The California Regional Exposure (CARE) Study 2018 – 2020

CDPH
California Department of Public Health

Acknowledgements

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Notice of errata, 2025: Typographical errors and broken hyperlinks have been addressed. Data tables in Appendices D – J have been corrected.

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BIOMONITORING CALIFORNIA
MEASURING CHEMICALS IN CALIFORNIANS

The California Environmental Contaminant Biomonitoring Program was established through legislation in 2006 by Senate Bill 1379 (Perata and Ortiz, Chapter 599, Statutes of 2006) and codified in Health & Safety Code Sections 105440 et seq. Also known as Biomonitoring California, the Program is a collaborative effort involving the California Department of Public Health (CDPH), the Office of Environmental Health Hazard Assessment (OEHHA), and the Department of Toxic Substances Control (DTSC).

Acronyms and abbreviations

1-NP: 1-Nitropyrene
6-OHNP: 6-Hydroxy-1-nitropyrene
8-OHNP: 8-Hydroxy-1-nitropyrene
ACS: American Community Survey
BP-3: Benzophenone-3
BPA: Bisphenol A
BPF: Bisphenol F
BPS: Bisphenol S
CARE Study: California Regional Exposure Study
CDC: U.S. Centers for Disease Control and Prevention
CDPH: California Department of Public Health
dL: Deciliter
DTSC: Department of Toxic Substances Control
g: Gram
GED: General Educational Development
GM: Geometric mean
K: Kilo, or thousand
L: Liter
LOC: Level of concern
µg: Microgram
N: Number, e.g., of participants
NHANES: National Health and Nutrition Examination Survey
OEHHA: Office of Environmental Health Hazard Assessment
Et-PFOSA-AcOH: 2-(N-Ethyl-perfluorooctane sulfonamido) acetic acid
Me-PFOSA-AcOH: 2-(N-Methyl-perfluorooctane sulfonamido) acetic acid
PFASs: Perfluoroalkyl and polyfluoroalkyl substances
PFBS: Perfluorobutane sulfonic acid
PFDA: Perfluorodecanoic acid
PFDoA: Perfluorododecanoic acid
PFHpA: Perfluoroheptanoic acid
PFHxS: Perfluorohexane sulfonic acid
PFNA: Perfluorononanoic acid
PFOA: Perfluorooctanoic acid
PFOS: Perfluorooctane sulfonic acid
PFOSA: Perfluorooctane sulfonamide
PFUnDA: Perfluoroundecanoic acid

Table of contents

Executive summary

Biomonitoring is the measurement of chemicals in human biological samples, such as blood and urine. It can provide an overall measure of exposure to certain chemicals found in air, water, soil, dust, food, and consumer products. Biomonitoring can help track the types and amounts of chemicals that get into people from all sources combined. These chemicals may be natural, such as lead and arsenic, or synthetic, like perfluoroalkyl and polyfluoroalkyl substances (PFASs), which are used to make products resistant to oil, stains, grease, and water. Some of these chemicals have been associated with harmful health effects, including cancer, respiratory disease, decreased fertility, and birth defects.

Californians may have different patterns of chemical exposure compared with people in other parts of the country because of our geography, climate, industries, demographics, and other factors. Different regions of California may also have different patterns of exposure from each other. The health consequences of environmental pollution are felt across the California population, particularly in communities already impacted by poverty, stress, and other socioeconomic factors. Reducing chemical exposures is an essential component of disease prevention, and biomonitoring is critical to this effort. Recognizing this need, the California legislature founded Biomonitoring California to conduct statewide surveys for the purpose of examining trends in chemical exposures over time; identifying highly exposed communities; and determining the effectiveness of environmental policies.

In accordance with the program's mandate, the California Regional Exposure (CARE) Study was designed to assess the extent to which people across the state are exposed to selected environmental chemicals, and to determine sources of exposure. We developed a regional approach, dividing California into eight regions, with the initial goal of reaching one region per year. This report covers the three regions that have been studied: CARE-LA (Los Angeles County; 2018); CARE-2 (Riverside, San Bernardino, Imperial, Mono, and Inyo counties; 2019) and CARE-3 (San Diego and Orange counties; 2020).

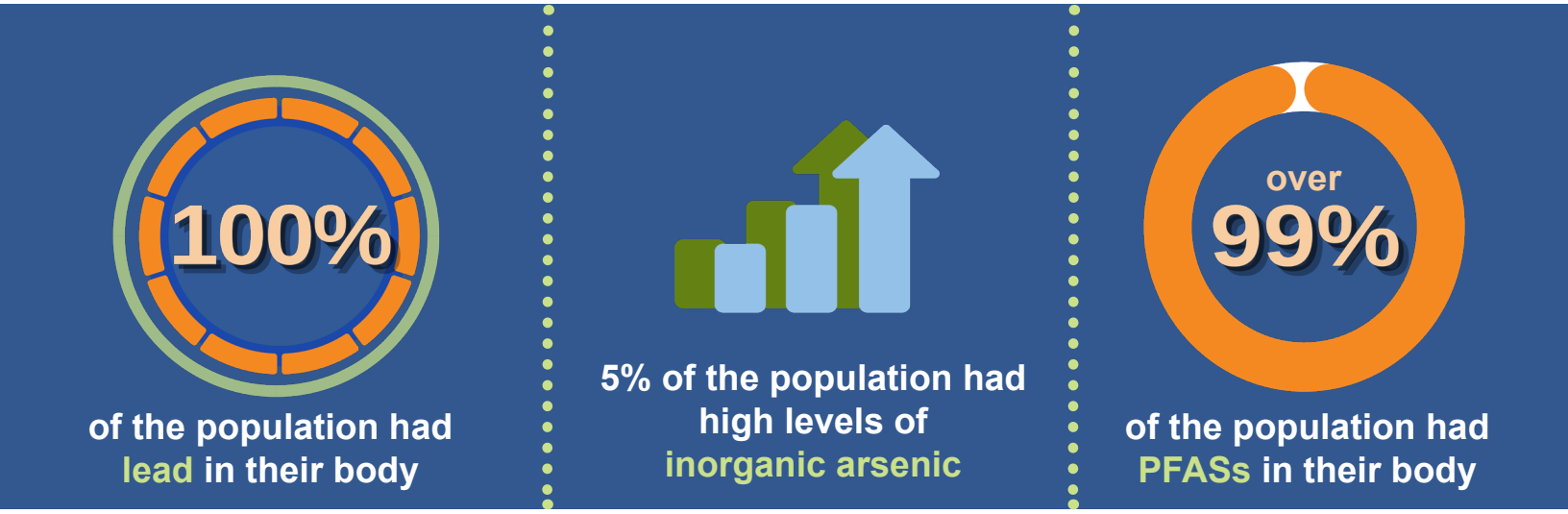
The chemicals included in the CARE Study were chosen due to known or suspected links to health outcomes, as well as widespread opportunities for exposure. We measured PFASs and metals, including arsenic, lead, and mercury in the three regions of the CARE Study covered by this report. We also measured environmental phenols and indicators of exposure to diesel exhaust in a subset of participants in these regions.

