



TESTING *for* PEASE

Interpreting Your PFC Blood Test Results

Testing for Pease Community Meeting | May 17, 2016

Interpreting Your PFC Blood Test Results

General overview of
TFP and PFCs at
Pease

Interpreting Your PFC
Blood Test Results

PFC & Health Effects:
the Known &
Unknown

How to Speak With
Your
Doctor about PFCs



Who is Testing for Pease?

Testing for Pease is a community action group, whose mission is to be a reliable resource for education and communication while advocating for a long-term health plan on behalf of those impacted by the PFC water contamination at the former Pease Air Force Base in Portsmouth, NH

From left to right: Alayna, Michelle, & Andrea



Why Did We Form?

- In May 2014, a local newspaper article revealed that PFC contamination (PFOS & PFOA) was discovered in the three wells supplying drinking water to the Pease Tradeport (former Pease Air Force Base).
- One well (Haven) tested over the Environmental Protection Agency (EPA) PHA (Provisional Health Advisory)
- As community members, we were concerned as we work/worked for companies on Pease and have/had children attending the daycares on Pease. All of our families were exposed to contaminated public drinking water at Pease.

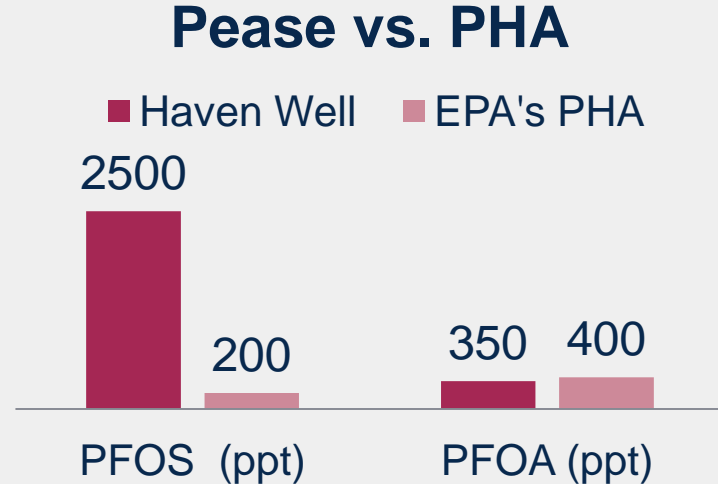
History of the Pease Air Force Base

- In 1991 Pease became a superfund site
- What is a superfund site?
 - A Superfund site is any land in the US that has been contaminated by hazardous waste and identified by the EPA as a candidate for clean up because it poses a risk to human health and/or the environment.
- Pease has 41 hazardous waste sites identified



Pease PFC Contamination

- In April of 2014, the Air Force tested for PFCs in the three drinking wells at the Pease Tradeport.
- All three wells tested positive for PFCs in the water.
- The Haven well tested over the EPA PHA for PFOS and just below the EPA PHA for PFOA



Pease PFC Contamination

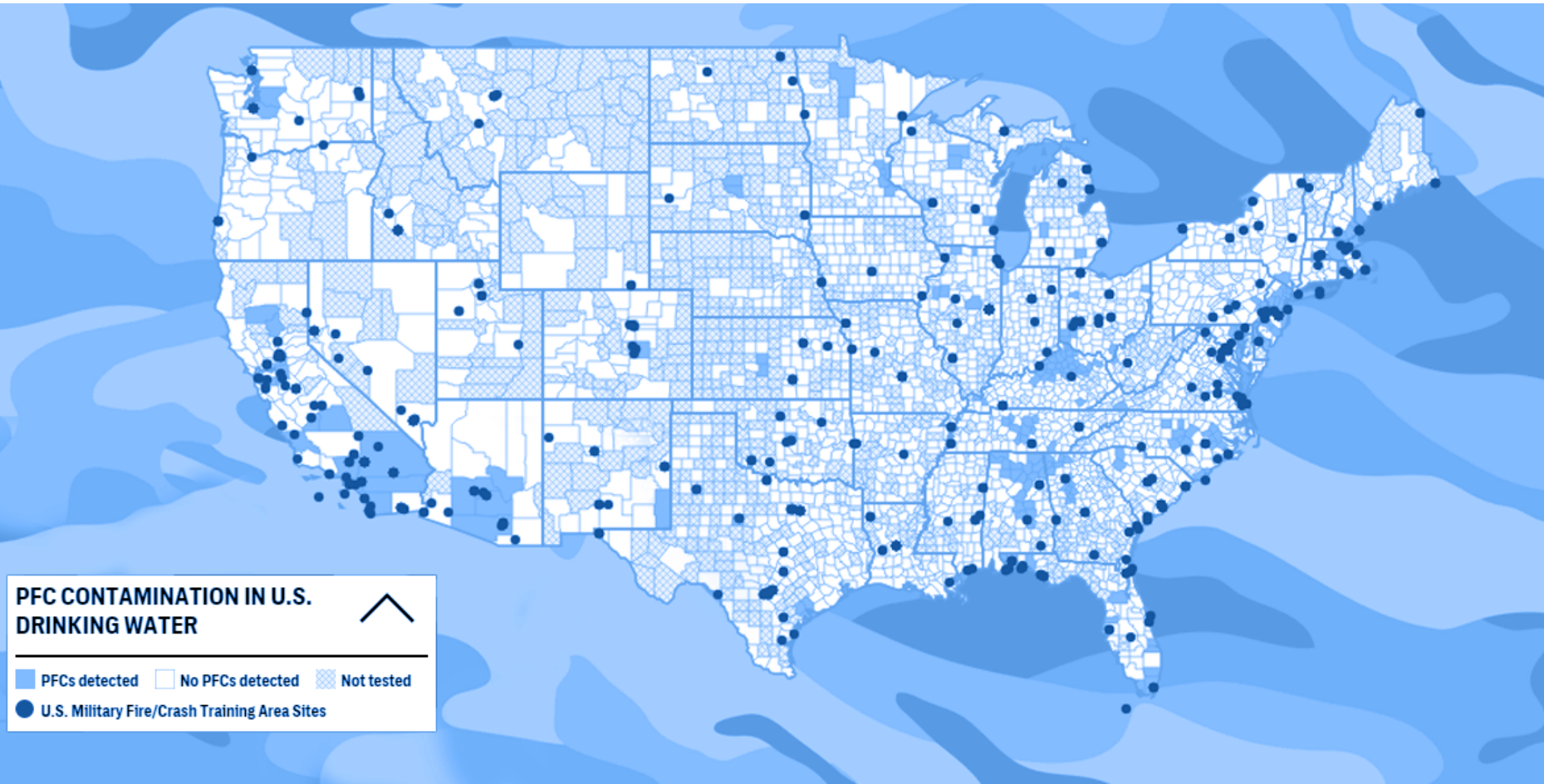
- The Haven well was shut down immediately on May 12, 2014.
- The Smith & Harrison wells remain open to this day and continue to supply water to the Pease Tradeport despite having low levels of PFCs in the water.
- The Air Force continues to routinely sample the wells on Pease to monitor PFC levels and track for migration of the contaminants.
- The Air Force has agreed to treat all three wells on Pease – Smith & Harrison well will be treated first. Press release by City of Portsmouth on April 8, 2016: “We anticipate having the filters in place and operational within six months”

How was Pease Contaminated with PFCs?

- Pease water became contaminated by a fire fighting foam known as AFFF (Aqueous Film Forming Foam)
- Used by the Air Force since the 1970's
- 21 areas identified where AFFF was used, stored, or released on Pease
- Effective in putting out petroleum based fires
- Department of Defense (DoD) continues to use AFFF today



As of 2014, 664 fire or crash training sites identified by the Dept of Defense where
AFFF laced with PFCs was used in the US

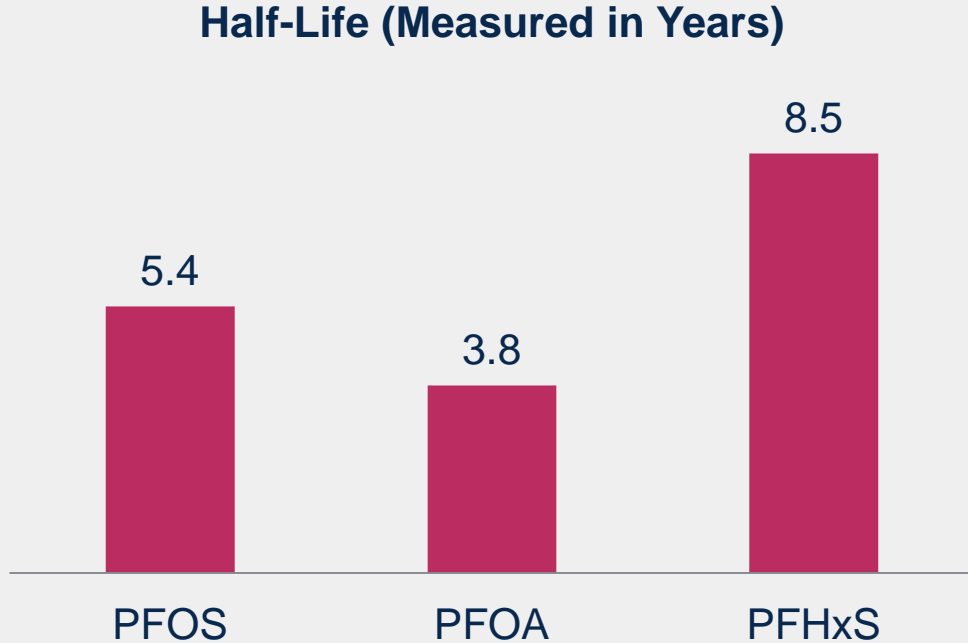


Why are we Concerned?

- In 2009, PFOS & PFOA were classified by the EPA as emerging contaminants
- PFCs are fully fluorinated compounds that are man made substances not naturally found in the environment
- PFCs bioaccumulate in the body and persist in the environment
- 99% of Americans have some detectable “background” levels of PFCs in their blood as they are used in many common consumer products
 - Fast food packaging (i.e. microwave popcorn bags, pizza boxes)
 - Nonstick cookware (i.e. Teflon)
 - Water repellant clothing
 - Stain resistant carpeting or furniture
 - Fire fighting foams

Why are we Concerned?

