Massachusetts PFAS & Your Health Study

Preliminary findings from the Massachusetts PFAS & Your Health Study

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SILENT SPRING INSTITUTE
Researching the Environment and Women's Health

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Additional thanks

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

Additional thanks

Barnstable Town Manager Mark Ells

Town of Barnstable: Hans Keijser, Dan Santos, Lynne Poyant

Barnstable Town Council

State Senator Julian Cyr and State Representative Kip Diggs

Barnstable area educators: Keith Lewison, Peter Sampou, Sara Ahern, George Noonan, Mike Smith, Jen Caron, Sturgis Charter Public School East Campus and West Campus

Students: Luc-Andre Sader, Laik O'Reilly, Olivia Jonsson, Lauren McNamara, Peter Maginnis

Barnstable County: Sean O'Brien

Greater Hyannis Civic Association: Betsy Young, Sam Wilson

A Baby Center: Robin Hayward

Cape Cod Healthcare pediatricians: Katie Rudman, Ken Colmer

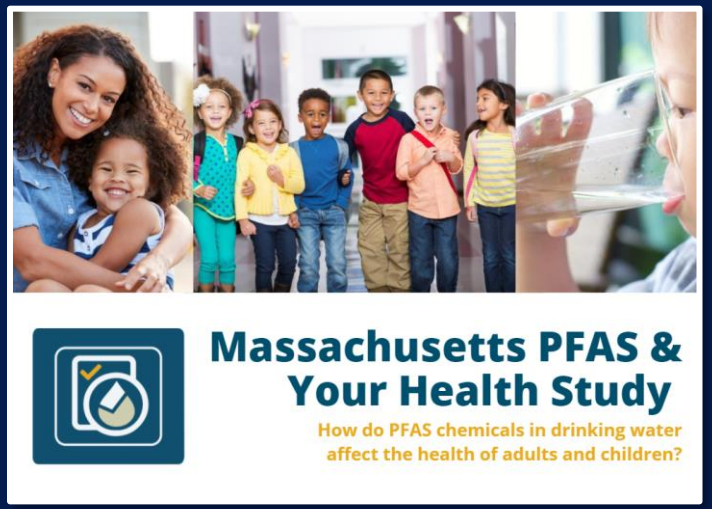
Bread and Roses: Nathan Herschler

AmeriCorps, Barnstable Adult Community Center, Hyannis Youth & Community Center, Hyannis Library

Jignesh Amin, Jen Bakewell, Betty Ludtke, Angela Rutzick, Carrie Carney

Overview

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

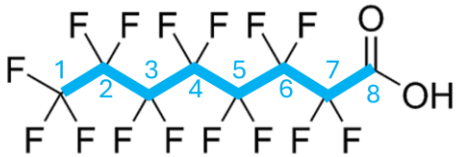


PFAS 101
Per- and polyfluoroalkyl substances

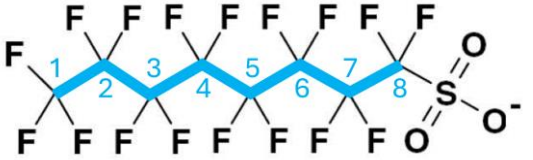
- Class of over 14,000 compounds
- "Forever chemicals" - resist degradation
- Mobile in environment
- Used in consumer products since 1950s
- Emerged as common drinking water pollutants around 2010-2015

Examples of "legacy" PFAS chemicals

PFOA ("C8")



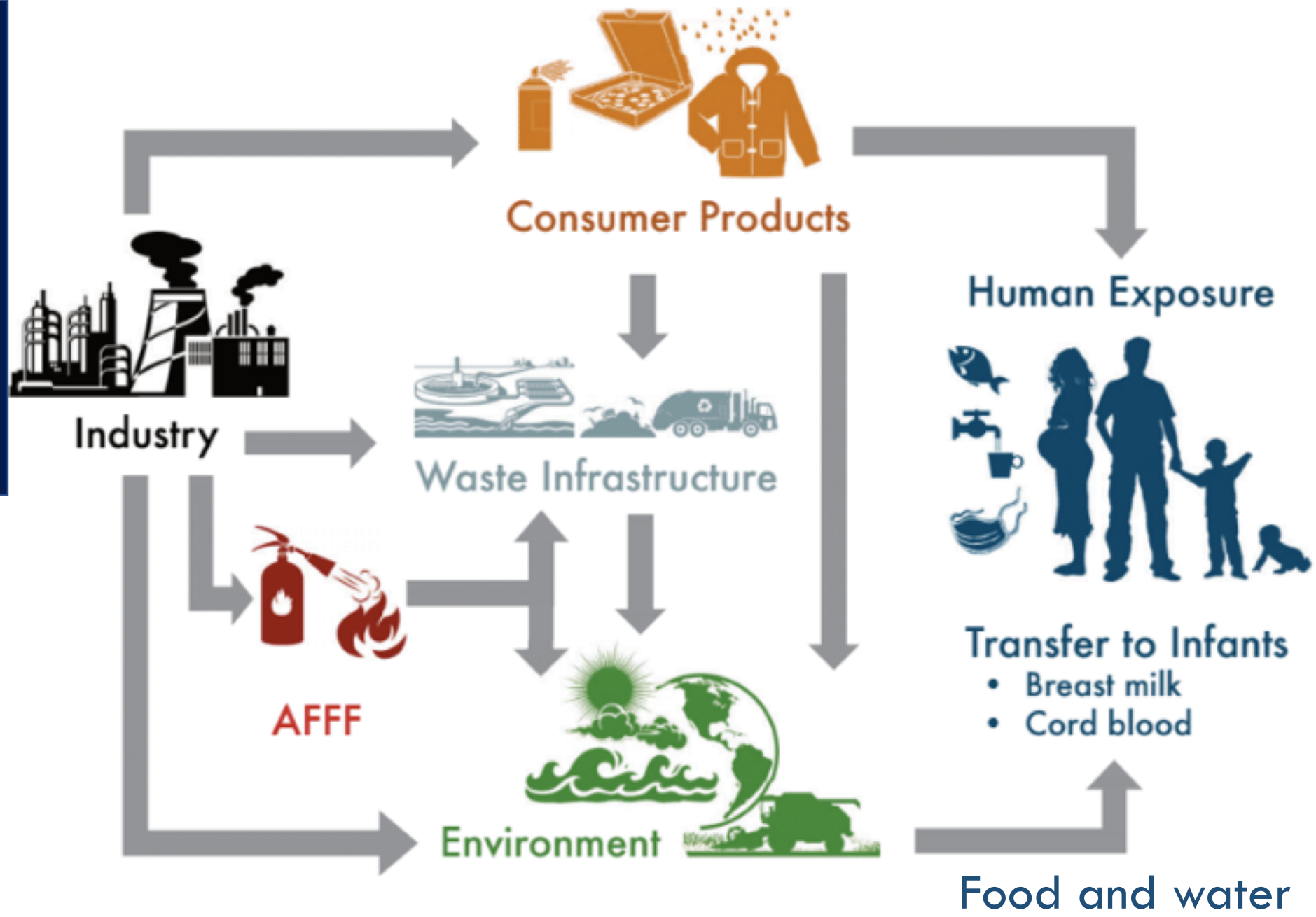
PFOS



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?



EM Sunderland et al. 2018. JESEE. 29:131-147.

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

A Calafat et al. 2007. EHP. 115: 1596-1602. HP Susmann et al. 2019. EHP. 127: 107003. Y Li et al. 2022. Environ Int. 163: 107198. Y Xu et al. 2020. EHP. 128: 077004.

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)

EPA: www.epa.gov/pfas/our-current-understanding-human-health-and-environmental-risks-pfas
EFSA: https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/j.efsa.2020.6223

PFAS in Hyannis drinking water


Firefighters attack an oil tanker fire at the academy in September 1964.