This report includes information on study design and methodology along with biomonitoring results by region and stratified by demographic factors. The findings provide an important look into Californians' exposures to several chemical groups and how they differ by sub-population. Key findings for CARE-LA (430 participants) and CARE-2 (359 participants) are summarized on page 6, followed by the full report. Detailed results for all three regions are presented in the Results section and in the Appendices.

Key findings: CARE-LA and CARE-2

Chemicals were found in most CARE Study participants, sometimes at levels high enough to warrant individual follow-up.

- 59 CARE-LA and 33 CARE-2 participants had elevated **arsenic** and/or **mercury** levels.



- **PFASs** were detected in all CARE-LA participants and all but one CARE-2 participants. On average, CARE participants had seven **PFASs** measured in their blood.

California is different from the nation in some ways.

HIGHER

In CARE-LA:

- **Arsenic** levels were 52% higher
- **Blood mercury** levels were 35% higher

LOWER

Lead levels were 23% lower in CARE-2.

On average, **PFOS, PFOA, PFNA, and PFHxS** levels were
- 35% lower for CARE-LA
- 37% lower for CARE-2

Chemical exposures often differ by race/ethnicity.

HIGHER

Black participants had 45% higher **blood cadmium** levels than White participants in CARE-LA.

Asian participants had higher levels than White participants:

Arsenic levels:
- 136% higher in CARE-LA
- 114% higher in CARE-2

Blood mercury levels:
- 156% higher in CARE-LA
- 135% higher in CARE-2

LOWER

Some **PFAS** levels were lower among **Hispanic/Latino participants** compared with White participants in CARE-LA.

Chemical exposures can also differ by other socio-demographic factors.

Blood lead levels increased with age in both CARE regions.

PFAS levels among men were up to 72% higher than women in CARE-LA and up to 198% higher in CARE-2.

CARE-LA participants who had education beyond high school had **PFOA** levels up to 61% higher than those who did not complete high school.

Introduction

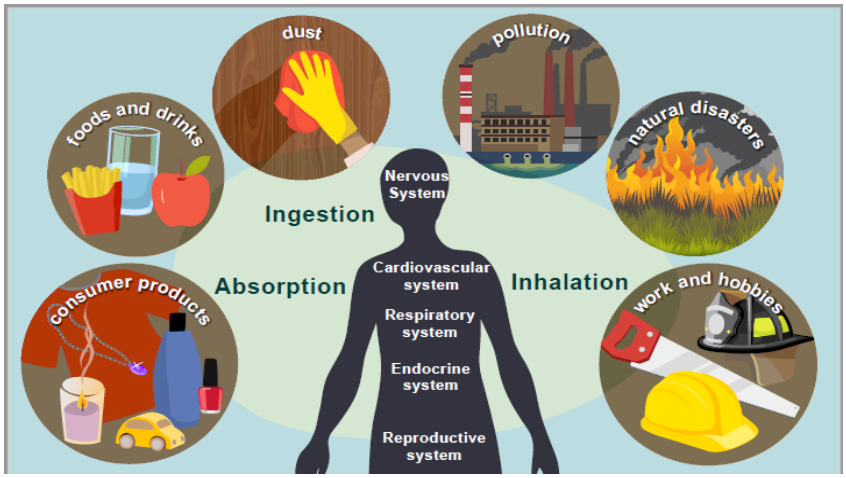
What is biomonitoring?

Biomonitoring is the measurement of chemicals or their metabolites in human biological samples, such as blood and urine. A relatively new field, biomonitoring is uniquely able to identify and quantify chemical exposures in a population. Biomonitoring can help track the types and amounts of chemicals that get into people from all sources combined. It can provide an overall measure of exposure to certain chemicals found in air, water, soil, dust, food, and consumer products. One example of biomonitoring is the widespread testing of children's blood for lead.

Importance of biomonitoring

Every day, people are exposed to thousands of chemicals in their environment, home, and workplace, as well as in food, drinking water, and common household items like furniture, clothing, and personal care products.

These chemicals may be natural, such as lead and arsenic, or synthetic, like perfluoroalkyl and polyfluoroalkyl substances (PFASs), which are used to make products resistant to oil, stains, grease, and water.



Sources of human exposure to environmental chemicals

Some of these chemicals have been associated with harmful effects, including cancer, respiratory disease, birth defects, and decreased fertility.

Understanding Chemical Exposures

We can measure chemicals in blood and urine samples to find out how much exposure people have had, but biomonitoring does not tell us how they were exposed to those chemicals.

We use surveys that ask participants about what they eat and drink; the products they use; and where they live, work, and recreate to try to understand how they might have been exposed to the chemicals we detected in their biological samples.

Californians may have different patterns of exposure compared with people in other parts of the country because of our geography, climate, industries, demographics, and other factors. Different regions of California may also have different patterns of exposure from each other. By measuring chemicals in many people across the state and over time, we can learn whether some populations are more exposed to chemicals than others, and how exposures to certain chemicals are changing.

The health consequences of environmental contaminants are felt across the California population, especially in communities already impacted by poverty, stress, and other socioeconomic factors. Infants and children are particularly vulnerable to chemical exposures because of their sensitive period of development and certain behaviors, like frequent hand-to-mouth activity. Reducing chemical exposures over the course of our lives is an essential component of disease prevention, and biomonitoring is critical to this effort.