- PFCs have long half lives in the body (half life is how long it would take for half of the chemical to be eliminated from the body assuming no additional exposure)



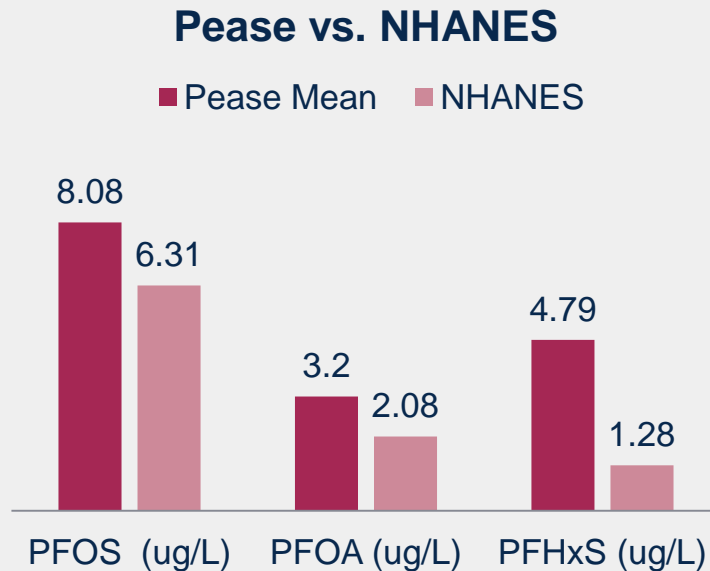
Why are we Concerned?

Federal health agency ATSDR (Agency For Toxic Substances and Disease Registry) lists potential health effects associated with PFC exposure in humans

- Developmental delays in the fetus and child, including possible changes in growth, learning, and behavior
- Decreased fertility and changes to the body's natural hormones
- Increased cholesterol
- Changes to the immune system
- Increased uric acid levels
- Changes in liver enzymes
- Prostate, kidney, and testicular cancer

1st Round Blood Test Results – Adults

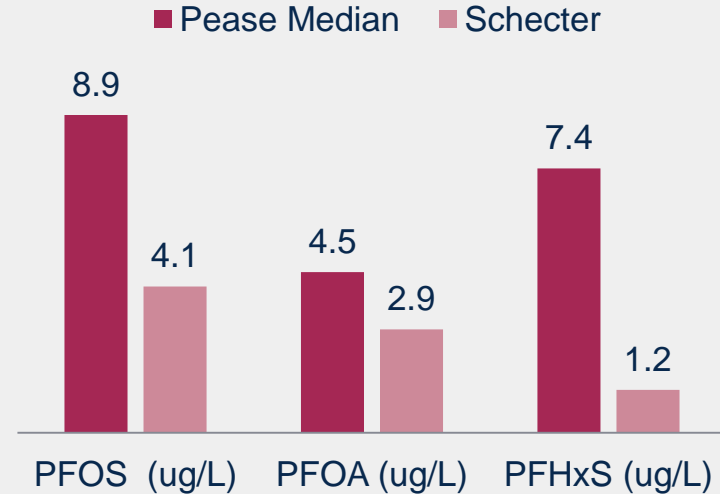
- 363 adult participants in the 1st round of testing
- Jun 17 - NH DHHS presents the first 98 adult blood test results in a community meeting
- Pease adult results are elevated when compared to national averages
- Pease adults compared to the NHANES data from 2012



1st Round Blood Test Results – Children

- 108 pediatric participants under the age 12
- Sept 9, 2015 - NH DHHS presents the pediatric blood test results from first round of testing in a community meeting
- Pease children results are elevated when compared to national averages
- Children compared to Schecter study in 2009

Pease vs. Schecter Study



What is being done to address PFCs at Pease?

- **CAP** with ATSDR to address community questions and concerns to design a long term plan and health study of current and prior exposed community members (community and former military members)
- **RAB** with Air Force to focus on clean up of the wells and environmental restoration of the aquifer
- **TFP** community action group providing education and resources to the community to stay informed on the PFC contamination at Pease. Advocating by sending letters, meeting with government officials, and collaborating with other states & communities facing PFC contamination.

Conclusion

- Contamination source is AFFF used when Pease was an active Air Force Base and AFFF continues to be used by DoD today
- Haven well shut down in May 2014, but Smith & Harrison wells remain open to this day with low level PFCs in the drinking water provided to the Pease community.
- Community blood test results from the first round reveal elevated PFC levels in Pease population when compared to national averages
- PFCs are concerning because they bioaccumulate in the body, have long half lives & persist in the body, and can be associated with adverse health effects

The PFC Contamination at Pease: A Community Perspective

Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has.

-Margaret Mead

For more information, please visit:

www.testingforpease.com

facebook.com/TestingforPease





Interpreting your blood test results and Silent Spring Institute's digital report-back interface

Laurel Schaider, Ph.D.

Research Scientist

Silent Spring Institute, Newton, MA

Testing for Pease Community Meeting

May 17, 2016

Interpreting blood testing results

- Means, medians, and more – what do they mean?
- Interpreting typical report from adult and pediatric blood testing results for PFCs
- Silent Spring Institute report-back demo



Your PFC Blood Test Results Compared with National Averages*

PFC Tested	Your Result (µg/L)	Levels in the U.S. Population (µg/L)		
		Range	Geometric Mean	95 th Percentile
PFOA perfluorooctanoic acid	How do I compare my results?	<LOD - 43.0	What do these numbers indicate?	
PFOS perfluorooctane sulfonic acid		0.14 - 235		
PFHxS perfluorohexyl sulfonate	1.9	<LOD - 47.8	1.28	5.44
PFUA perfluoroundecanoic acid	<LOD	<LOD - 6.96	**	0.620
PFOSA perfluorooctane sulfonamide	<LOD	<LOD - 0.62	**	<LOD
PFNA perfluorononanoic acid	0.4	<LOD - 80.8	0.881	2.54
PFDeA perfluorodecanoic acid	0.1	<LOD - 17.8	0.199	0.690
Me-PFOSA-AcOH ₂ 2-(N-methyl-perfluorooctane sulfonamido) acetic acid	0.2	<LOD - 4.25	**	0.690
Et-PFOSA-AcOH 2-(N-ethyl-perfluorooctane sulfonamido) acetic acid	<LOD	<LOD - 0.72	**	0.110

(µg/L) = micrograms per liter

LOD = limit of detection (0.1 µg/L)

What do we know about health effects?

*Fourth National Report on Human Exposure to Environmental Chemicals, Updated Tables (February, 2015) for specimens collected 2011-2012.

** The national average was not calculated for this PFC, as the proportion of results below limit of detection was too great to provide a valid result. Samples were analyzed at the National Center for Environmental Health, U.S. Centers for Disease Control and Prevention, Chamblee, GA.

A health level of concern has not been established for perfluorochemicals in blood.

KIDS

Your PFC Blood Test Results Compared with Children in the Schechter Study

PFC Tested	Your Result (µg/L)	Schechter Study Results (µg/L)	
		Range	Median
PFOA perfluorooctanoic acid	12	<0.1 - 13.5	2.85
PFOS perfluorooctane sulfonic acid	17.5	<0.2 - 93.3	4.10
PFHxS perfluorohexyl sulfonate	9.5	<0.1 - 31.2	1.20
PFUA perfluoroundecanoic acid	<0.1	Not reported in Schechter study	Not reported in Schechter study
PFOSA perfluorooctane sulfonamide	<0.1	<0.1 - 0.60	<0.1
PFNA perfluorononanoic acid	1.6	<0.1 - 55.8	1.20
PFDeA perfluorodecanoic acid	0.3	<0.2 - 2.10	<0.2
Me-PFOSA-AcOH ₂ 2-(N-ethyl-perfluorooctane sulfonamido) acetic acid	0.7	<0.2 - 28.9	<0.2
Et-PFOSA-AcOH 2-(N-ethyl-perfluorooctane sulfonamido) acetic acid	<0.1	<0.2 - 0.70	<0.2

(µg/L) = micrograms per liter

Median = middle PFC value of all 300 children tested

Note: A value reported as <0.1 or <0.2 indicates the result was less than the Limit of Detection (LOD) for that PFC by that testing method. Samples were analyzed at the National Center for Environmental Health, U.S. Centers for Disease Control and Prevention, Chamblee, GA.

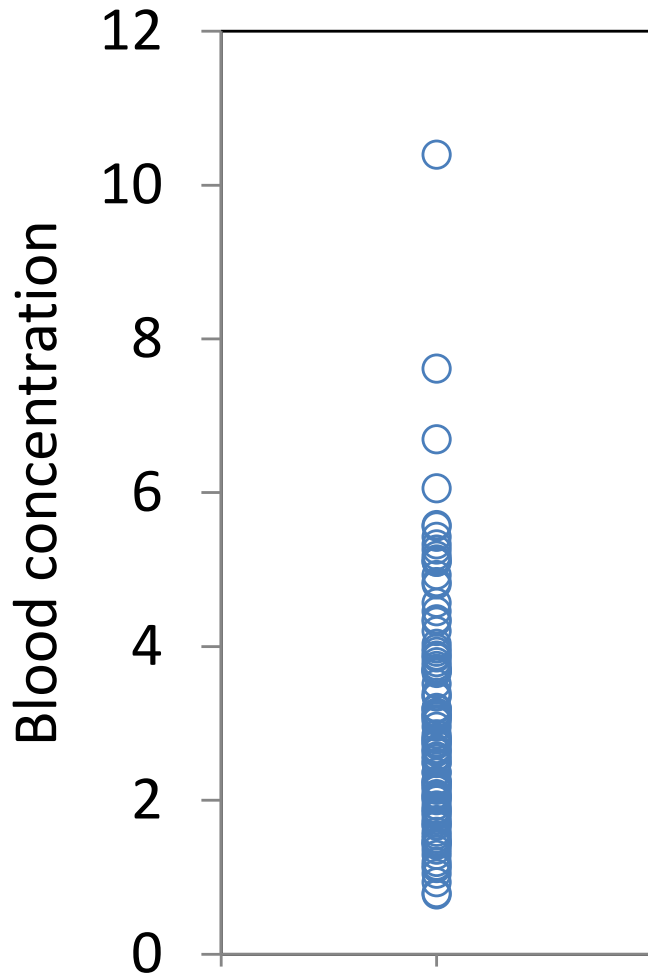
A health level of concern has not been established for perfluorochemicals in blood.