- 2010: Silent Spring first discovered PFAS in Hyannis water
- In 2013-2015, Hyannis had higher PFAS than any other water supply in MA
- Main sources: AFFF firefighting foams at Barnstable Co. Fire Training Academy and Barnstable Municipal Airport
- In 2016, Hyannis started filtering water to remove PFAS
- All Hyannis water is now filtered for PFAS

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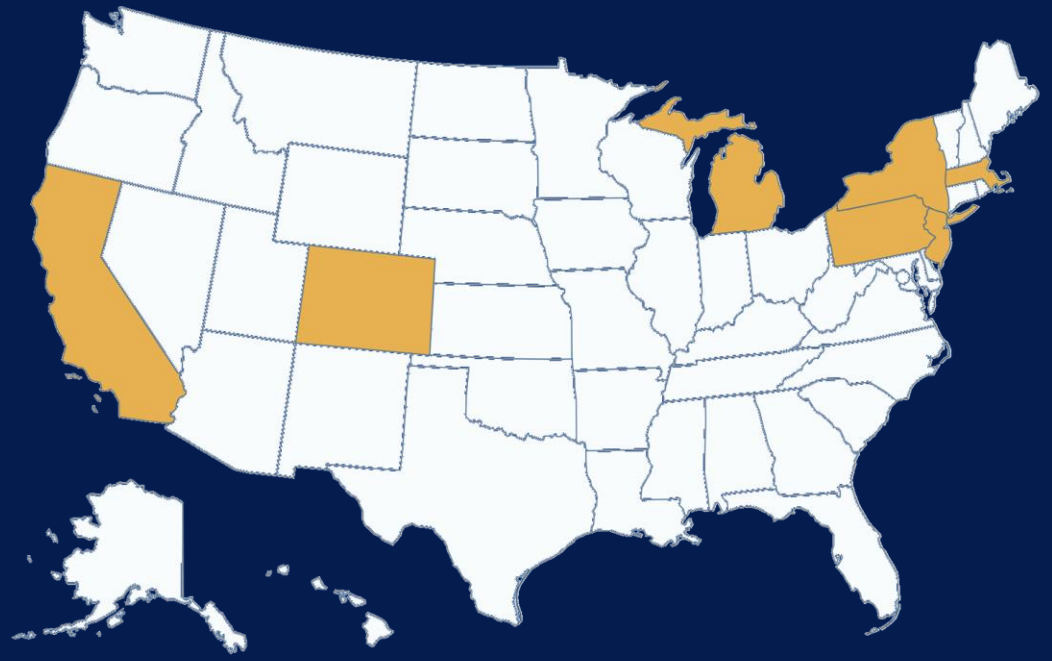
CDC PFAS Multi-site Health Study

- 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

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

Research partners

Silent Spring Institute (lead)

Harvard School of Public Health

Eastern Research Group

Local partners

MA Breast Cancer Coalition (MBCC)

People of Ayer Concerned about the Environment (PACE)

Community outreach

Postcards to all Hyannis addresses

Tabling at local stores and events

Lawn signs around town

Door-to-door canvassing

Community outreach

Engaging community leaders

Barnstable Town Hall, Town of Barnstable E-News and social media

Media coverage

CAPE COD TIMES

NEWS

Saturday open house: Current and former Hyannis residents needed for national PFAS study

Jeannette Hinkle Cape Cod Times

Published 4:42 a.m. ET Feb. 16, 2022

View Comments

Social media, Silent Spring website

MA_PFAS_study

MAPFASHealthStudy

MAPFAS

Who was eligible in Hyannis?

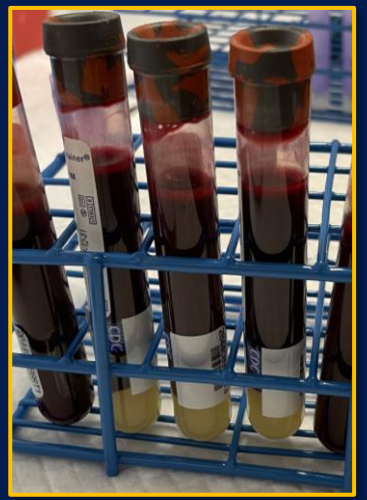
- **Adults (ages 18+):**
  - Lived in Hyannis anytime between May 2006 and July 2016
- **Children (ages 4-17):**
  - Lived in Hyannis anytime between May 2006 and July 2016 and/or their mothers lived in Hyannis during this time prior to child's birth

Who was eligible?

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

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 timeline

Sept. 2019: Silent Spring awarded grant from CDC/ATSDR

Sept. 2021: CDC/ATSDR receives approval for study protocols

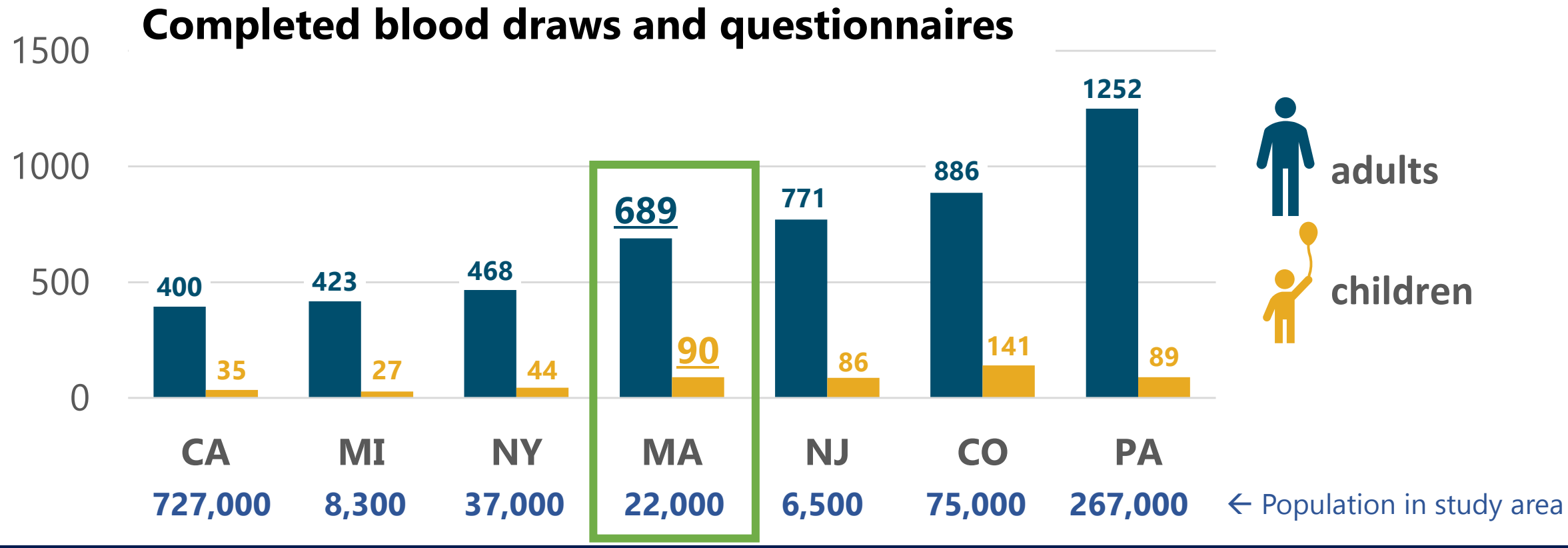
Nov. 2021: Launch of enrollment in Hyannis

Nov. 2022: Launch of enrollment in Ayer

Sept. 2023: End of data collection across all sites

June 2024: Community meetings with initial PFAS results

MA PFAS & Your Health Study
Enrollment across all sites



Enrollment numbers as of September 2023

Study enrollment in Hyannis and Ayer

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

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Information about Hyannis participants

	Adults *N* = 385	**Children** *N* = 41
Median Age	62 years	12 years
Females	70%	56%
Males	30%	44%
Hispanic	5%	22%
Non-Hispanic Black	4%	10%
Non-Hispanic White	83%	66%
Non-Hispanic Other*	6%	2%
Data not available	2%	0%