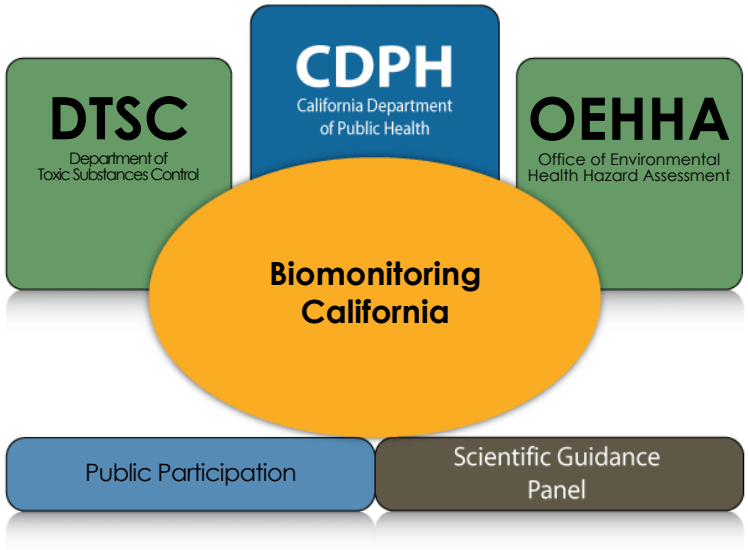
It is important to note that the detection of a chemical in a person's blood or urine indicates exposure and does not in itself mean that the chemical will cause illness, disease, or other health effects. Some chemicals, such as lead and mercury, have been well studied, but for most chemicals that we biomonitor, more research is needed to evaluate the potential health risks of exposure and determine the levels of exposure at which risk increases. Data from biomonitoring studies can help California researchers understand how chemical exposures might affect health. This data can also help inform policies to reduce chemical exposures in California and protect our health and the environment.

About the Program

The California Environmental Contaminant Biomonitoring Program (the Program) was established through legislation in 2006 by Senate Bill 1379 (Perata and Ortiz, Chapter 599, Statutes of 2006) and codified in Health & Safety Code Sections 105440 et seq.

Also known as Biomonitoring California, the Program is a collaborative effort involving the California Department of Public Health (CDPH), the Office of Environmental Health Hazard Assessment (OEHHA), and the Department of Toxic Substances Control (DTSC). It receives technical advice and peer review from a Scientific Guidance Panel and input from the public. The principal mandated goals of the Program are to:

- Monitor levels and establish trends of specific environmental chemicals in representative statewide samples of Californians
- Help assess the effectiveness of existing public health and environmental programs in reducing chemical exposures
- Conduct community-focused surveys as feasible



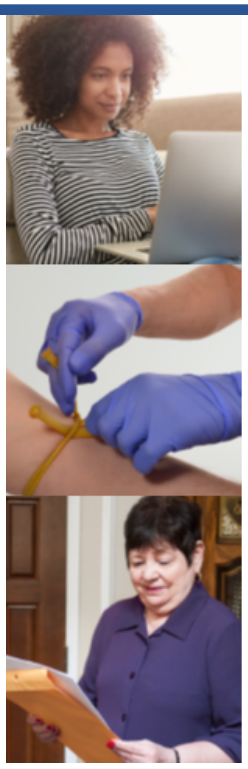
Biomonitoring requires in-person interactions for the collection of urine and blood, which is demanding of staff and participant time. Since the resulting participation rates can be low, study designs that utilize convenience sampling rather than randomized probabilistic sampling are sometimes used. Including design elements to broaden the study's reach and involve a diverse population, such as described in this report, is key to improving the representativeness and utility of the findings.

Biomonitoring California is one of a small number of state biomonitoring programs in the U.S. These programs have been developed in recognition that each state has unique histories, demographics, and industries, all of which may impact exposures. Data from these programs complement the biomonitoring data collected at a nationwide level by the National Health and Nutrition Examination Survey (NHANES) program of the Centers for Disease Control and Prevention (CDC).

California and other states use national data to understand the similarities and differences between their states and the nation as a whole. Similarly, statewide biomonitoring surveillance like the CARE Study generates baseline data as a benchmark for other biomonitoring studies in the state, contributing to our understanding of the range of chemical exposures among Californians.

What happens when someone participates in a biomonitoring study?

- Researchers explain the goals of the study and which chemicals will be measured. If the person agrees to participate, they sign a consent form.
- The participant answers questions about their food and beverage consumption, use of personal care and other products, jobs, and hobbies.
- Blood and/or urine samples are collected and sent to the laboratory, which tests the samples for the specific chemicals being studied.
- If any chemical is above the established level of concern, the participant is notified and provided with personalized follow-up.
- Participants can opt to receive their individual results. Results are confidential and are not sent to employers, health insurance companies, or anyone else without the participant's consent.
- Results packets also contain fact sheets on each chemical or chemical group explaining where the chemical is found; what the potential health effects are; and ways to possibly reduce exposure.



The California Regional Exposure (CARE) Study

The CARE Study was designed to assess chemical exposures across the state. Because of the challenges of collecting biological samples across great distances, we divided California into eight regions, with the goal of studying one or more regions per year.

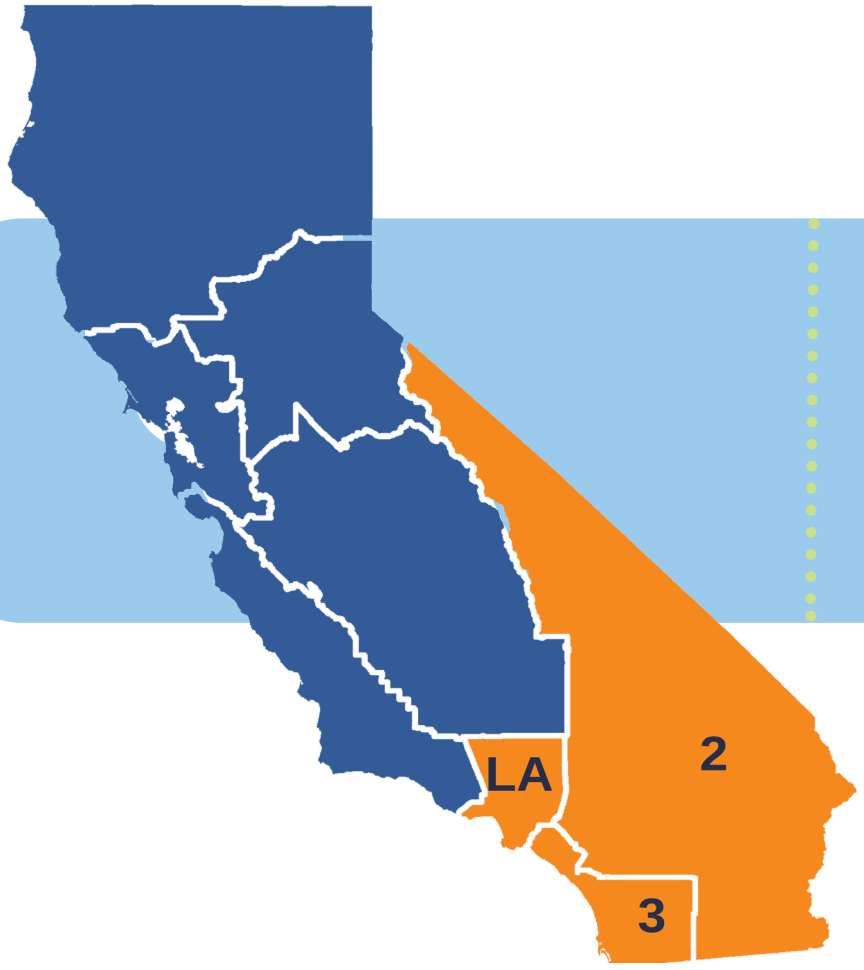
This report covers three regions. The CARE Study was launched in 2018 in Los Angeles County (CARE-LA). In 2019, we conducted CARE-2 in the Eastern/ Southeastern Counties (Riverside, San Bernardino, Imperial, Mono, and Inyo). In early 2020, we began enrollment and sample collection for CARE-3 in San Diego and Orange counties but ended early due to the COVID-19 emergency.