Interpreting blood testing results

- **Means, medians, and more – what do they mean?**
- Interpreting typical report from adult and pediatric blood testing results for PFCs
- Silent Spring Institute report-back demo



Example data set



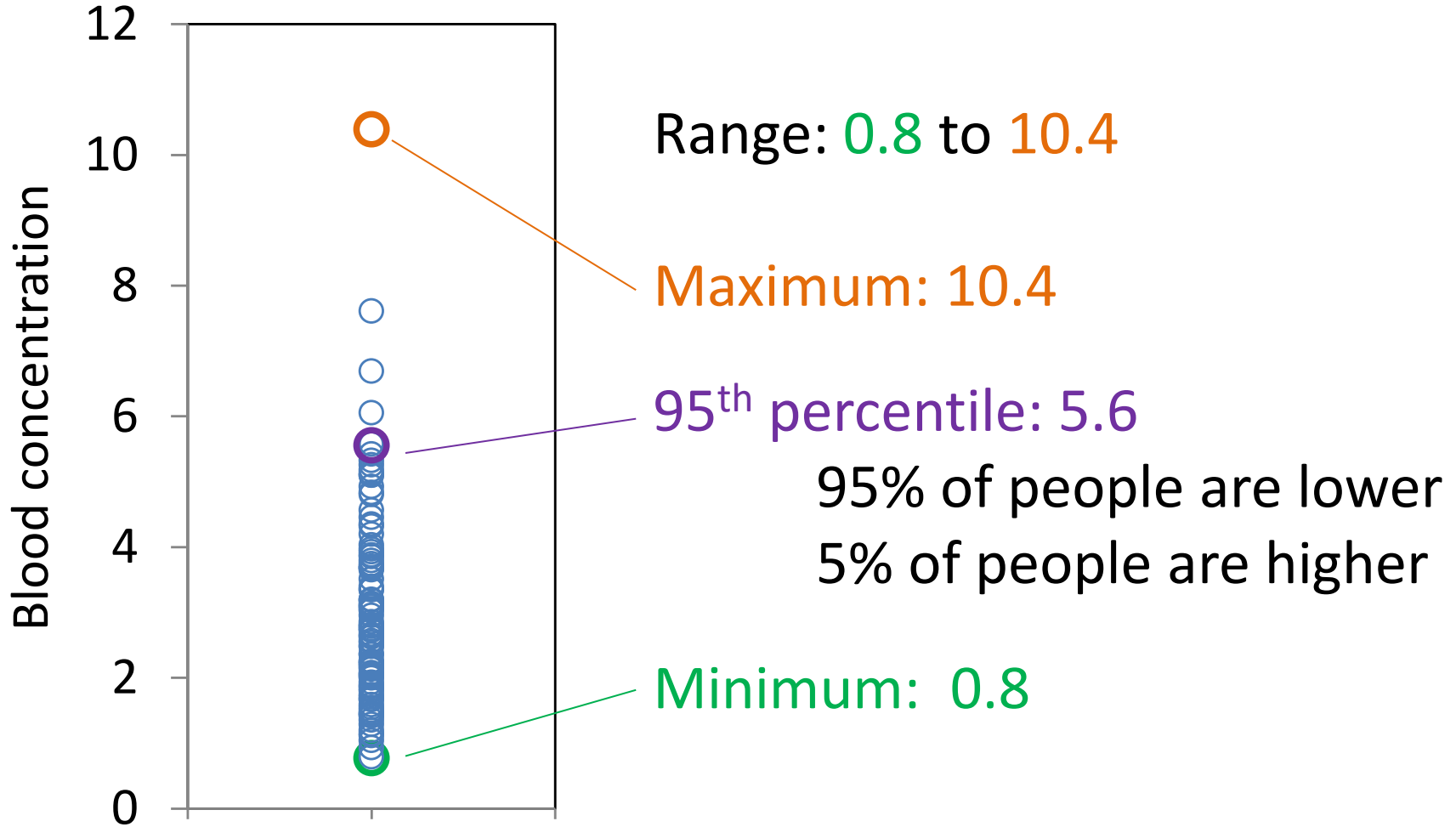
Hypothetical data

100 people

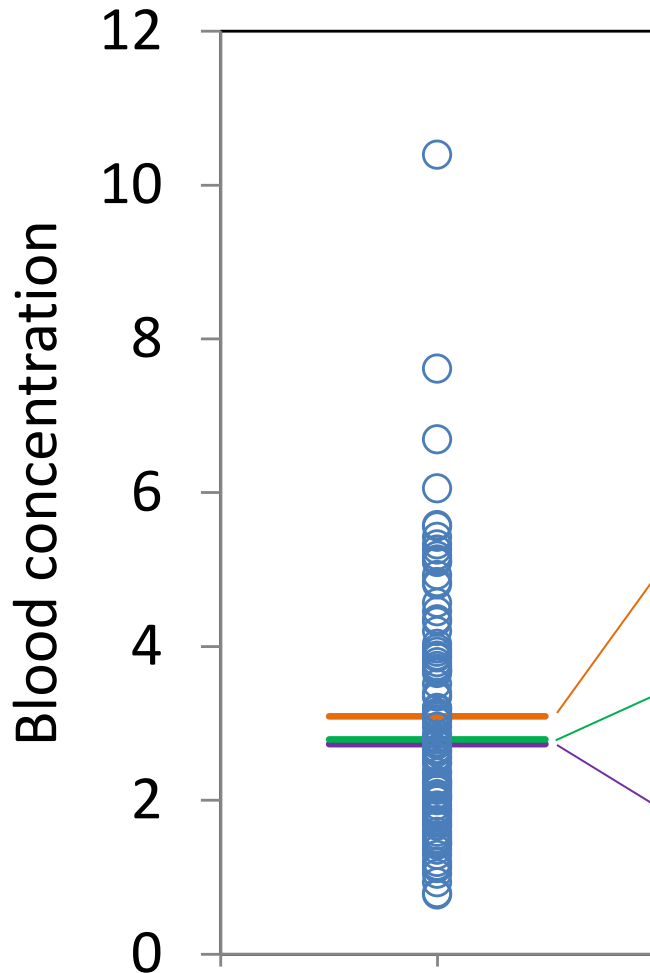
Every circle represents a person



What are the highest levels?



What is a typical level?



3 ways to calculate:

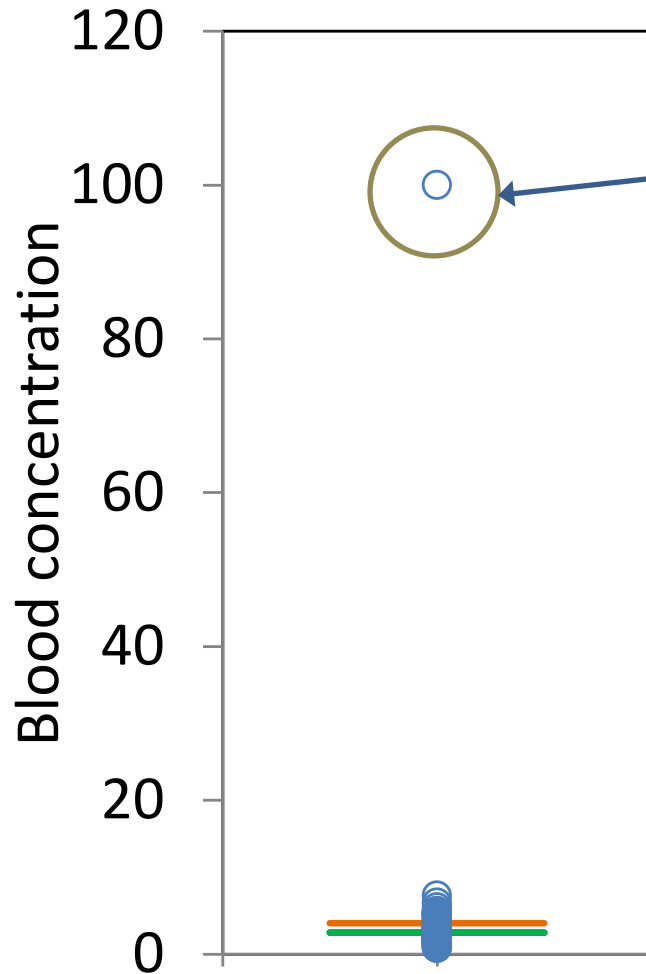
Average: 3.1
or “mean” or “arithmetic mean”

Median: 2.8
Half above, half below

Geometric mean: 2.7
Another type of average
More similar to median



What happens if one person is really high?



