid microwave popcorn and eat more fresh foods
- Avoid cosmetics and other products with “fluoro-” ingredients
- Minimize contact with fluorinated ski and floor wax
- Look for products that say “PFAS-free”

Try Silent Spring’s Detox Me Smartphone app!



Tonight's agenda

- What are PFAS?
- Study overview and timeline
- Summary of blood PFAS levels in Ayer
- How to interpret your results
- **Next steps and key takeaways**



Next steps for our study

- Working with ATSDR and other sites to analyze data and look for links between PFAS and health effects
- Conducting additional analyses on blood samples from some Massachusetts participants
- Reconstructing past levels of PFAS in the drinking water to estimate past exposures
- Planning to provide updates to the community over time



Key take-aways



- Ayer community is part of a major CDC study to understand PFAS health effects
- Median PFAS levels in Ayer were generally similar to the general US population and lower than Hyannis
- Analysis of data to look for links with health effects is ongoing and may inform future regulations and clinical guidance



THANK YOU!

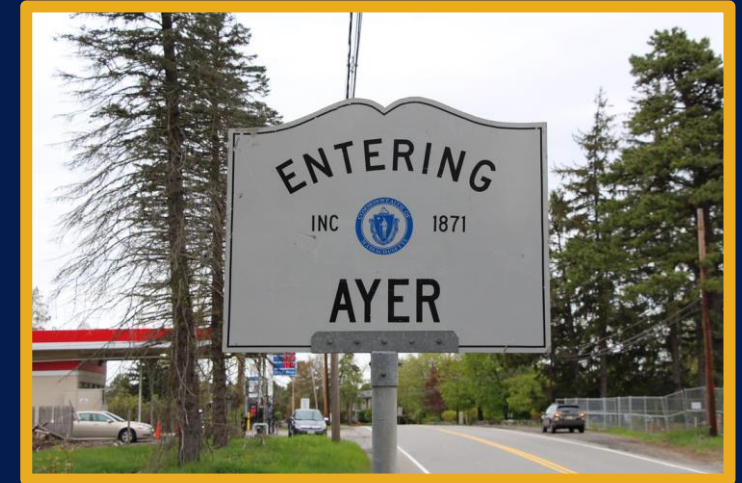
Laurel Schaidler, PhD

Senior Scientist, Silent Spring Institute
schaidler@silentspring.org

Emily Heckel, MPH

Staff Scientist, Silent Spring Institute
heckel@silentspring.org

To contact our Ayer study team:
ayer-pfas-study@silentspring.org



Scan for study
webpage



**Tell us what you think!
Please take our short survey
about tonight's event.**

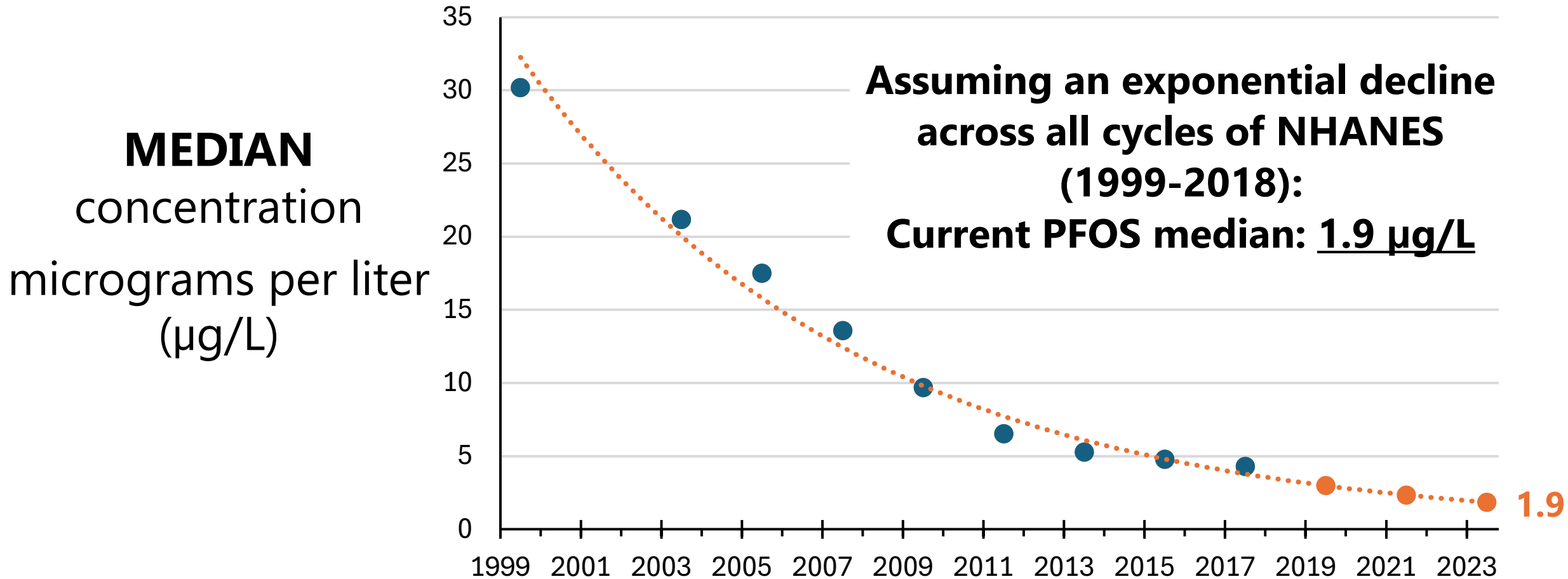
**Scan this code to
take our survey
on your phone**



EXTRA SLIDES



Estimated current PFOS in NHANES



Estimated current PFHxS in NHANES