Another goal of the CARE Study was to engage with local stakeholders in each region, including community groups and local health officials, in order to raise awareness of the utility of biomonitoring and exchange information on local or regional chemical exposure issues and concerns. This engagement has enabled the Program to rely on local stakeholders to assist with recruitment efforts and dissemination of study findings, as well as build their capacity around environmental exposures in a biomonitoring context.

Through the CARE Study, the Program has created lasting partnerships that will help build local capacity and increase overall awareness of environmental health issues in the state.

For each region, the study goals were to:

- Enroll between 300-500 adults representing different races and ethnicities, income levels, and communities within the study area
- Collect information from participants to identify potential exposure sources
- Collect blood and urine samples
- Measure levels of selected chemicals
- Return individual results to participants, with fact sheets describing the chemicals measured, including where they are found; what the potential health concerns are; and ways to possibly reduce exposures
- Hold public meetings to describe overall study findings
- Release summary results to the public through our website at: www.biomonitoring.ca.gov/explore-results



This report provides information about the levels of chemicals measured across three regions, with a focus on the two regions with full implementation: **CARE-LA** (430 participants) and **CARE-2** (359 participants).

Chemicals measured in the CARE Study

People are exposed to thousands of chemicals in the course of their lives. Prior Biomonitoring California studies have detected a wide range of chemicals of concern in virtually all participants. For the CARE Study, we primarily focused on two chemical groups: metals and perfluoroalkyl and polyfluoroalkyl substances (PFASs). These chemicals have known and/or suspected links to adverse health outcomes, and there are widespread opportunities for exposures to both chemical groups across the state. In addition, we measured environmental phenols and metabolites of 1-nitropyrene, an indicator of exposure to diesel exhaust, in a subset of participants. For more information on where the chemicals measured in the CARE Study are found, their potential health effects, and how individuals might reduce their exposures, refer to Appendix A.

Metals

Metals are naturally occurring elements found in the earth's crust and used in many industries and products. People can be exposed to metals through food and drinking water; soil and dust in and around homes; and commonplace items like plumbing fixtures, paint, batteries, and jewelry. Exposures to metals are linked to a range of potential health effects, including cancer; cardiovascular disease; toxicity to the respiratory system, nervous system, and kidneys; and harm to the developing infant and child. Our laboratory measures the following metals:

Metals in blood:

- Cadmium
- Lead
- Manganese
- Mercury

Metals in urine:

- Antimony
- Arsenic
- Cadmium
- Cobalt
- Manganese
- Mercury
- Molybdenum
- Thallium
- Uranium

Helpful or Harmful?

Some metals, like manganese, are essential nutrients but can be harmful in large amounts. Others, like arsenic, cadmium, lead, and mercury, can be harmful even at low levels.

Perfluoroalkyl and polyfluoroalkyl substances (PFASs)

PFASs are synthetic chemicals used to make products resistant to oil, stains, grease, and water. They are used in many products, including stain- or water-resistant fabric and carpets, grease-repellent take-out containers and fast-food wrappers, and some personal care products. PFASs are also used in fire-fighting foam and some industrial processes. Studies across the U.S. have found that many drinking water sources, including some in California, have been contaminated with PFASs. While there are thousands of PFASs in existence, the most well-studied PFASs have known or suspected health impacts, such as affecting the developing fetus and child; reducing fertility; increasing the risk of thyroid disease; interfering with the body's natural hormones and the immune system; and increasing cancer risk.

For the CARE Study, our laboratory measured the following 12 PFASs in serum, which is the liquid portion of blood:

- N-Ethyl-perfluorooctane sulfonamido acetic acid (Et-PFOSA-AcOH)
- N-Methyl-perfluorooctane sulfonamido acetic acid (Me-PFOSA-AcOH)
- Perfluorobutane sulfonic acid (PFBS)
- Perfluorodecanoic acid (PFDA)
- Perfluorododecanoic acid (PFDoA)
- Perfluoroheptanoic acid (PFHpA)
- Perfluorohexane sulfonic acid (PFHxS)
- Perfluorononanoic acid (PFNA)
- Perfluorooctane sulfonamide (PFOSA)
- Perfluorooctane sulfonic acid (PFOS)
- Perfluorooctanoic acid (PFOA)
- Perfluoroundecanoic acid (PFUnDA)

Additional chemicals

Environmental phenols are a broad class of chemicals with a common chemical structure that are used in many different materials. Some examples include bisphenol A (BPA), used in hard plastics, fabric adhesives, and some cash register receipts; bisphenol S (BPS) and bisphenol F (BPF), which are substituted for BPA in some uses; parabens, which are added as preservatives to many products; and benzophenone-3 (BP-3), which is a UV stabilizer and the active ingredient in many sunscreens. Many phenols affect the endocrine system.

Our laboratory measured the following chemicals in urine:

- Benzophenone-3 (BP-3)
- Bisphenol A (BPA)
- Bisphenol F (BPF)
- Bisphenol S (BPS)
- Parabens
  - Butyl paraben
  - Ethyl paraben
  - Methyl paraben
  - Propyl paraben
- Triclocarban[1]
- Triclosan

1-Nitropyrene (1-NP) is one of many chemicals found in diesel exhaust, which is produced by vehicles and other machinery that run on diesel fuel. Exposure to diesel exhaust is associated with cancer, asthma, and other serious health effects. We measured two metabolites of 1-NP, 6-hydroxy-1-nitropyrene (6-OHNP) and 8-hydroxy-1-nitropyrene (8-OHNP), in urine as biomarkers of exposure to diesel exhaust.

[1] Triclocarban is included in the environmental phenols group because of its similar chemical structure and usage in products.