Maximum now 100

Average

3.1 → 4.0

Median

2.8 → 2.8

Geometric mean

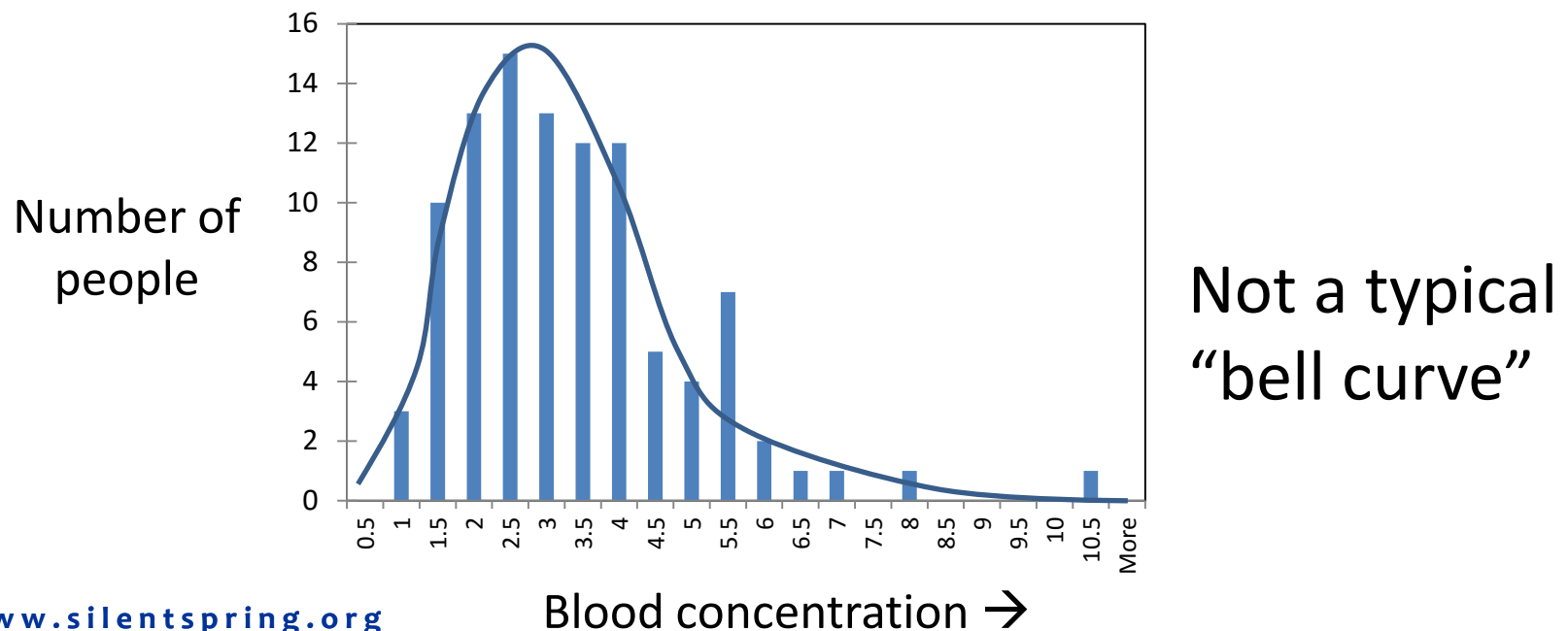
2.7 → 2.8

- Average changes a lot
- Median and geometric mean stay the same



Summarizing population data

- ✓ Medians and geometric means give a more reliable measure of a typical value than averages.
- ✓ Averages tend to be higher than medians.
- ✓ Averages can be influenced by a few high points.



Units of concentration for blood test results

Your Result ($\mu\text{g/L}$)

- $\mu\text{g/L}$ = micrograms of PFC per liter of blood
- ng/mL = nanograms of PFC per milliliter of blood
- A $\mu\text{g/L}$ is the same as a ng/mL



What is LOD?

LOD = Limit of detection (a.k.a. detection limit)

- Lowest level that can be measured by the lab
- Chemicals can be present below the LOD

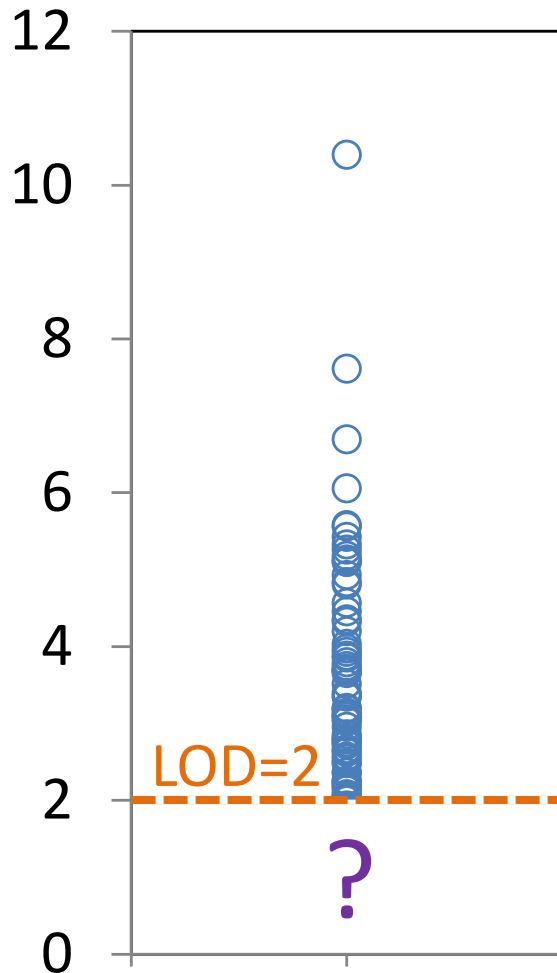
What if I'm below the LOD?

- <0.1 means less than 0.1.
- <LOD is not the same thing as zero

<u>Range</u> <0.1 – 13.5
<u>Range</u> <LOD – 43.0



What do LODs mean?



Anyone less than the LOD is between 0 and the LOD.

LODs are not related to health guidelines.



Interpreting blood testing results

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- **Interpreting typical report from adult and pediatric blood testing results for PFCs**
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Your PFC Blood Test Results Compared with National Averages*

PFC Tested	Your Result (µg/L)	Levels in the U.S. Population (µg/L)		
		Range	Geometric Mean	95 th Percentile
PFOA perfluorooctanoic acid	3.6	<LOD – 43.0	2.08	5.67
PFOS perfluorooctane sulfonic acid	3.9	0.14 – 235	6.31	21.7

How do your results compare?

For PFOA, your level is above the geometric mean in the U.S. study. For PFOS, your level is below the geometric mean for the U.S. study.

For both of these chemicals, your level is well below the maximum in the U.S. study. For PFOA, your level is close to the 95th percentile for the U.S. study.

*Based on testing of 2,100 Americans in 2011-2012 (NHANES).

KIDS Your PFC Blood Test Results Compared with Children in the Schechter Study

PFC Tested	Your Result (µg/L)	Schechter Study Results (µg/L)	
		Range	Median
PFOA perfluorooctanoic acid	12	<0.1 – 13.5	2.85
PFOS perfluorooctane sulfonic acid	17.5	<0.2 – 93.3	4.10

How do your results compare?

For both of these chemicals, your child is above the median value in Schechter's study.

For both of these chemicals, your child is below the maximum value in Schechter's study.

For PFOA, your child's level is close to the maximum.

For PFOS, your child's level is well below the maximum

Who was tested in Schechter's study?

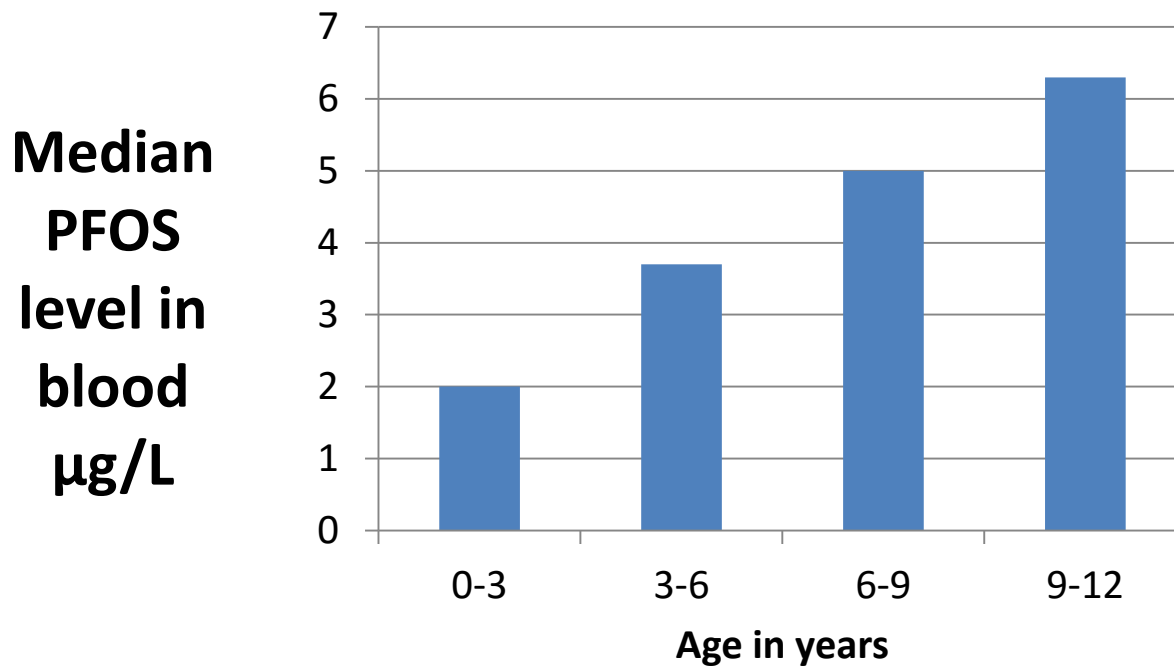
Schechter study

- 300 children in Texas, ages 12 and under
- Children gave blood samples at medical center as part of medical care.
- 8 PFCs tested
- Results presented with a maximum & median, broken down by gender and age

A. Schechter and others. 2012. Polyfluoroalkyl Compounds in Texas Children from Birth through 12 Years of Age. Environmental Health Perspectives. Volume 120. Pages 590-594.

Schechter study

- Older children tended to have higher blood levels.
- Why? Accumulation over time? Exposures prior to phase-out?



A. Schechter and others. 2012. Polyfluoroalkyl Compounds in Texas Children from Birth through 12 Years of Age. Environmental Health Perspectives. Volume 120. Pages 590-594.

What do my results mean for my family's health?

- Comparing to other people is useful for context.
- But, you can be relatively high compared to others and not be at a level of health concern.
- Or, you can be relatively low compared to others and be at a level of health concern.



Another study on children

- Grandjean and Budtz-Jorgensen (2013)
 - 431 children in Faroe Islands
 - PFCs in blood measured at age 5
 - Antibody levels in blood measured in same kids at age 7
 - Immunotoxic effects: decreases in vaccine antibodies in the blood
 - Suggested levels above 1.3 ng/mL (PFOS) or 0.3 ng/mL (PFOA) could affect children's immune systems



Interpreting blood testing results

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- **Silent Spring Institute report-back demo**



How can we report results back to families to provide more explanation and context?