* Other includes other races, more than 1 race, or missing race

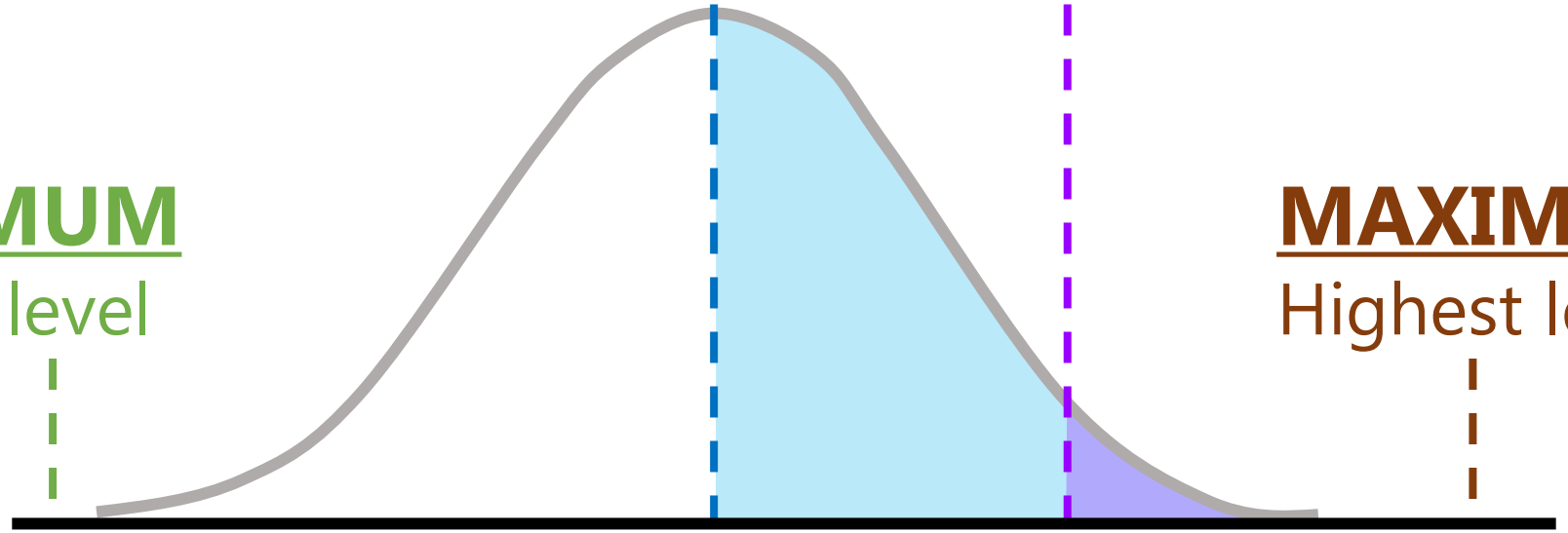
Key terms for community data

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 Hyannis adult blood results

Units: micrograms per liter (µg/L)	% of people with this chemical	Minimum	Median	95th percentile	Maximum
PFOS	100%	0.27	7.0	19.1	51.9
PFHxS	99.7%	<0.1	5.0	18.9	45.4
PFOA	100%	0.17	1.9	4.7	19.3
PFNA	98%	<0.1	0.6	1.7	4.4
PFDA	70%	<0.1	0.2	0.5	1.7
PFUnDA	62%	<0.1	0.1	0.4	1.8
MeFOSAA	30%	<0.1	<0.1	0.5	1.5

Note: µg/L is equivalent to ng/mL (nanograms per milliliter)

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PFHxS	99.7%	We tested for 7 PFAS chemicals			
PFOA	100%				
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PFDA	70%	<0.1	0.2	0.5	1.7
PFUnDA	62%	<0.1	0.1	0.4	1.8
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Summary of Hyannis adult blood results

Units: micrograms per liter (µg/L)	% of people with this chemical	Minimum	Median	95th percentile	Maximum
PFOS	**100%**	4 PFAS chemicals were detected in nearly all participants			
PFHxS	**99.7%**				
PFOA	**100%**				
PFNA	**98%**				
PFDA	70%	<0.1	0.2	0.5	1.7
PFUnDA	62%	<0.1	0.1	0.4	1.8
MeFOSAA	30%	<0.1	<0.1	0.5	1.5

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PFHxS	99.7%	<0.1	5.0	18.9	45.4
PFOA	100%	0.17	1.9	4.7	19.3
PFNA					4.4
PFDA					1.7
PFUnDA					1.8
MeFOSAA					1.5

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

Note: µg/L is equivalent to ng/mL (nanograms per milliliter)

Summary of Hyannis adult blood results

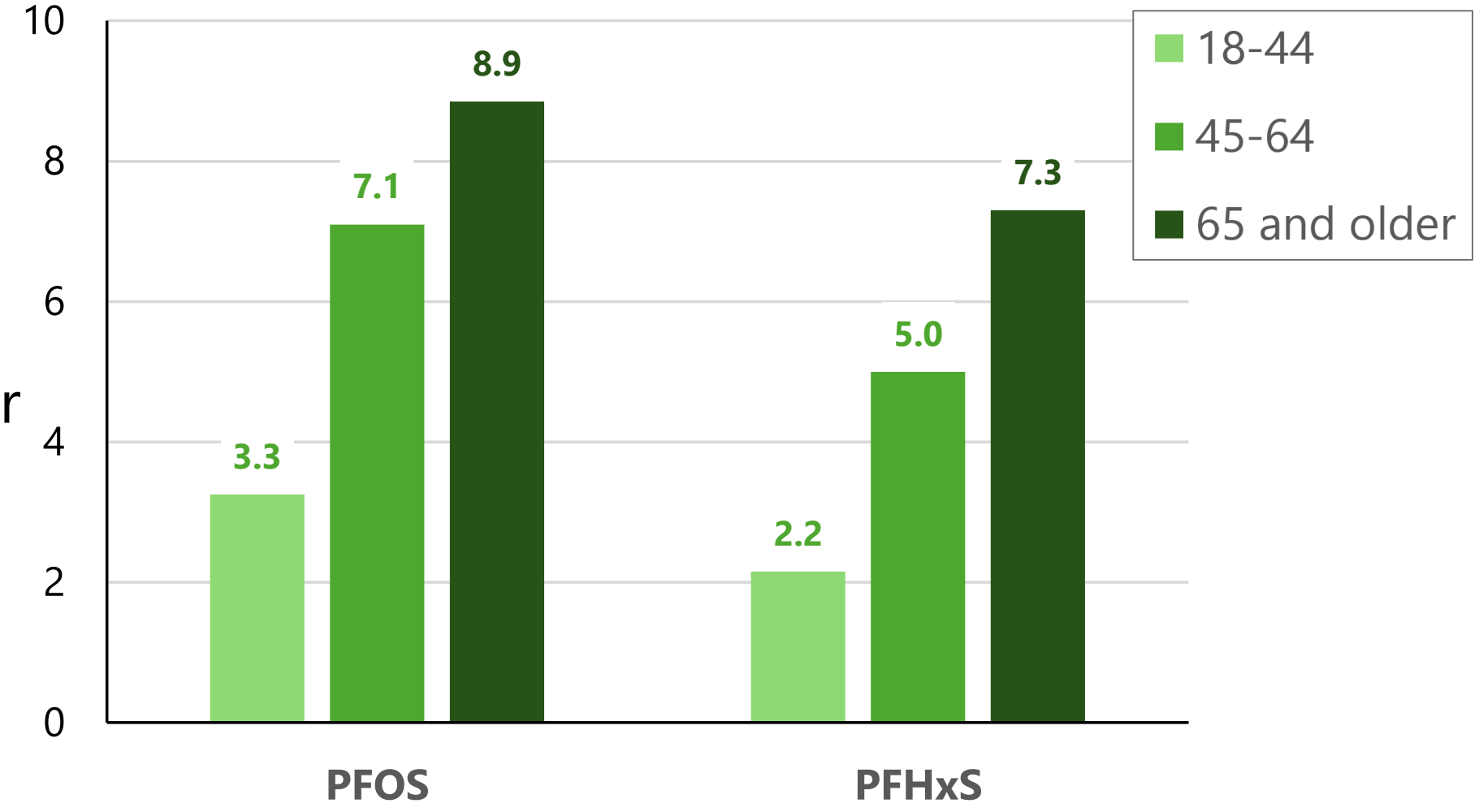
Units: micrograms per liter (µg/L)	% of people with this chemical	Minimum	Median	95th percentile	Maximum
PFOS	PFOS and PFHxS were found at the highest levels		**7.0**	**19.1**	51.9
PFHxS			**5.0**	**18.9**	45.4
PFOA			1.9	4.7	19.3
PFNA			0.6	1.7	4.4
PFDA	70%	<0.1	0.2	0.5	1.7
PFUnDA	62%	<0.1	0.1	0.4	1.8
MeFOSAA	30%	<0.1	<0.1	0.5	1.5