Levels of concern (LOCs) and individual follow-up

All the chemicals measured in the CARE Study pose potential significant health concerns, but for most of them, we lack adequate scientific information to determine the health risks associated with specific levels found in people. While we do not have enough information to establish what levels could be considered "safe," the Program has adopted levels of concern (LOCs) for arsenic, cadmium, lead, and mercury, as there is sufficient evidence of the health impacts of elevated levels of these metals to warrant participant notification and education.

Participants whose levels exceeded an LOC received personalized follow-up, such as discussions to identify potential sources of their chemical exposures, and advice on ways they might reduce their exposures. In some cases, clinical follow-up was recommended, with technical assistance provided by the Program as needed. For more details on our program's LOC follow-up protocols, refer to the table below and Appendix B.

Table 1: Follow-up actions for elevated levels of metals in blood and urine

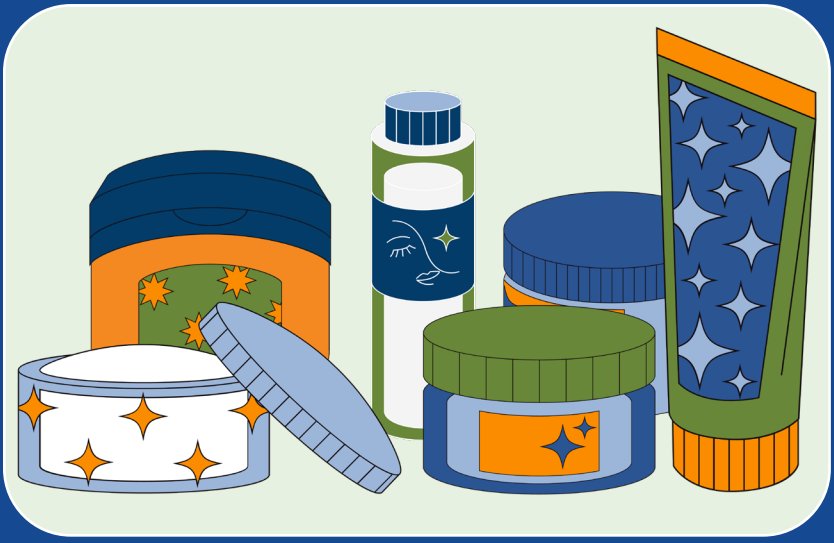
Blood metals	Blood levels that trigger follow-up	Notification letter	Phone contact that includes survey/discussion to identify possible exposure sources
Cadmium	≥ 5 µg/L	X	X
Lead	4.5 -< 9.5 µg/dL	X	X
Lead	≥ 9.5 µg/dL	Follow-up by the CDPH Occupational Lead Poisoning Prevention Program	Follow-up by the CDPH Occupational Lead Poisoning Prevention Program
Mercury	≥ 5.8 µg/L	X	X
Urine metals	**Urine levels that trigger follow-up**	**Notification letter**	**Phone contact that includes survey/discussion to identify possible exposure sources**
Total arsenic	≥ 50 µg/L	X	X
Inorganic arsenic	≥ 19.5 µg/L	X	X
Cadmium	> 3 µg/g creatinine	X	X
Mercury	≥ 10 µg/L	X	X

Case study: Mercury in skin cream

Mercury has been found in some skin creams made in other countries and sold in the United States, including over the internet. These creams are used to lighten age spots or remove wrinkles, freckles, acne, or other blemishes. Most people who use these creams do not realize that they contain mercury, which can poison them as well as household members who are not using the creams themselves. Some people have had serious health problems and have even been hospitalized after using these creams.

In CARE-2, we identified a study participant with an elevated level of mercury in her urine sample.

In accordance with our protocol, we discussed potential sources with her and discovered she had been using a suspect skin cream. She had also been experiencing symptoms of mercury poisoning, including hypertension, tremors, limb weakness, and memory loss. Testing of her skin cream revealed dangerous levels of mercury. With the participant's permission, we contacted her health care provider and recommended clinical follow-up, including further testing for mercury, and offered on-going technical assistance. We also provided resources developed by our Program and the Environmental Health Investigations Branch, including a health alert on mercury in skin creams. In addition, we recommended testing any children who may have come into contact with the participant or her skin cream to evaluate them for mercury exposures.



For more information on mercury in skin creams, including photographs of creams that have been purchased in California, refer to CDPH's List of Face Creams Containing Mercury.

Methods

The CARE Study recruitment and sampling methods were developed to enroll participants who reflected the demographic distribution of the regional populations. Eligibility was limited to adults who had lived in the region for at least the previous 12 months. The following is a brief description of methods used in the studies; more details on the study methods can be found in Appendix C.

We sought participation from a broad audience through a mass mailing, Craigslist, and professional and social networks, as well as targeted outreach for hard-to-reach communities. Potential participants could indicate interest by filling out a screening form online, over the phone, or in person. Eligible individuals were then selected in accordance with sampling goals and invited to participate. We increased the accessibility of the study by providing materials in different languages, such as Spanish and Chinese; offering appointments at a variety of times including weekends and evenings; and holding sample collection events at community centers around the regions, with an option of at-home appointments as needed.

After enrolling, participants completed a questionnaire addressing long-term or frequent environmental exposures, reproductive history, and additional demographics. At the sample collection appointments, participants completed an additional questionnaire related to recent short-term exposures; provided a urine sample; and had blood samples drawn by a licensed phlebotomist. All participants were evaluated for exposure to metals and PFASs. In addition, some participants' samples were evaluated for exposures to environmental phenols and 1-nitropyrene. Laboratory analyses were performed by the Environmental Health Laboratory at CDPH (metals and phenols); the Environmental Chemistry Laboratory at DTSC (PFASs); and the Simpson Laboratory at the University of Washington (1-nitropyrene metabolites).

For all chemicals in this report, we provide descriptive information including the geometric mean (a type of average) and the 50th and 95th percentiles. We applied weighting to the metals and PFAS data from CARE-LA and CARE-2 to make the data more representative of the regional populations and compensate for any impacts of under- or over-representation of different demographic characteristics. Unweighted data in this report should be viewed as representative of the participants rather than the underlying population. Descriptions found in the results section reference the weighted results, and both weighted and unweighted data are available in the Appendices.

For the metals that have specific levels of concern (LOCs) and the most commonly detected PFASs, we provide comparisons of the geometric means between CARE-LA, CARE-2, and national levels from the 2017-2018 cycle of NHANES. We also present results broken out by five demographic variables: gender, race/ethnicity, age, education, and income, because of their potential impacts on exposures and/or biological processing of chemicals. We compared the analyte values between demographic groups with a calculation, called "adjusted percent change," that accounts for impacts of other demographic factors. Positive values indicate a percent increase over the comparison group, and negative values indicate a decrease. We also take participant hydration levels into account through adjustment for urinary creatinine or specific gravity.