DERBI:

Digital Exposure Report-Back Interface

Framework for generating personalized exposure reports for print and the web





Personal Exposure Report-Back Ethics (PERE) Study

- Interviews in 8 studies
 - Researchers, participants, IRBs members
- Workshop for 44 stakeholders
- Observations at community meetings
- User testing of reports
- DERBI - digital methods

Funded by NIEHS, NSF, CBCRP



Individual and Community Report-back

- Multi-level
- What we know/don't know
- Exposure reduction





Participant experiences

- Participants wanted their results
- Increased trust in researchers
- Pride in contributing to science and community
- Learning and conceptual shifts
- Reflections on family illnesses, “toxic trespass”
- Motivation to reduce exposure

Altman et al., 2008; Adams et al., 2011



The first DERBI users



CDC Green Housing Study

(GHS)

- Print reports



chds

Child Health and
Development Studies

Child Health and Development Studies

(CHDS)

- Web reports



<http://silentspring.org/research-area/digital-exposure-report-back-interface-derbi>

Everyday Chemical Exposures

[Household Exposure Study](#)

[Household Exposure Study in
Richmond and Bolinas, California](#)

[Testing Exposure Reduction
Strategies](#)

[Flame Retardants](#)

[Ethics in Community Research](#)

[Reporting Individual Exposure
Results](#)

[Digital Exposure Report-Back
Interface \(DERBI\)](#)

[Data Sharing and Privacy
Protection](#)

Chemicals and Breast Cancer

[Chemical Effects on Mammary
Gland Development](#)

[Tools for Green Chemistry: High
Throughput Screening](#)

[Mammary Gland Carcinogens List](#)

[Science Reviews and Database](#)

[Guide to Cohort Studies](#)

Environmental Justice

Digital Exposure Report-Back Interface (DERBI)

Thanks to advances in technology, scientists in environmental health studies are now able to detect a wide variety of contaminants in people's bodies and in their homes. Increasingly, participants in these studies want to know what their chemical levels are, even when the health effects are uncertain. To ensure that information from these kinds of studies is shared effectively and ethically, scientists need new tools for communicating results to participants.



Tools like these are critical as we enter the era of precision medicine—a new approach to disease prevention and treatment that takes into account not just genes and lifestyle, but also environmental exposures as well. In fact, one of the key requirements of the President's Precision Medicine Initiative (PMI), which seeks to engage a million volunteers to contribute their health data for

RELATED MEDIA COVERAGE

[NIEHS Partnerships for
Environmental Public Health
Newsletter - New Digital Tool
Helps Researchers Personalize
Results Report-Back](#)

For a demonstration of Silent Spring Institute's
DERBI report-back interface, visit:

[http://silentspring.org/research-area/digital-
exposure-report-back-interface-derbi](http://silentspring.org/research-area/digital-exposure-report-back-interface-derbi)

And scroll down to:

To view an example of a web-based report from the
Child Health and Development Studies, click [here](#)





Thank you!

Laurel Schaider

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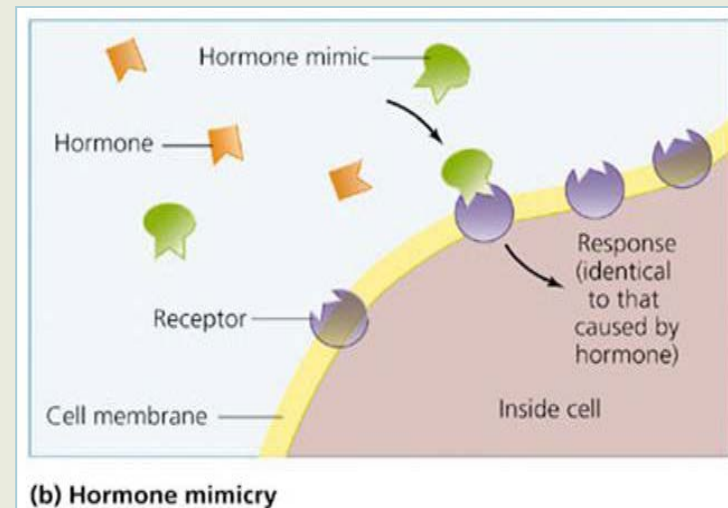
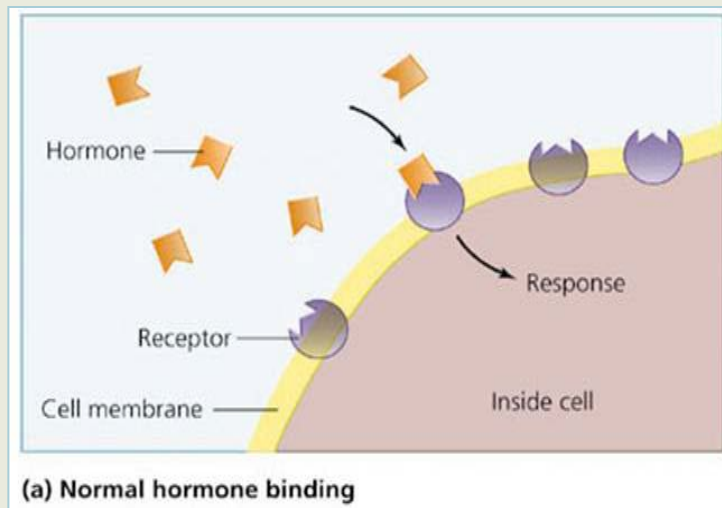
Overview of Health Effects Associated with Perfluoroalkyl Substances



Courtney Carignan, Ph.D.
Testing for Pease Community Meeting
May 17, 2016

Endocrine Disrupting Chemicals (EDCs)

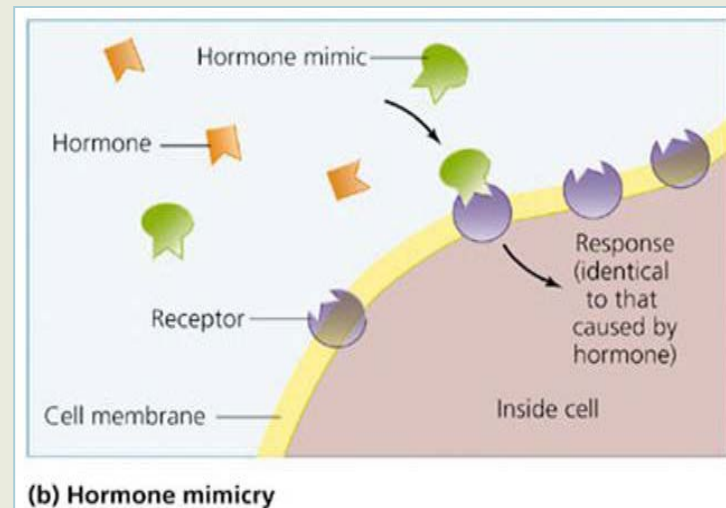
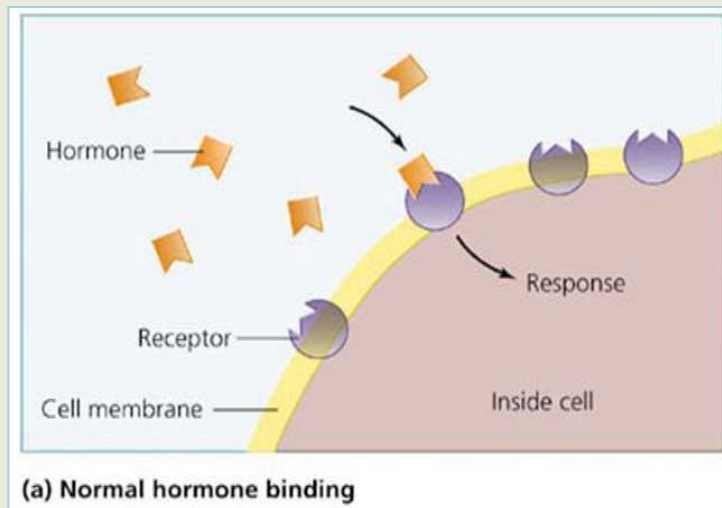
The hundreds or more exogenous chemical(s), or mixtures of chemicals, that **interfere with any aspect of hormone action.**



Estrogen action, Androgen action, Thyroid hormone

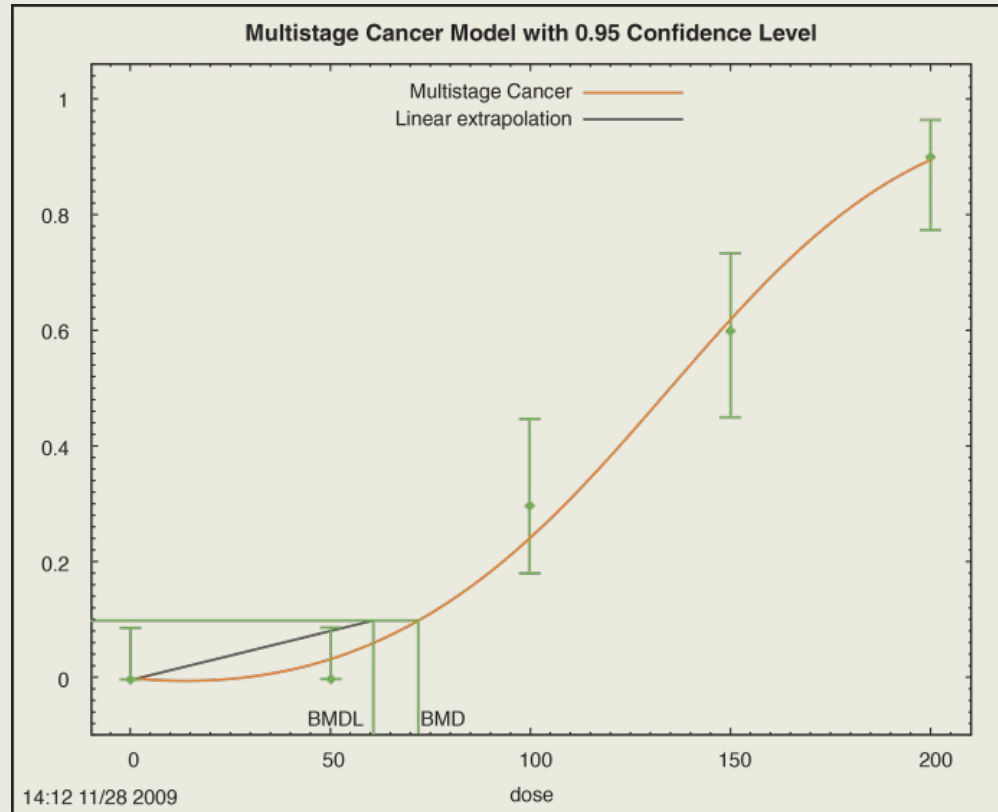
Endocrine Disrupting Chemicals (EDCs)