Note: µg/L is equivalent to ng/mL (nanograms per milliliter)

PFAS levels in Hyannis adults increase with age

MEDIAN
concentration

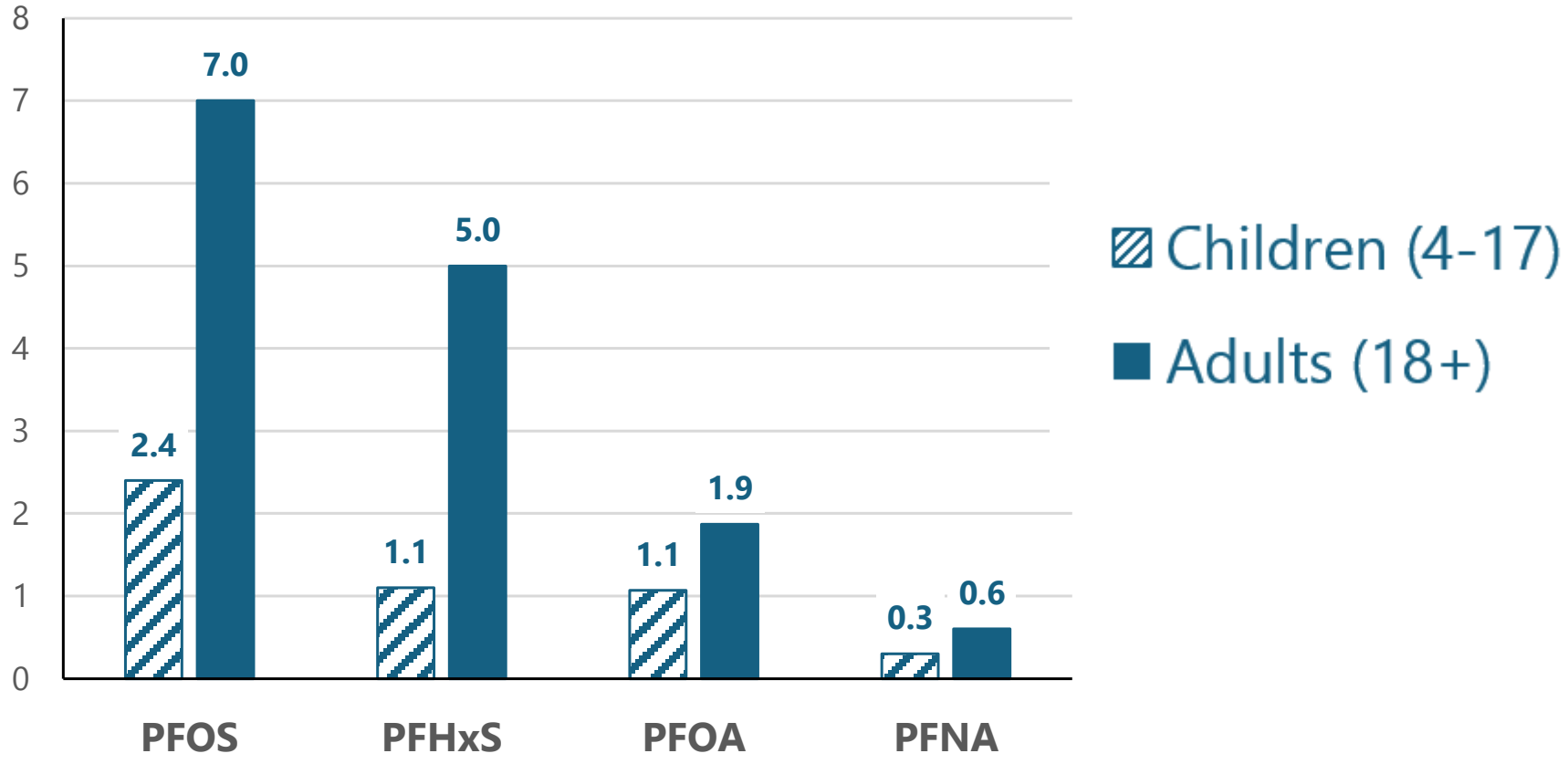
micrograms per liter (µg/L)



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

MEDIAN
concentration

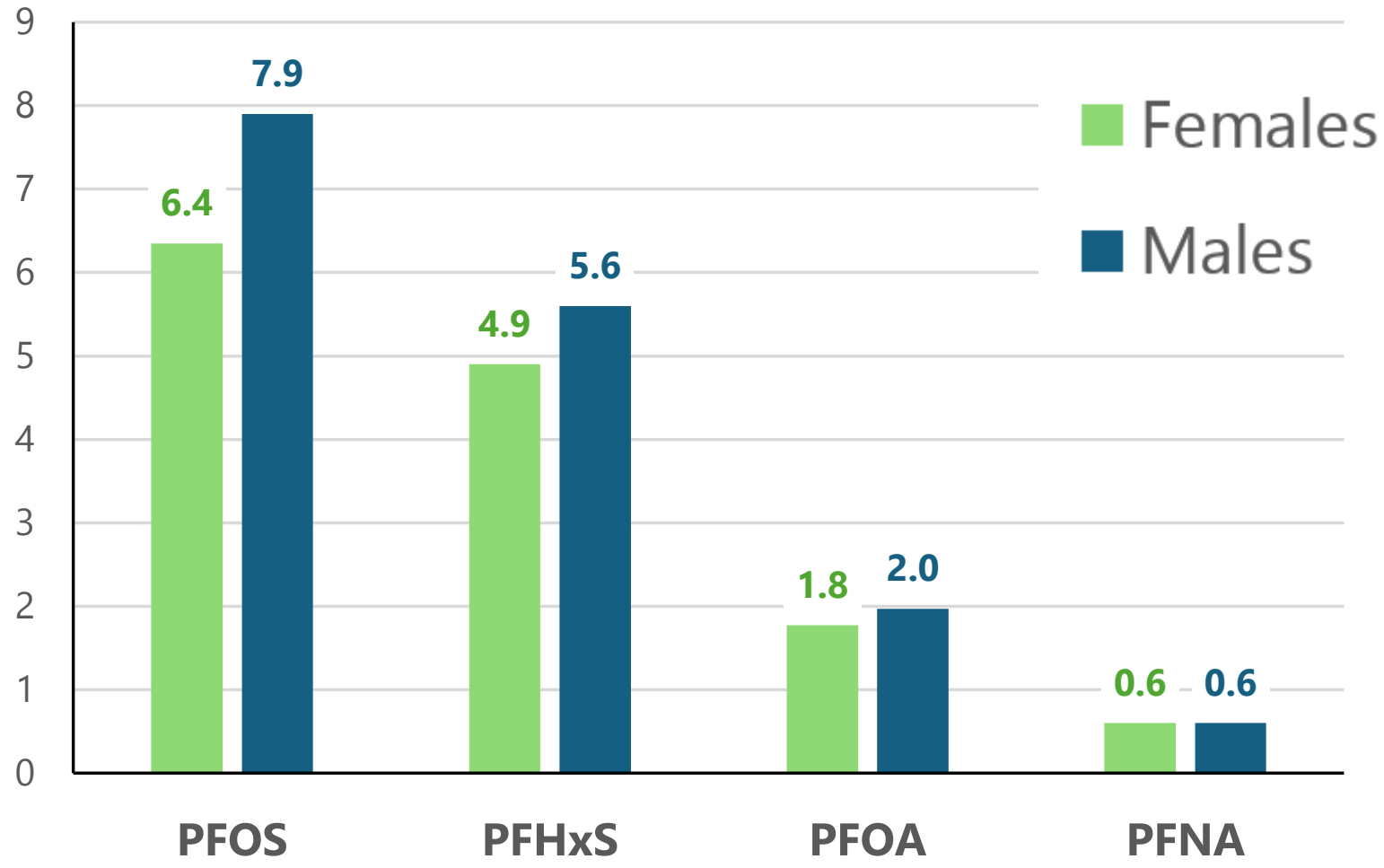
micrograms per liter (µg/L)



PFAS levels were slightly higher in men than women for some PFAS in Hyannis

MEDIAN
concentration

micrograms per liter (µg/L)