Distribution information for other chemicals measured, including the metals and PFASs not discussed in the Results section, can be found in the Appendices.

Description of CARE-LA and CARE-2 populations

Outreach throughout the regions garnered interest from 912 people for CARE-LA and 720 people for CARE-2. With a goal of 500 participants for CARE-LA, we invited 737 people to participate; 58.3% finished all the steps of the study, resulting in 430 participants.

For CARE-2, we had a goal of 350 participants. We invited 583 people to participate; 61.6% finished all steps, resulting in 359 participants.

Table 2. CARE-LA study population and demographic characteristics (N = 430 participants)

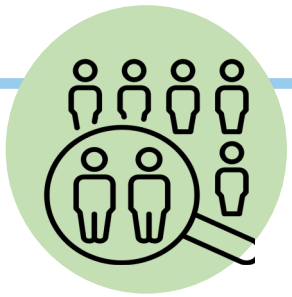
Demographic characteristic	Number[1]	Percent (%)[1]	Weighted Percent (%)[1]	Regional Population Percent (%)[2]
18-39 years	148	34.4	40.7	41.9
40-59 years	179	41.6	31.8	33.4
60 years or over	103	24.0	27.5	24.6
Male[3]	165	38.4	51.0	48.8
Female	262	60.9	49.0	51.2
Asian[4]	70	16.3	13.9	14.6
Black	48	11.2	8.9	7.8
Hispanic or Latino	156	36.3	44.7	48.6
White	129	30.0	29.1	25.9
Other	25	5.8	3.3	3.1
No high school degree	42	9.8	17.6	19.4
High school diploma/GED	24	5.6	18.6	21.4
College, some college, or trade/technical school	241	56.0	52.7	49.3
Graduate degree	120	27.9	11.1	9.9
Income ≤$25,000	98	22.8	21.4	18.8
Income $25,001-$75,000	134	31.2	36.2	35.2
Income $75,001-$150,000	106	24.7	25.5	28.3
Income >$150,000	37	8.6	17.0	17.8

1 Numbers may not total 430, and unweighted percentages may not sum to 100% because of missing data. Weighted percentages include imputed values for missing data and sum to 100%.

2 From ACS 2018, using the 1-year estimates provided for large U.S. counties.

3 Three participants did not select male or female and indicated another gender identity. Information on sex assigned at birth was not collected from participants in CARE-LA; therefore, gender identity was used as an approximate comparison to ACS data on sex in order to weight data and calculate regional population percentages.

4 Definitions of race/ethnicity categories: Asian (single identification), Black (single identification), Hispanic or Latino (any race), White (single identification), Other (Non-Hispanic multi-racial, American Indian or Alaskan Native, Native Hawaiian or Other Pacific Islander). Additional race/ethnicity breakdowns available in Appendix D.



Tables 2 and 3 present information on the participants in CARE-LA and CARE-2 and include comparisons to the American Community Survey (ACS) conducted by the U.S. Census Bureau. Study data were weighted to make the study more representative of the regional populations (see Methods section for more details).

Table 3. CARE-2 study population and demographic characteristic (N = 359 participants)

Demographic characteristic	Number[1]	Percent (%)[1]	Weighted Percent (%)[1]	Regional Population Percent (%)[2]
18-39 years	102	28.4	38.3	42.2
40-59 years	142	39.6	35.5	33.4
60 years or over	115	32.0	26.3	24.4
Male[3]	156	43.5	47.4	49.4
Female	202	56.3	52.6	50.6
Asian[4]	22	6.1	6.9	6.4
Black	16	4.5	7.3	6.7
Hispanic or Latino	166	46.2	49.4	52.1
White	131	36.5	32.9	31.5
Other	17	4.7	3.4	3.3
No high school degree	20	5.6	15.0	18.3
High school diploma/GED	54	15.0	27.2	27.9
College, some college, or trade/technical school	216	60.2	49.9	47.2
Graduate degree	67	18.7	8.0	6.6
Income ≤$25,000	90	25.1	19.6	18.3
Income $25,001-$75,000	137	38.2	37.4	38.4
Income $75,001-$150,000	65	18.1	30.1	29.8
Income >$150,000	20	5.6	12.9	13.6

1 Numbers may not total 359, and unweighted percentages may not sum to 100% because of missing data. Weighted percentages include imputed values for missing data and sum to 100%.

2 From ACS 2019, using the 5-year estimates provided for smaller U.S. counties.

3 No participants indicated another gender identity. Sex assigned at birth and gender were both collected in CARE-2, and participants' responses were concordant, with one missing for both.

4 Definitions of race/ethnicity categories: Asian (single identification), Black (single identification), Hispanic or Latino (any race), White (single identification), Other (Non-Hispanic multi-racial, American Indian or Alaskan Native, Native Hawaiian or Other Pacific Islander). Additional race/ethnicity breakdowns available in Appendix D.

Metals

Ten metals were measured in CARE-LA and CARE-2: lead in blood; antimony, arsenic, cobalt, molybdenum, thallium, and uranium in urine; and cadmium, manganese, and mercury in both blood and urine. Information on sources and potential health effects of these metals can be found in our fact sheets in Appendix A and in the "Chemicals Measured in the CARE Study" section of this report.

This section focuses on four commonly detected metals with levels of concern (LOCs): arsenic, cadmium, lead, and mercury. These four metals were detected in nearly all (>91%) of the CARE-LA and CARE-2 participants, with arsenic and lead detected in every participant.

Concentrations above the LOCs

Table 4: Number of CARE-LA and CARE-2 participants with metals concentrations above the 2020 levels of concern, and corresponding weighted study population percentages

Analyte	Level of concern	CARE-LA Number	CARE-LA Weighted Percent (%)	CARE-2 Number	CARE-2 Weighted Percent (%)
Arsenic (urine)	≥ 20 µg/L inorganic arsenic	20	5.1	10	4.8
	≥ 50 µg/L total arsenic	31	6.3	16	4.3
Cadmium (blood)	≥ 5 µg/L	0	0	0	0
Cadmium (urine)	> 3 µg/g creatinine	0	0	0	0
Lead (blood)	≥ 4.5 µg/dL[1]	1	<0.1	3	0.6
Mercury (blood)	≥ 5.8 µg/L if pregnant or may become pregnant[2]	9	2.6	6	8.9
	≥ 10 µg/L for all other adults	8	3.3	3	0.9
	≥ 5.8 µg/L applied to all participants[3]	27	5.4	14	5.1
Mercury (urine)	≥ 10 µg/L	0	0	1	<0.1

1 Since CARE-LA and CARE-2 were conducted, the CDC blood lead reference level has been lowered to ≥ 3.5 µg/dL. Applying this LOC to CARE-LA and CARE-2 would result in increased numbers of exceedances.