- Can act at low levels in the body
- Can act in sensitive time windows of development



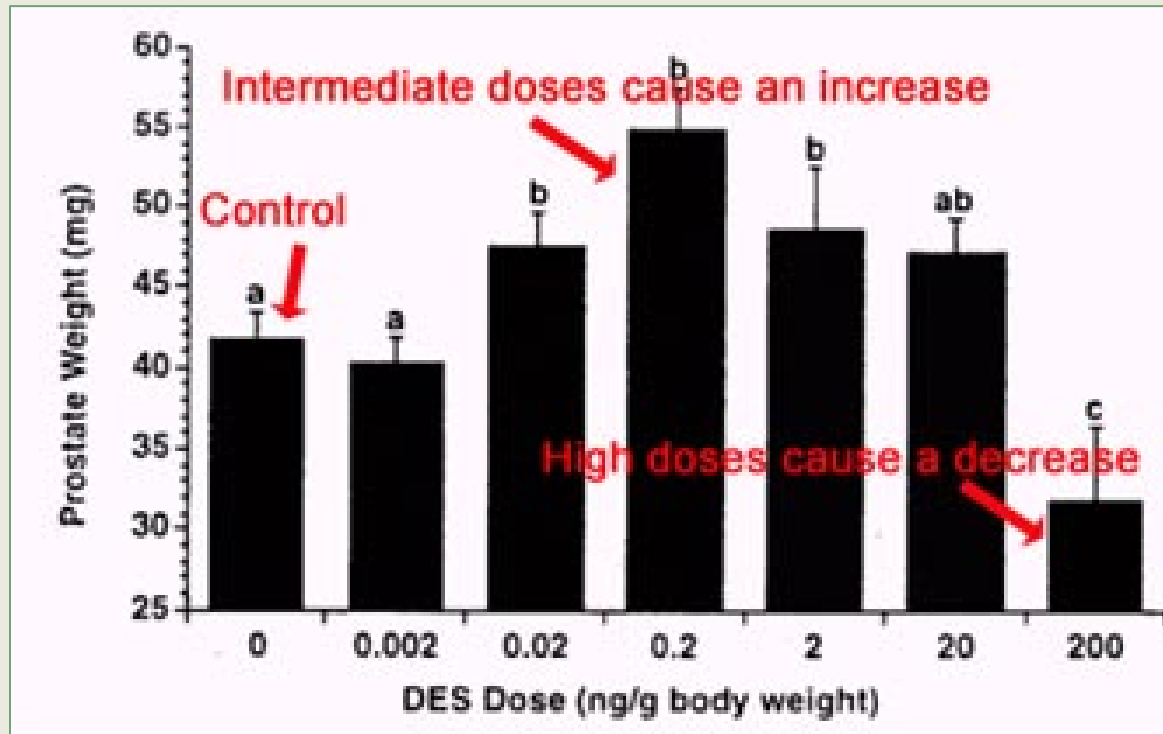
Estrogen action, Androgen action, Thyroid hormone

Traditional Toxicology



Assumes that relationship between dose and health outcome goes from low to high

Can act at low levels in the body



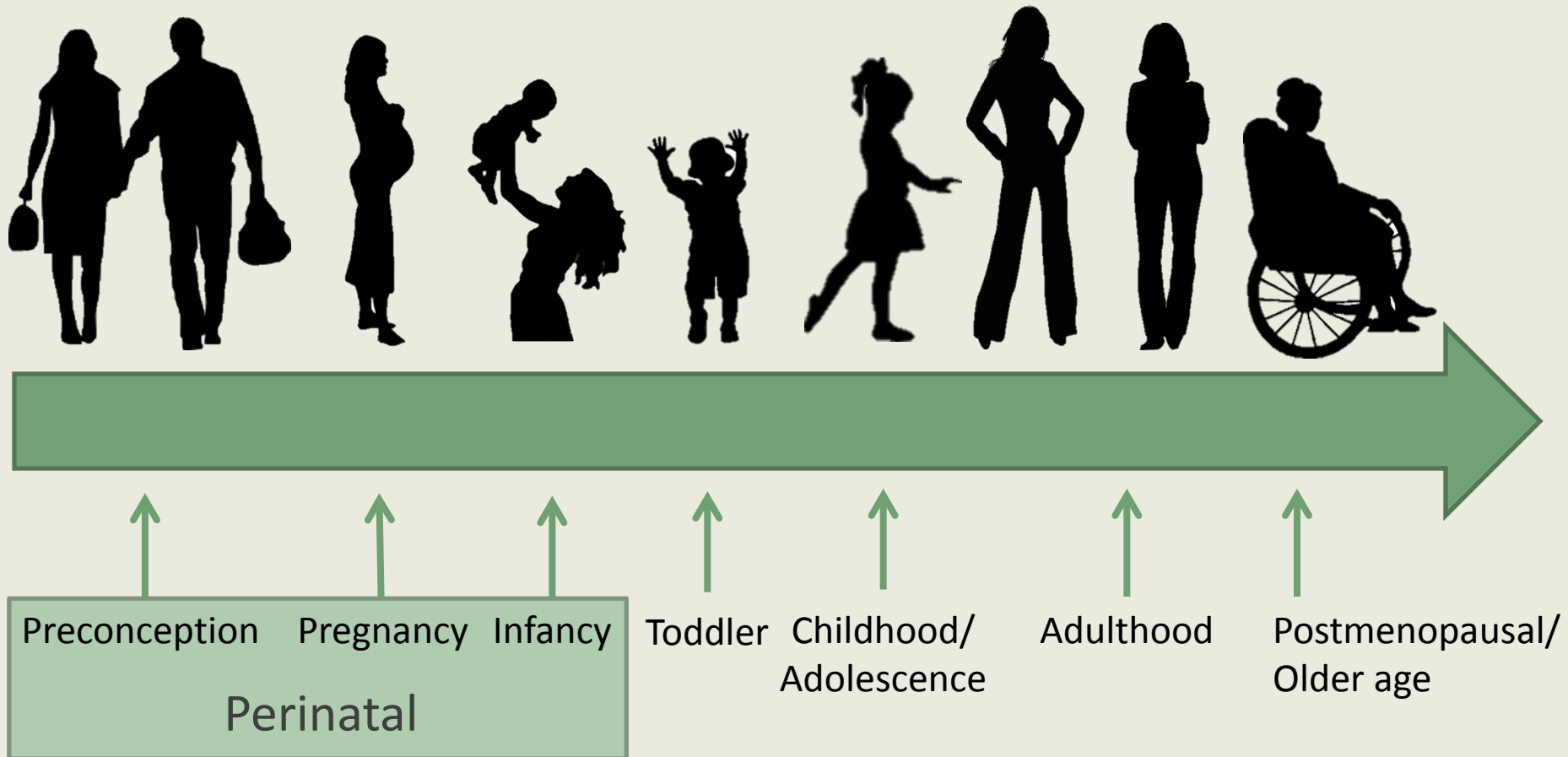
Vom Saal et al. 1997

With EDCs, greater effects can be found at an intermediate dose

Must keep in mind when interpreting study findings,

This change in paradigm has been difficult for regulatory policies to adapt to 5

Act at sensitive windows of development



Timing of exposure is important when designing and interpreting health studies

Evidence that EDC exposure can impact

- Fertility & Reproduction
- Neurodevelopment
- Neuroendocrine system
- Obesity & diabetes
- Hormone-sensitive cancers

EDCs are in many products

Because they are not captured by our regulatory framework, not because scientists agree they're safe