Learning about PFAS in the general population

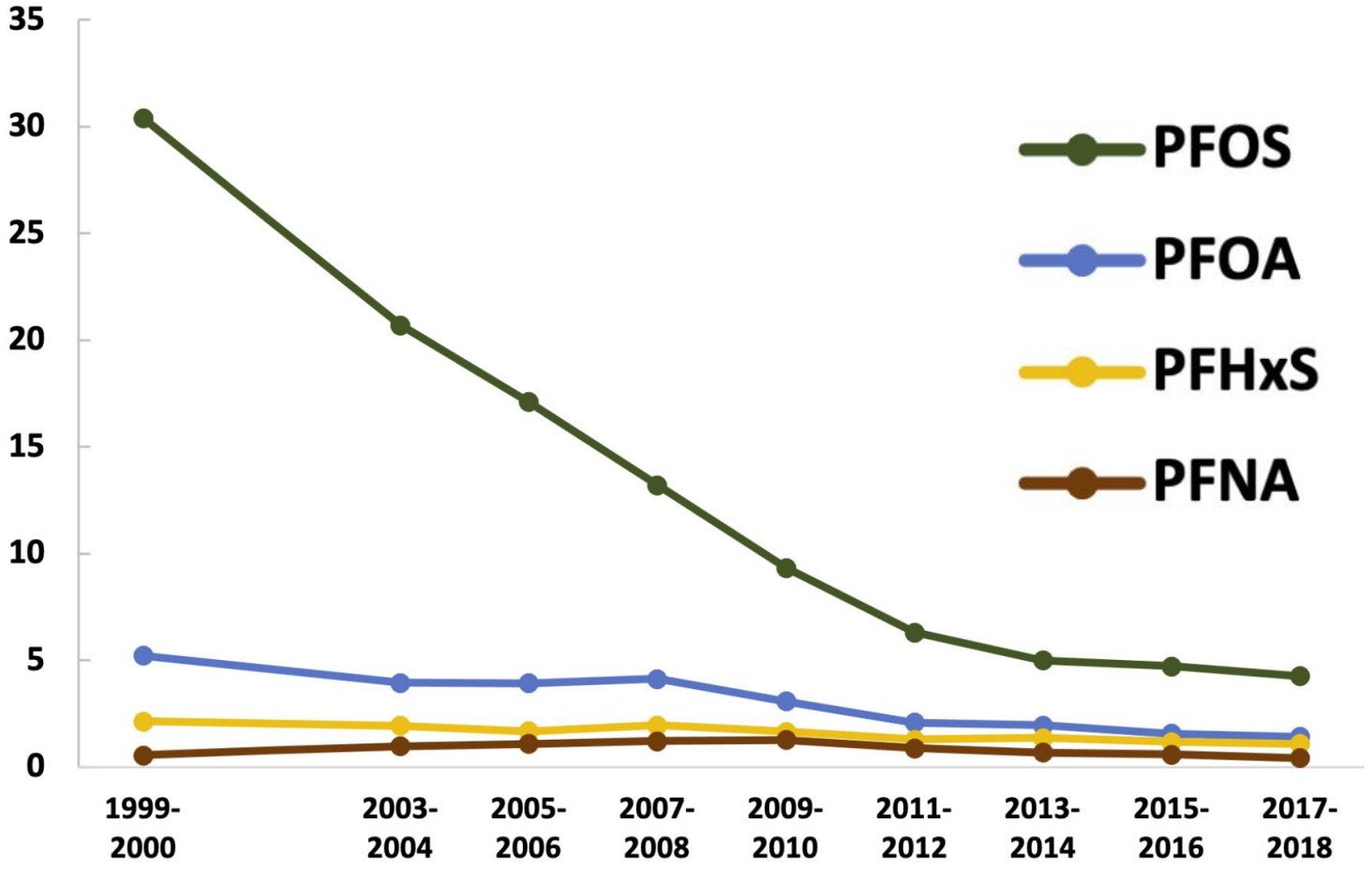
NHANES: National Health and Nutrition Examination Survey

- 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 (µg/L)

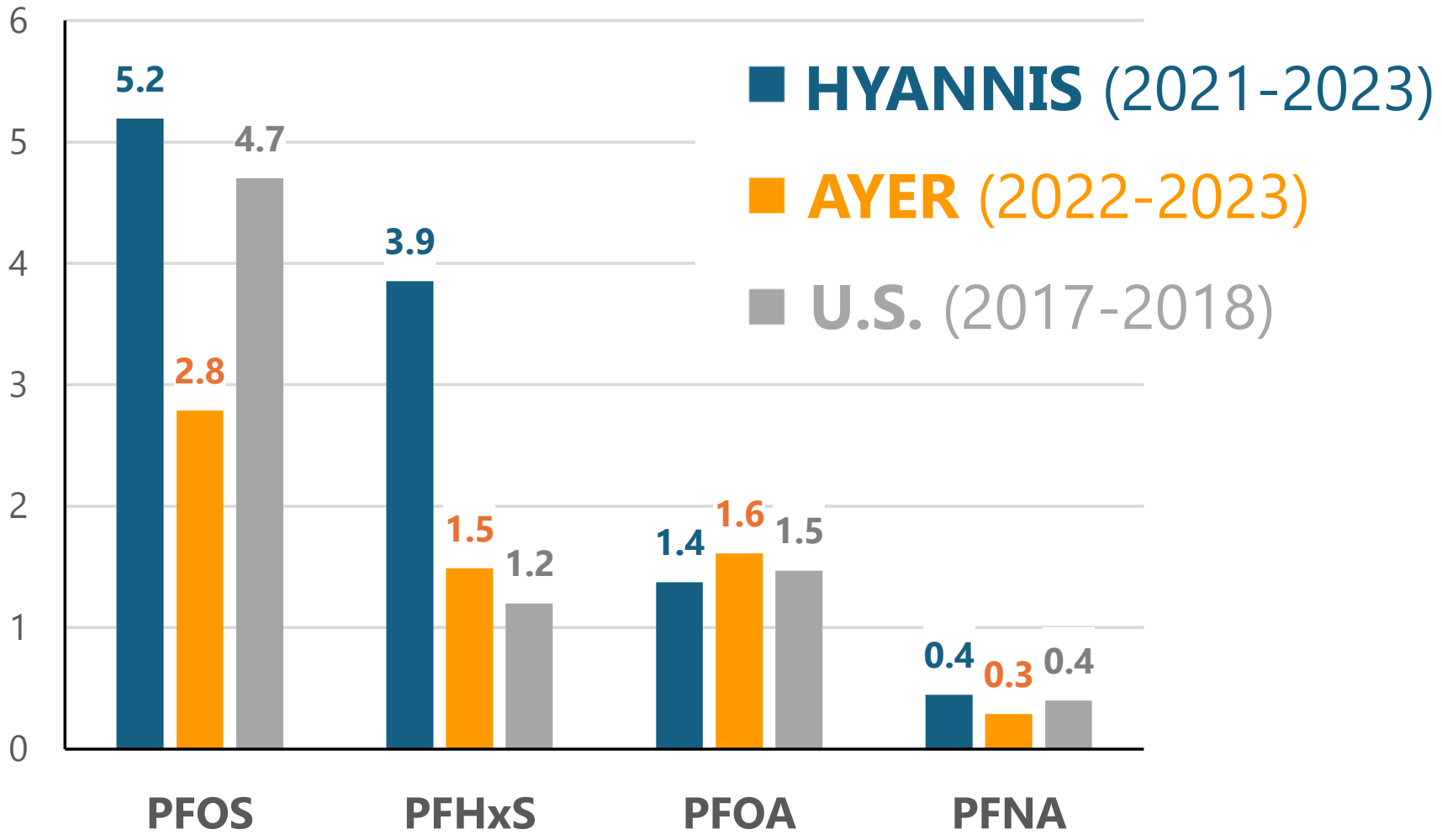


Data and graph from NHANES:
https://www.atsdr.cdc.gov/pfas/images/pfas-blood-levels-usa-chart.jpg

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

MEDIAN
concentration

micrograms per liter (µg/L)