2 Persons who are or may become pregnant are defined here as those assigned female at birth and 18-49 years of age. Sex assigned at birth was not captured in CARE-LA; gender identity was used as a proxy.

3 Program follow-up was provided to all participants with blood mercury levels that exceeded 5.8 µg/L, regardless of sex or gender.

Table 4 provides information on the number and weighted percentages of participants in the study population with a metal result at or above its respective LOC. These LOC definitions have evolved over the course of the CARE Study, and several were lowered (made more protective) between the time CARE-LA and CARE-3 were conducted. To estimate the population-wide impacts of metals exposures, we have applied the lowest LOCs used for CARE-3 in 2020 to the CARE-LA and CARE-2 data.

The majority of LOC exceedances in both CARE-LA and CARE-2 were due to arsenic and mercury exposures, with 77 arsenic and 42 mercury exceedances. A total of 59 CARE-LA and 33 CARE-2 participants were identified as having an elevated arsenic and/or mercury level, with 8 participants having both elevated arsenic and mercury. More information on LOCs and follow-up protocols for participants with exceedances is available in Appendix B.

Arsenic

Average concentrations and comparisons with U.S. levels

The geometric mean concentration of total urinary arsenic was 10.6 µg/g creatinine in CARE-LA and 8.40 µg/g creatinine in CARE-2. Arsenic levels measured in CARE-LA were 26% higher than the levels measured in CARE-2 and 47% higher than those measured nationally (statistically significant comparison indicated by asterisk in figures). While CARE-2 levels were higher than national levels, the difference was not statistically significant (Figure 1).

Total urinary arsenic levels reflect exposure to organic and inorganic forms of arsenic. Most organic arsenic species are not considered a health concern, whereas inorganic arsenic species can impact health. Across the two regions, we identified 47 participants who had total arsenic levels at or above the LOC of 50 µg/L. When weighted, this corresponds to 6% of the LA County population and 4% of the CARE-2 regional population. In order to assess their exposure to inorganic arsenic, we performed further laboratory analyses (speciation) for participants with elevated total arsenic levels. In total, we identified 30 participants across the two regions (approximately 5% of each population) whose inorganic arsenic levels were at or above the LOC of 20 µg/L.

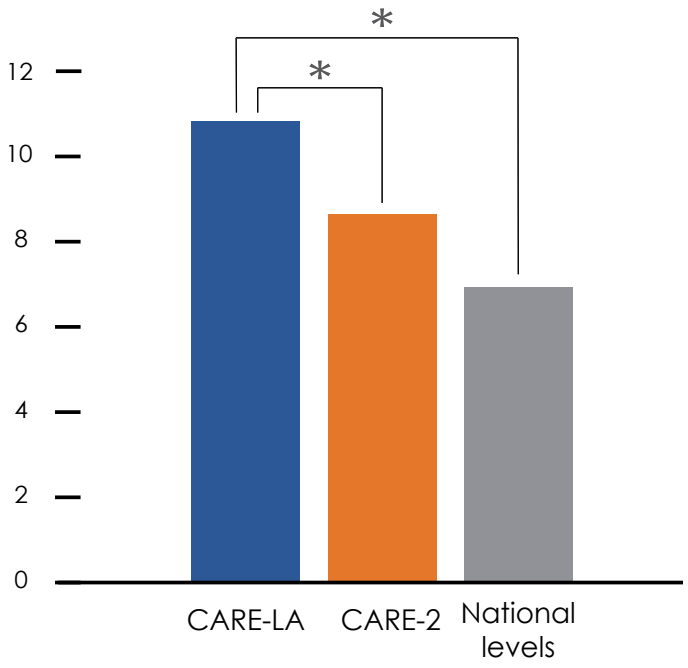


Figure 1

Notable demographic trends

National data have shown differences in total arsenic levels by race/ethnicity, with the highest concentrations in Asian populations. This pattern was also observed in the CARE-LA and CARE-2 regions, with the Asian population 136% higher than the White population in LA County (Figure 2) and 114% higher in the CARE-2 region (Figure 3).

Arsenic levels also increased with age in CARE-LA: the highest age category (60+ years old) had levels 56% higher than the lowest age category (18-39 years old). In CARE-2, the highest levels were found in the middle age category (40-59 years old), which were 59% higher than the lowest age category. No trends by gender were observed.

Arsenic concentrations varied between education levels in CARE-LA, with the lowest concentrations observed in those whose highest level of education was a high school diploma or GED. In CARE-2, arsenic levels generally decreased with higher income, with particularly low levels in the highest income category (more than $150K).