Personal care products



Consumer products



Canned foods

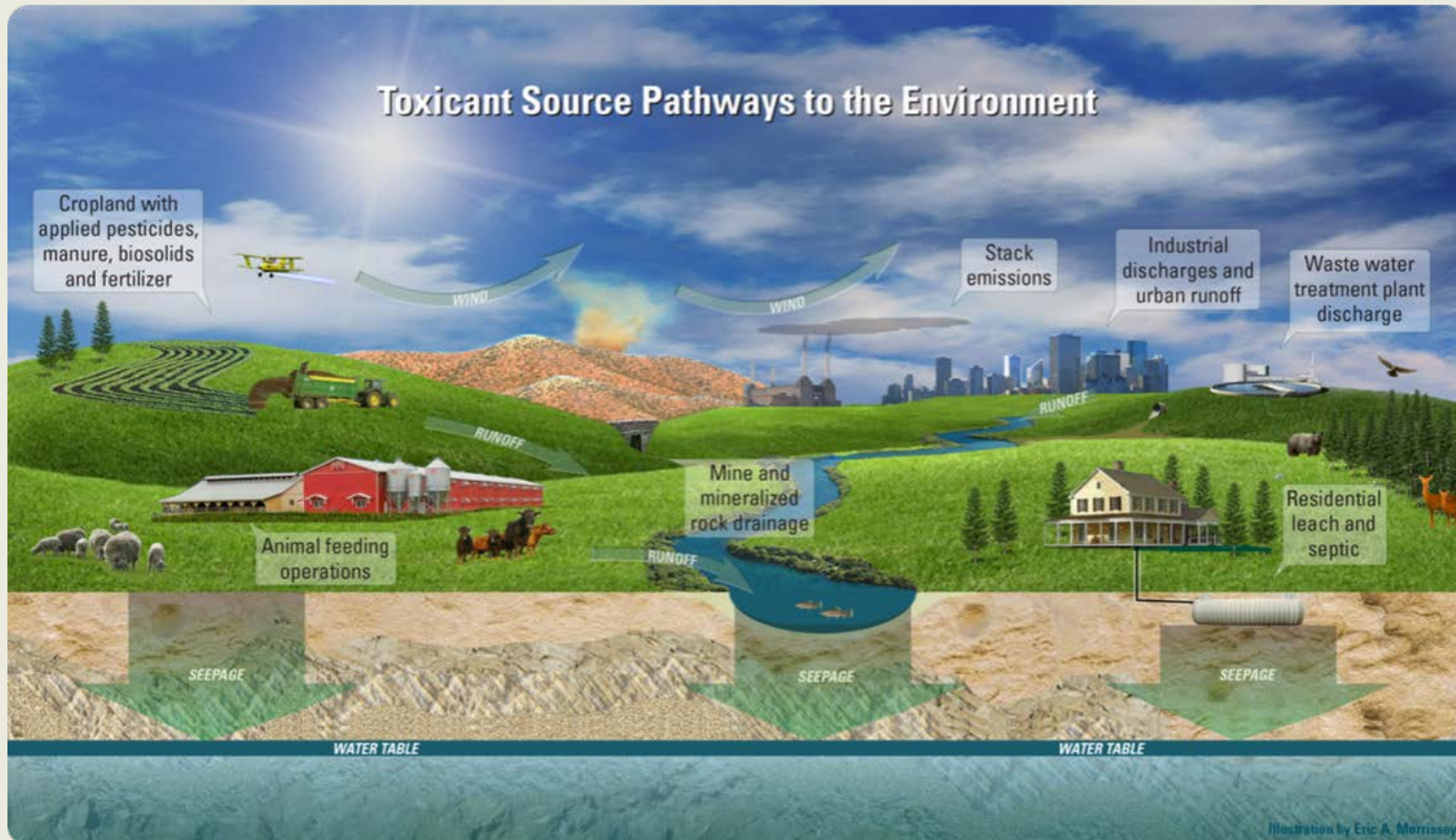


Food packaging

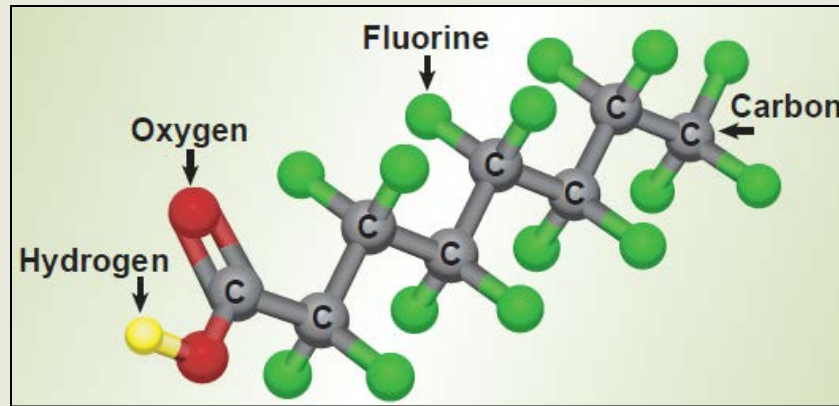


EDCs are in food and drinking water

Which do have some protections



Perfluorinated chemicals (PFCs)



- Also known as perfluoroalkyl substances (PFAS)
- One side of the chemical likes water, the other repels water
- C-F bond is very strong – does not break down easily: can persist in the environment for geologic time
- These properties are what makes it useful and also difficult for the body to excrete; it recirculates in the blood stream for years

Most Health Data is on PFOA

Standard PFC Serum Panel



PFOA



PFOS

PFHxS

PFUA

PFOSA

PFNA

PFDeA

Me-PFOSA-AcOH₂

Et-PFOSA-AcOH

PFCs in AFFF

6:2 FTS $C_8F_{15}H_4SO_3^-$

PFOSA $C_8F_{17}SO_3NH^-$

PFBS $C_4F_9SO_3^-$

PFHxS $C_6F_{13}H_4SO_3^-$

PFHpS $C_7F_{15}SO_3^-$

PFOS $C_8F_{17}SO_3^-$

PFDCS $C_{10}F_{21}SO_3^-$

PFBA $C_4F_9COO^-$

PFPeA $C_5F_{11}COO^-$

PFHxA $C_6F_{13}COO^-$

PFHpA $C_7F_{15}COO^-$

PFOA $C_8F_{17}COO^-$

PFNA $C_9F_{19}COO^-$

PFDCa $C_{10}F_{21}COO^-$

Precautious Approach

1. Assume that health effects found for one PFC could potentially apply to another
2. Continue to study health effects from cumulative exposures to mixtures of PFCs

Human Health Studies

Summarize and interpret findings:

1. C8 Health Study
2. Faroese
3. Other studies

Not comprehensive of all the literature, intent is to provide a frame of reference

C8 Health Study

- Established as part of DuPont lawsuit settlement to determine probable links between PFOA and various disease conditions
- Enrolled seventy thousand residents near Parkersburg, West Virginia
- Got blood samples, residential histories and questionnaire results
- Confirmed health conditions using medical records
- Published results in scientific journals
- Made determinations of whether there was a 'Probable Link' (more likely than not)

Probable links

- Kidney cancer
- Testicular cancer
- High cholesterol
- Thyroid disease
- Ulcerative colitis
- Pre-eclampsia (high blood pressure) in pregnancy

C8 Science Panel Website:

<http://www.c8sciencepanel.org/publications.html>

Cancer Study

Even though the study was large, it was still statistically underpowered. Elevated odds ratios (odds of developing a given cancer) are highlighted in green, although not always statistically significant.

Cancer	Low	Medium	High	Very High
Brain	1.5 (0.8, 2.7)	1.8 (1.1, 3.2)	0.6 (0.2, 1.6)	—
Female breast	0.9 (0.7, 1.2)	1.1 (0.8, 1.5)	0.7 (0.5, 1.0)	1.4 (0.9, 2.3)
* Kidney	0.8 (0.4, 1.5)	1.2 (0.7, 2.0)	2.0 (1.3, 3.2)	2.0 (1.0, 3.9)
Non-Hodgkin lymphoma	1.0 (0.6, 1.6)	1.5 (1.0, 2.2)	1.1 (0.7, 1.9)	1.8 (1.0, 3.4)
Ovary	0.5 (0.2, 1.4)	1.4 (0.7, 2.7)	1.4 (0.7, 2.9)	2.1 (0.8, 5.5)
Prostate	1.1 (0.8, 1.5)	0.8 (0.6, 1.0)	0.8 (0.5, 1.1)	1.5 (0.9, 2.5)
* Testis	0.2 (0.0, 1.6)	0.6 (0.2, 2.2)	0.3 (0.0, 2.7)	2.8 (0.8, 9.2)

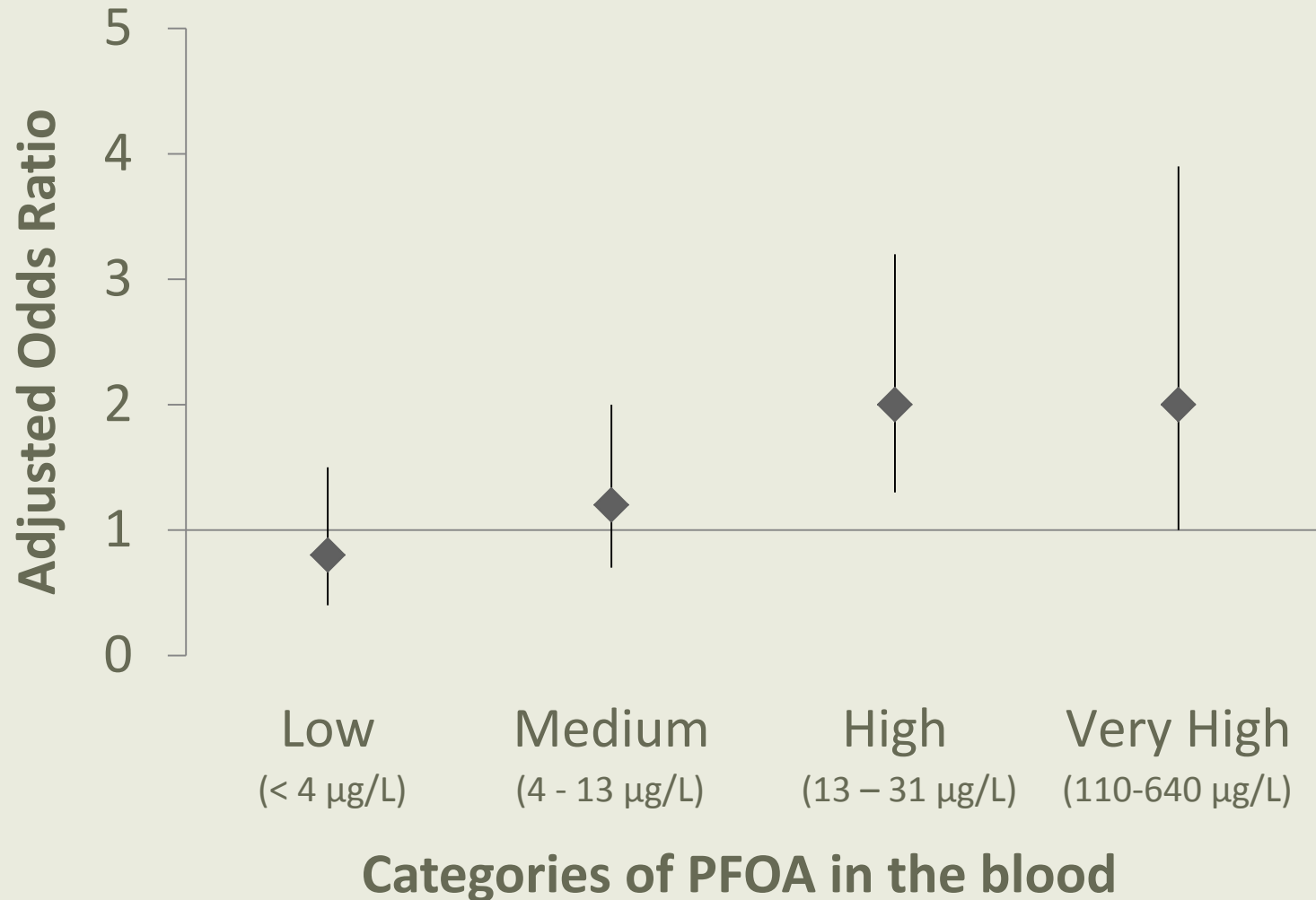
* C8 Science panel made determination of probable link

Adapted from Vieira et al. 2013

Cancer Study

- Other studies have indicated associations with cancers of the ovary, prostate and pancreas
- Other cancers that no associations were found with PFOA include bladder, brain, cervix, colon, leukemia, liver, lung, melanoma, multiple myeloma, pancreas, thyroid, uterus
- More research is needed on PFCs and cancer

Conceptualizing Kidney Cancer



Conceptualizing Kidney Cancer

- Those with high or very high exposure had doubled odds of developing kidney cancer compared to the reference group ('Unexposed'), considering a 10 year latency in a population with long term (often lifetime) exposure to PFCs in drinking water
- Lines indicate the range of statistical uncertainty around the odds ratio.