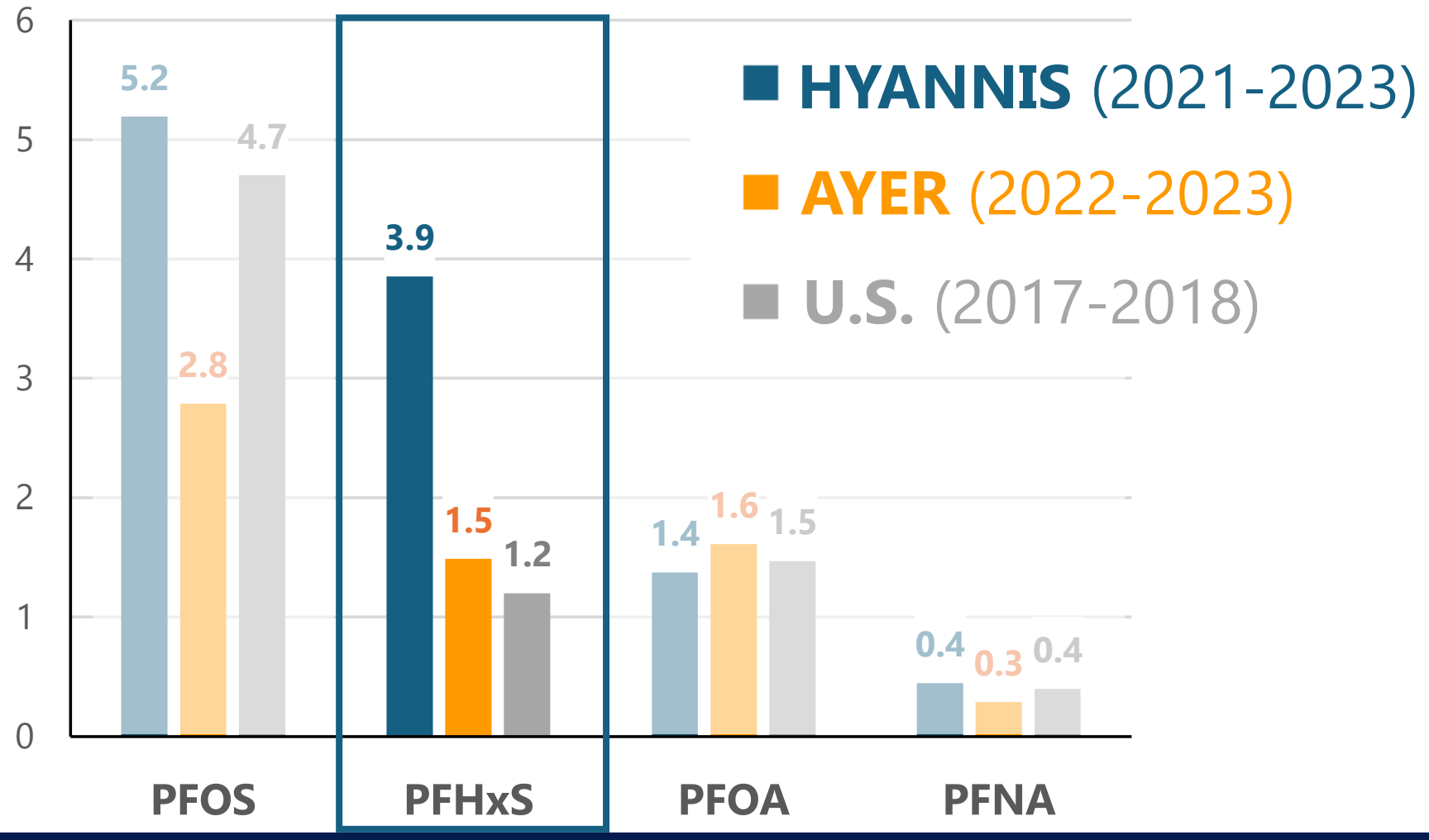


Note: Hyannis and Ayer medians are adjusted to the age distribution of NHANES

Hyannis median for PFHxS was 3.2 times higher than the general population

MEDIAN
concentration

micrograms per liter (µg/L)



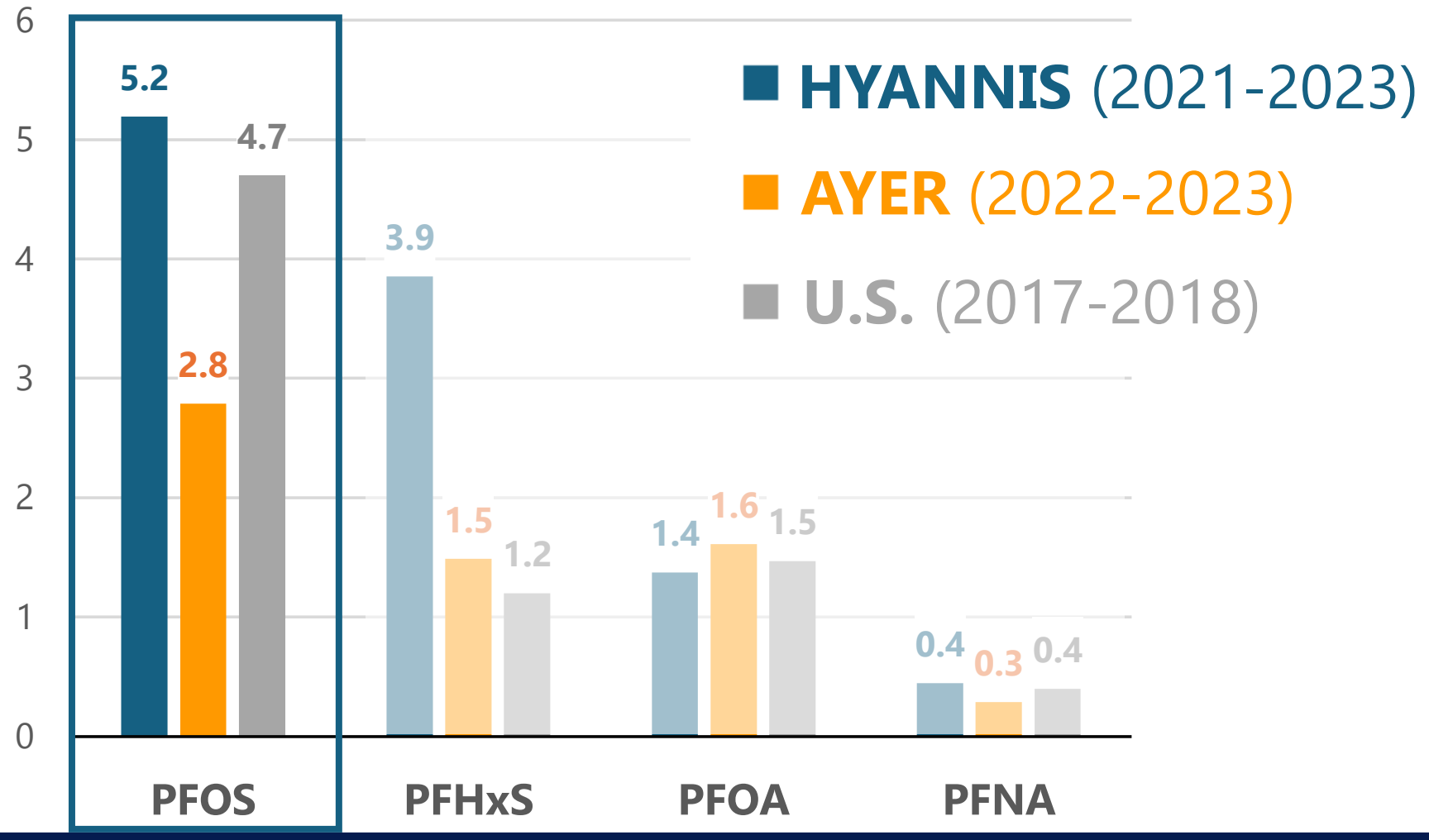
Note: Hyannis and Ayer medians are adjusted to the age distribution of NHANES

Hyannis median for PFOS was 10% higher than the general population

MEDIAN
concentration

micrograms per liter (µg/L)

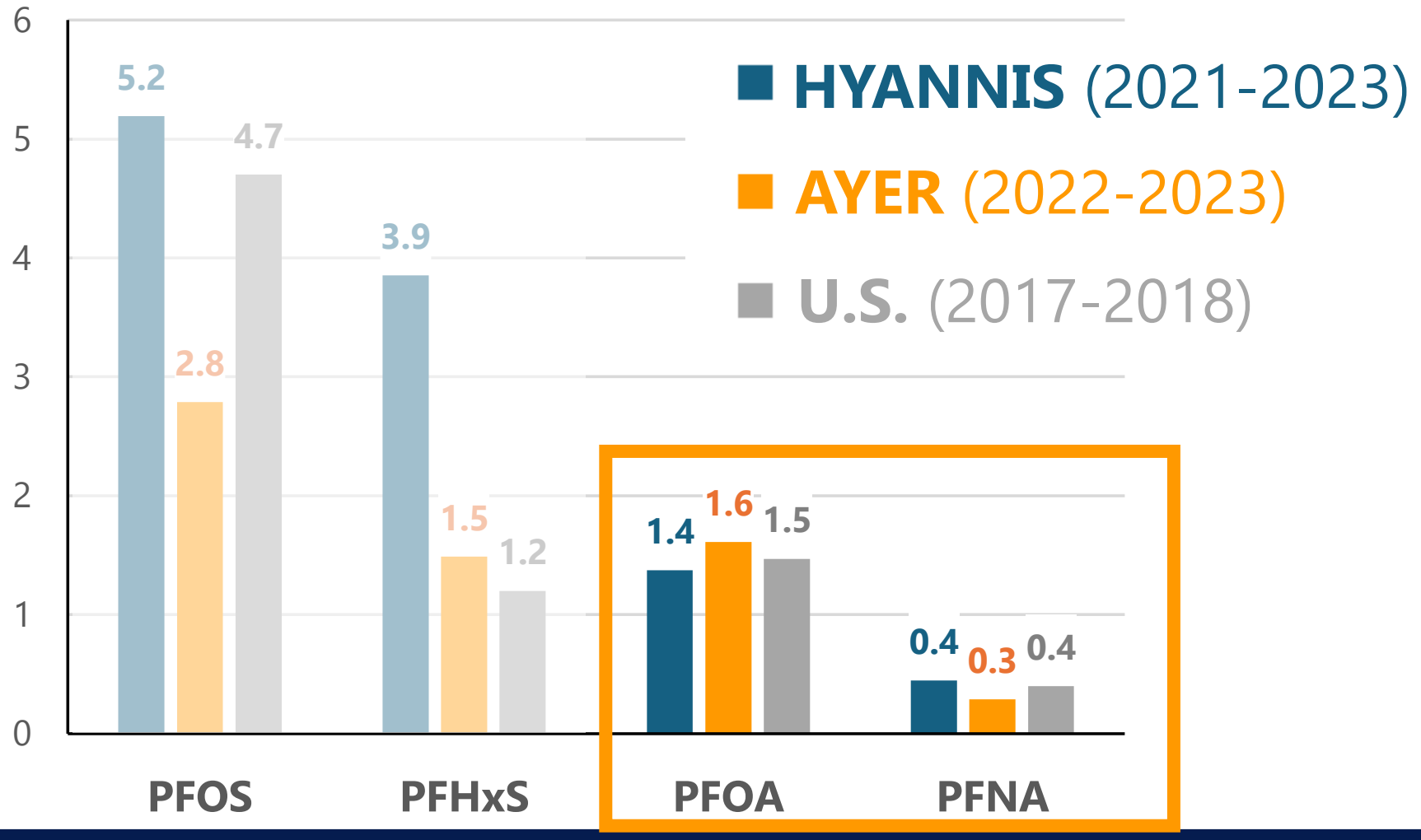
Note: Hyannis and Ayer medians are adjusted to the age distribution of NHANES



Hyannis was similar to the general U.S. population for PFOA, PFNA, and 3 other PFAS

MEDIAN
concentration

micrograms per liter (µg/L)



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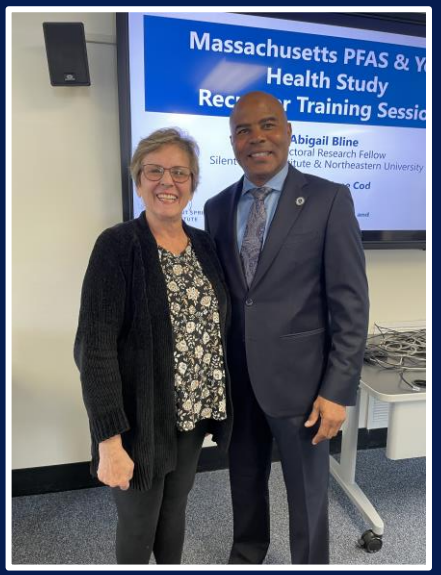

Sample report-back letters sent to participants

Name of chemical	Your result (µg/L)	2017-2018 NHANES results (µg/L)		
		Age group (years)	Median	95th 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
PFHxS *- perfluorohexane sulfonic acid*	**12.5**	20+	1.20	3.80
MeFOSAA *- 2-(N-methyl-perfluorooctane sulfonamido) acetic acid*	<0.1	20+	0.10	0.60
PFNA *- perfluorononanoic acid*	0.7	20+	0.40	1.40
PFDA *- perfluorodecanoic acid*	0.1	20+	0.20	0.60
PFUnDA *- perfluoroundecanoic acid*	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		

Note: µg/L is equivalent to ng/mL (nanograms per milliliter)

Results for 7 PFAS chemicals

Name of chemical	Your result (µg/L)	2017-2018 NHANES results (µg/L)		
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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		

Note: µg/L is equivalent to ng/mL (nanograms per milliliter)

Compare to general U.S. population

Name of chemical	Your result (µg/L)	2017-2018 NHANES results (µg/L)		
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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

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PFNA *- perfluorononanoic acid*	0.7	20+	0.40	1.40
PFDA *- perfluorodecanoic acid*	0.1	20+	0.20	0.60
PFUnDA *- perfluoroundecanoic acid*	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		

Note: µg/L is equivalent to ng/mL (nanograms per milliliter)

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	95th 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
PFHxS *- perfluorohexane sulfonic acid*	**12.5**	20+	1.20	3.80
MeFOSAA *- 2-(N-methyl-perfluorooctane sulfonamido) acetic acid*	<0.1	20+	0.10	0.60
PFNA *- perfluorononanoic acid*	0.7	20+	0.40	1.40
PFDA *- perfluorodecanoic acid*	0.1	20+	0.20	0.60
PFUnDA *- perfluoroundecanoic acid*	0.1	20+	0.10	0.40
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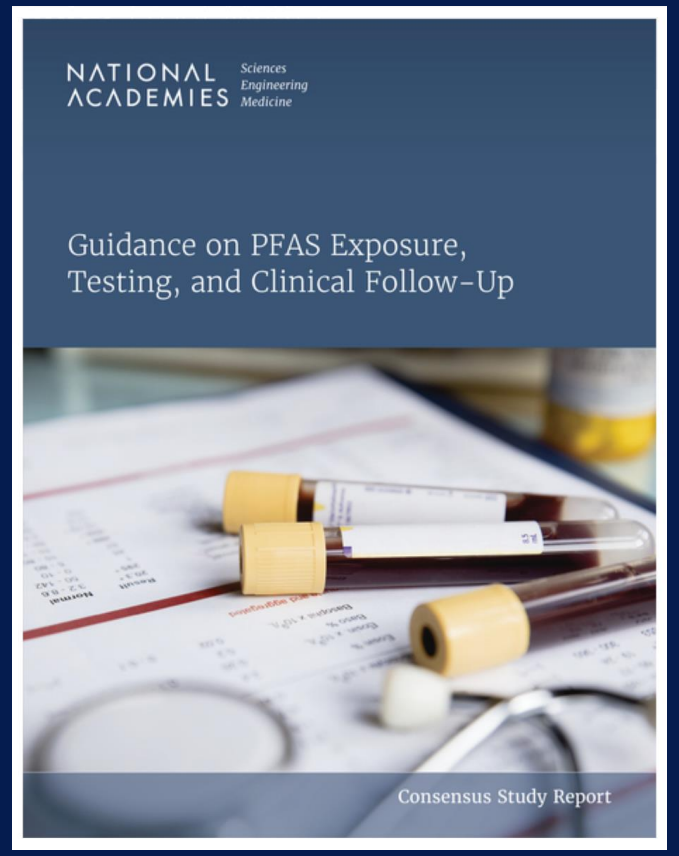
National Academies report (2022)
Guidance on PFAS Exposure, Testing, and Clinical Follow-Up