Conceptualizing Kidney Cancer

Health studies can only be interpreted on a population basis, and do not extrapolate to individual risk. The following points are for conceptual purposes:

- According to the American Cancer Society the lifetime risk of developing cancer is 1 in 63
- This rate is already quite high and believed to have an environmental influence
- A doubling in lifetime risk would be approximately 1 in 30
- Personal risk is influenced by many factors such as duration of exposure, genetic susceptibility, other environmental exposures, diet, exercise, ect.

Neurodevelopment

Increase in prevalence of ADHD with increasing prenatal PFHxS exposure (Stein and Savitz 2011)



Faroes study

- Followed children born to mothers on the Faroe Islands off Denmark; original concerns were PCBs and mercury
- Higher levels of PFCs were associated with declines in antibody concentrations at age 7
- Associations were stronger than for other chemicals studied in this population
- PFC blood levels in Faroes are similar to Pease population
- Findings for PFCs were much stronger than for PCBs (a well studied legacy contaminant)

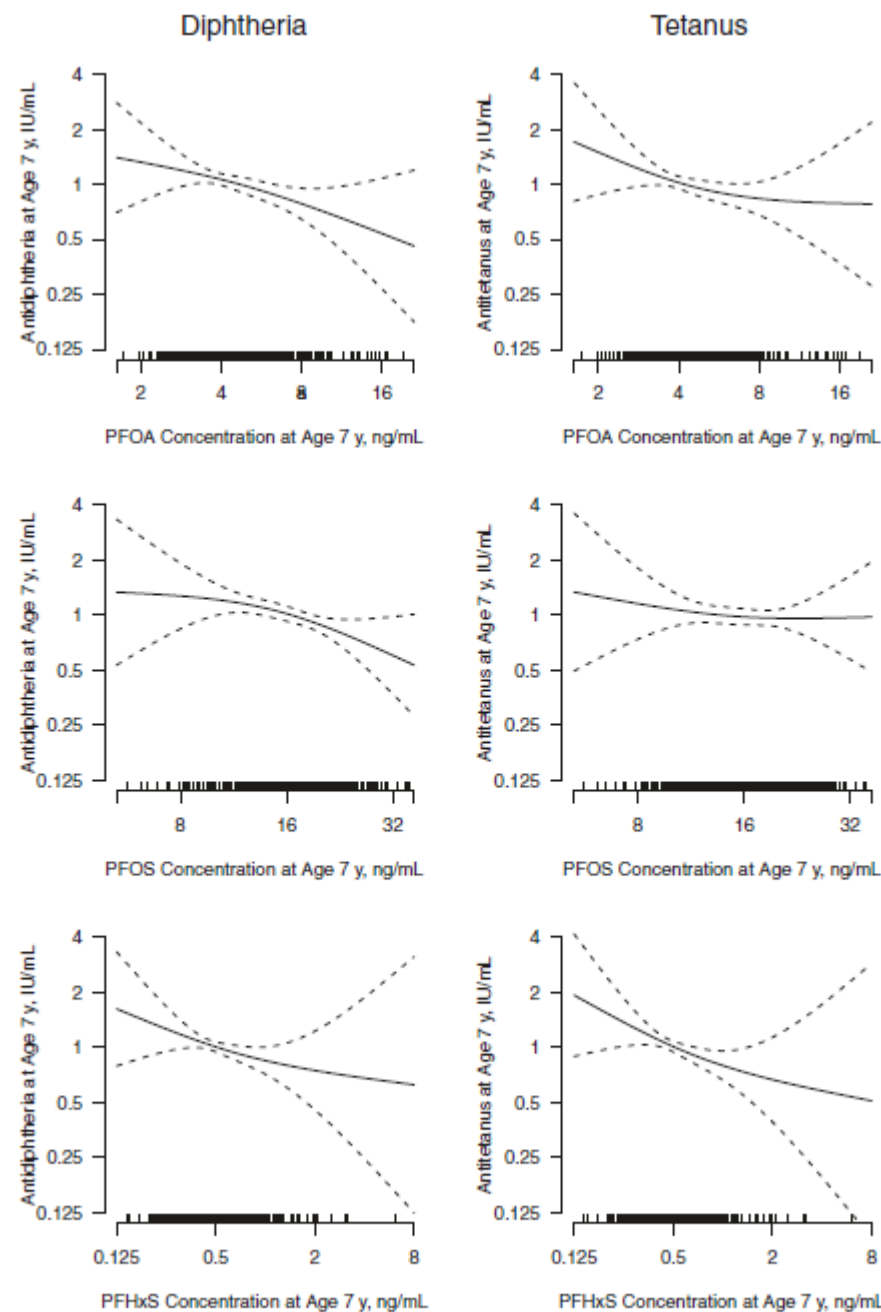


Fig. 3 Associations between PFAS and antibody concentrations at age 7 years. Dose-response functions are modeled by generalized additive models with cubic smoothing spline with 3 degrees of freedom, adjusted for age, sex, and booster vaccination type. The dashed lines indicate the 95 % confidence intervals. The spikes on the horizontal line indicate individual observations

Faroes study

- For the anti-tetanus antibody, PFHxS showed the strongest association with a decrease by 22.3% for a doubling in the exposure. Associations were approximately linear.
- A 2 fold increase in the sum of PFCs was associated with a 50% decrease in antibody concentration.
- Findings suggest cumulative effects of PFCs on immune function.
- Clinically protective level for antibodies is 0.1 IU/mL
- Used as a marker of immune function, clinical relevance still being researched

Other studies of immune function

- Fetal exposure: Decrease in immune responses and increased frequencies of common cold and gastroenteritis (Granum et al. 2013)
- C8 Adults: Decreased immune response to influenza vaccine and an increased risk of not attaining the antibody threshold considered to offer long term protection (Looker et al. 2013)

Other Health Effects

- Fetal exposure:
 - Male fertility (Toft et al. 2012, Vested et al. 2013))
 - Delayed puberty (~100 days)
 - Mammary gland tumors and altered breast development (animal studies)
- Adult exposure and female fertility (increased time to pregnancy and increased odds of infertility, but not miscarriage, Valez et al. 2015)
- Abnormal liver enzymes

Research is ongoing

- Studies to determine how the various PFCs of different chain lengths are distributed throughout the body and excreted over time, known as toxicokinetic studies, are being conducted for PFBS, PFDA, PFHxA, PFHxS, PFOA, PFOS, and 8:2 FTOH in male and female young adult rats.
- Short-term, 28-day toxicity studies are being conducted for PFBS, PFDA, PFHxA, PFHxS, PFNA, PFOA, and PFOS in male and female young adult rats.
- A 28-day immunotoxicity study is also being conducted for PFDA in female rats.
- A two-year study is being conducted on PFOA, to evaluate its potential to cause cancer and other toxic effects. This study evaluates the effect of exposure to PFOA, beginning in the womb and continuing through adulthood, in male and female rats.
- The NTP is also planning to conduct studies in rats and mice to determine the effects of PFCs during pregnancy and on early life of the offspring, including puberty.

- National Institute of Environmental Health Sciences
- Ronneby, Sweeden
 - High exposure to PFOS via groundwater contaminated with AFFF
 - Large study ongoing
 - Including pregnancy cohort

Known health effects provide opportunity for intervention

- Standard primary care screenings can include:
 - Cholesterol
 - Cancer (kidney, testicular, ect)
 - Thyroid hormone
- See the Testing for Pease fact sheet for a full list of medical monitoring suggestions from multiple sources to be used in discussion with your physician
- Some studies have found that the stress of learning this type of information can also impact wellness. This may also be something to discuss with your physician and could be another source of intervention for individuals and as a community.



How to talk to your doctor about blood tests



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C8 Medical Monitoring Program

- Focused on diseases identified by C8 Health studies as “probably linked” to PFOA
 - Pregnancy-induced hypertension, kidney cancer, testicular cancer, thyroid disease, ulcerative colitis, high cholesterol
- See www.c-8medicalmonitoringprogram.com, with specific screening tests prepared by a medical panel for discussion with your doctor
 - Screening recommendations by age <15, 15-18, 18-19, 20 or older, pregnant females



Vermont Dept. of Health

- VT Dept. of Health April 21, 2016 “PFOA Information for Health Professionals” refers people to C8 Health Project and EPA draft health effects document.
 - Also notes “consistent findings” for increased serum lipids, decreased birth weight, increased uric acid levels, alteration of liver enzymes
 - See healthvermont.gov/enviro/PFOA_c8_health_project_summary.pdf



New York Dept. of Health

- Slow to respond to Hoosick Falls PFOA drinking water contamination
 - Initial advisory said PFOA “does not constitute an immediate health hazard”
- Subsequent water filtration and blood testing programs are now underway
- Said setting PFOA water level at 100 ppt was “out of an abundance of caution”





False alarm vs. false reassurance: finding the balance

- Problem: Differing views of PFOS/PFOA hazards and health effects
 - CDC/ATSDR, NHDHHS, VTDoH
 - Independent scientists, C8 Health Study
- Problem: Emerging science and on-going studies mean changing recommendations
 - Example of immune effects in children
- Problem: Persistence in humans and the environment



Recommendations

- Stay informed, use latest fact sheets
 - See ATSDR Pease International Tradeport Site
 - www.atsdr.cdc.gov/sites/pease/additional_resources.html
- Provide physician and health care staff with facts and concerns
- Express appropriate alarm but accept appropriate reassurance if it is based on medical history and clinical compassion