- "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



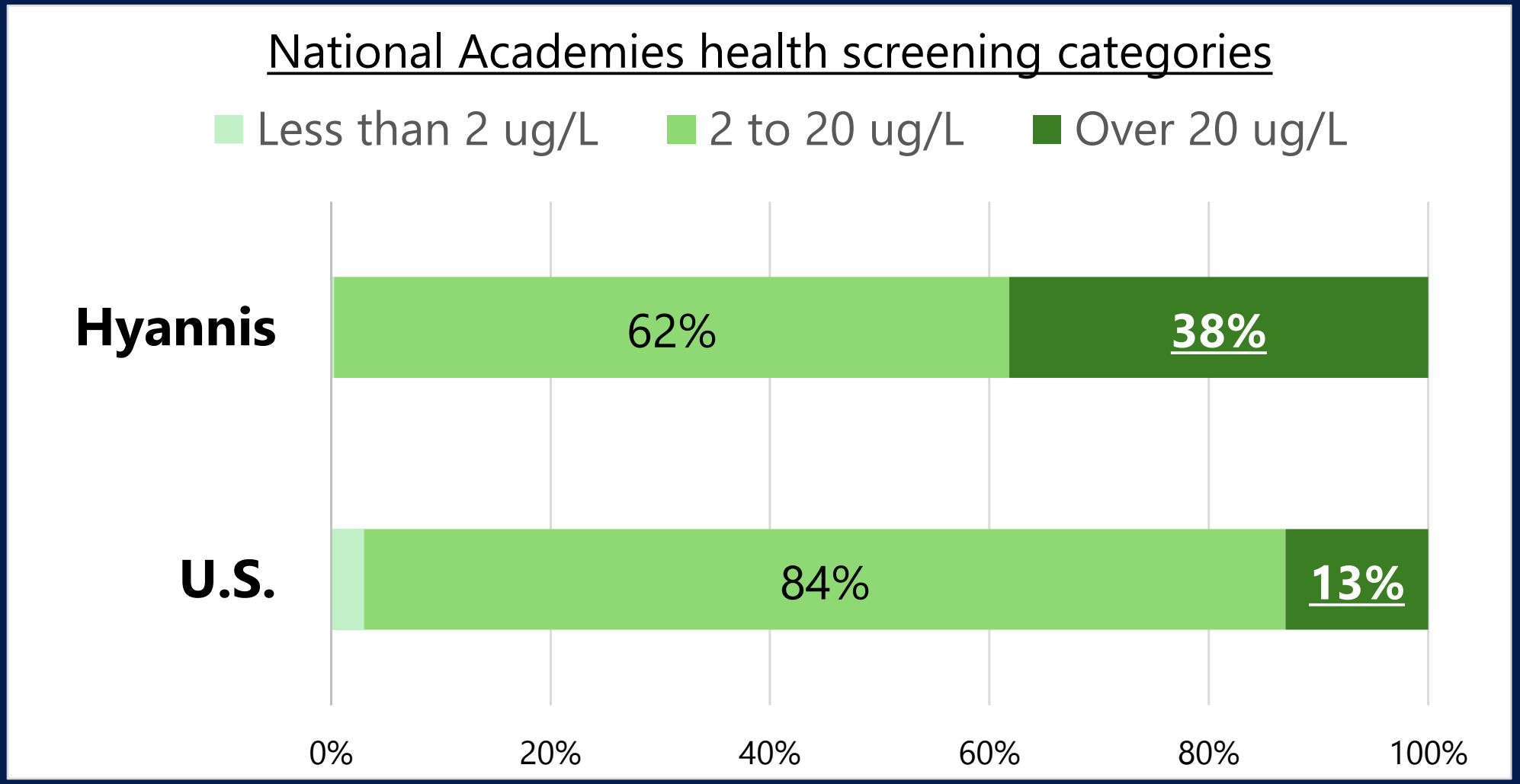
Scan for resources ►

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

Sum of 7 common PFAS (µg/L)	National Academies suggested patient follow-up
Less than 2 µg/L	Clinicians should provide usual standard of care
2 up to 20 µg/L	Within usual standard of care, clinicians should: • 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 µg/L or higher	In addition to usual standard of care, clinicians should:
	• Prioritize screening for dyslipidemia with a lipid panel (for patients over age 2)
	• At all well visits:
	  ○ 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)

Hyannis had a higher proportion of adults above 20 µg/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/**

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
PFAS Research, Education, 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 and Eurofins measure PFAS in blood serum, and EmpowerDX offers a home finger-prick test. NMS 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).

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.

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

Scan for resources ►

Massachusetts PFAS and Your Health Study

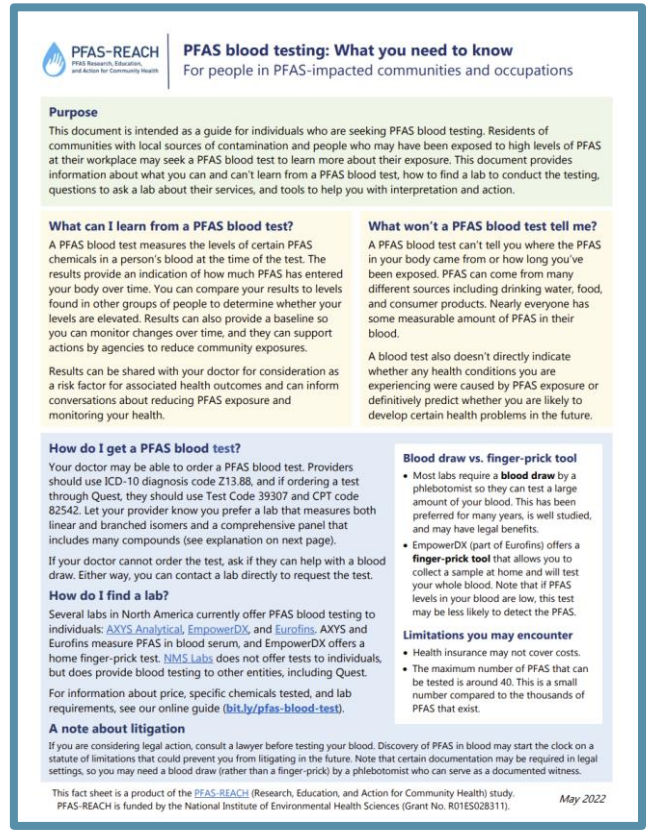
https://bit.ly/ma-pfas

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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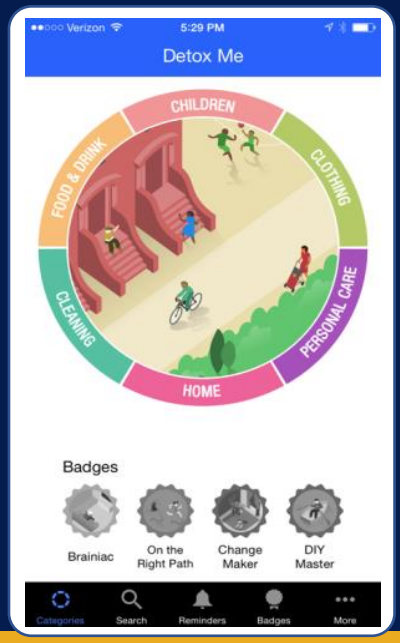
May 2022

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!



Overview

- What are PFAS?
- Study overview and timeline
- Summary of blood PFAS levels in Hyannis
- 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 associations between PFAS and health effects
- Conducting additional analyses on blood samples from some Massachusetts participants
- Reconstructing past levels of PFAS in the water to estimate past exposures
- Planning to provide updates to the community over time

Key take-aways

- Hyannis community is part of a major CDC study to understand PFAS health effects
- Levels of two PFAS were higher in Hyannis residents than in the general population and in Ayer
- Analysis of data to look for links with health effects is ongoing and may inform future regulations and clinical guidance

THANK YOU!

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To contact our Hyannis study team:
pfas-health-study@silentspring.org

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

Scan this code to take our survey on your phone