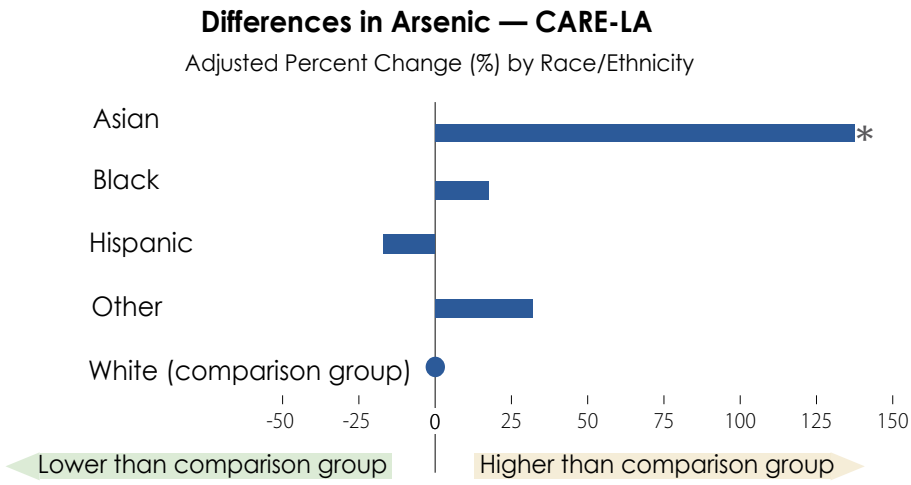


Figure 2

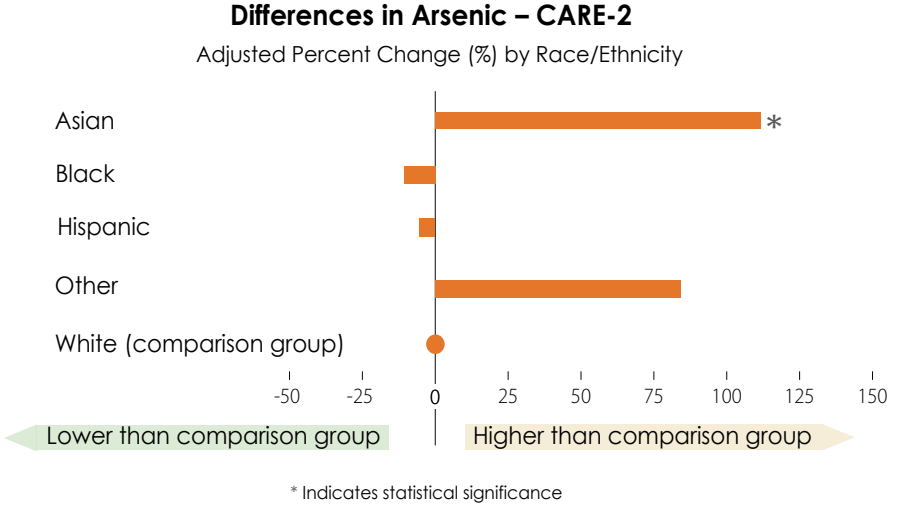


Figure 3

Cadmium

Cadmium was measured in both blood and urine; blood cadmium generally reflects recent exposures, while urinary cadmium reflects chronic exposures.

Average concentrations and comparisons with U.S. levels

The geometric mean concentration of blood cadmium was 0.258 µg/L in CARE-LA and 0.275 µg/L in CARE-2. These levels were similar to national levels (Figure 4). For urinary cadmium, the geometric mean concentration was 0.199 µg/g creatinine in CARE-LA and 0.226 µg/g creatinine in CARE-2. CARE-2 levels were 20% higher than national levels, while CARE-LA was not significantly different from CARE-2 or national levels (Figure 5). No participants had levels exceeding the LOC for blood or urinary cadmium.

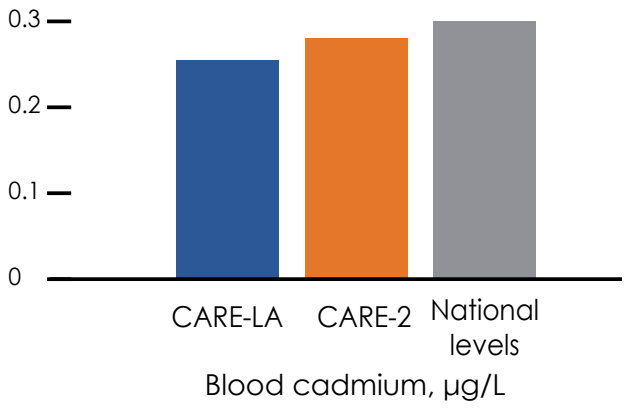


Figure 4

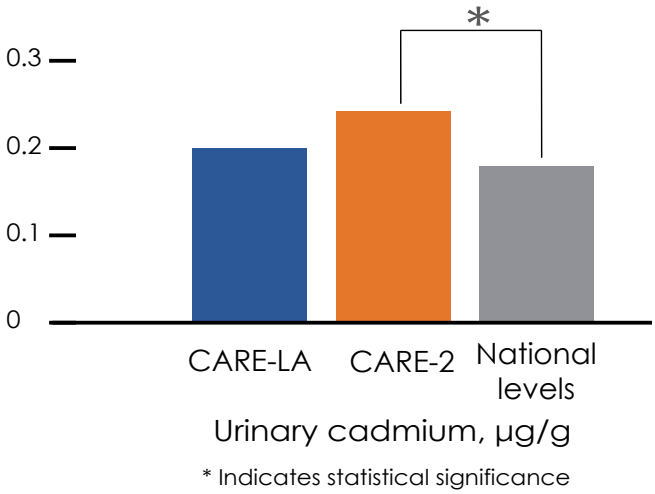
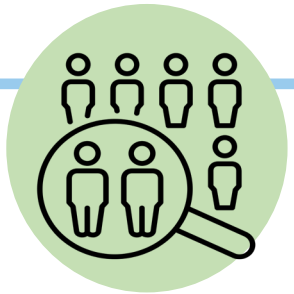


Figure 5



Notable demographic trends

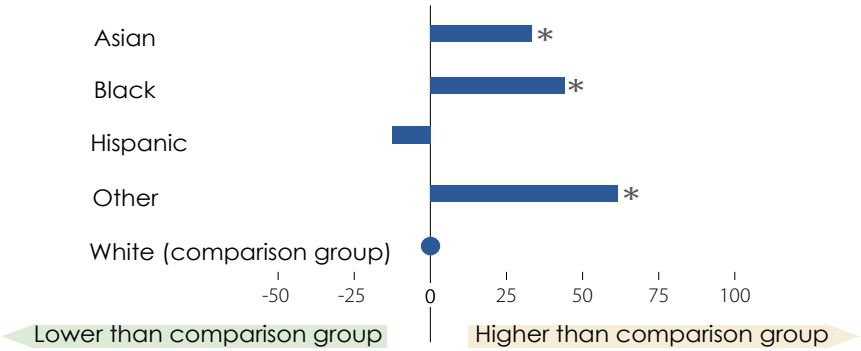
National data frequently show higher concentrations of blood cadmium among females than males. This was reflected in CARE-LA, where females had 52% higher levels than males, but not evident in CARE-2. The lowest blood cadmium concentrations were found in the youngest age category (18-39 years) in both of these CARE regions, while the highest concentrations were found in older age categories: in CARE-LA, the 40-59 age category was 47% higher than the youngest age category, and in CARE-2, the 60+ age category was 70% higher. In CARE-LA, blood cadmium levels did not follow a simple pattern with income.

National data consistently find Asian populations to have the highest blood cadmium concentrations of any race/ethnicity group. In CARE-LA, the Asian, Black, and Other race categories had higher levels than the White category: the Asian population was 32% higher; the Black population was 45% higher; and the Other race category was 61% higher (Figure 6). No differences were observed by race/ethnicity in CARE-2. (Figure 7)

Similar to the patterns seen with blood cadmium, national data also show Asian populations to have the highest urinary cadmium concentrations of any race/ethnicity group. This pattern was reflected in the two CARE regions: compared with the White population, the Asian populations had levels 26% higher in CARE-LA and 87% higher in CARE-2.

Differences in Cadmium (Blood) — CARE-LA

Adjusted Percent Change (%) by Race/Ethnicity



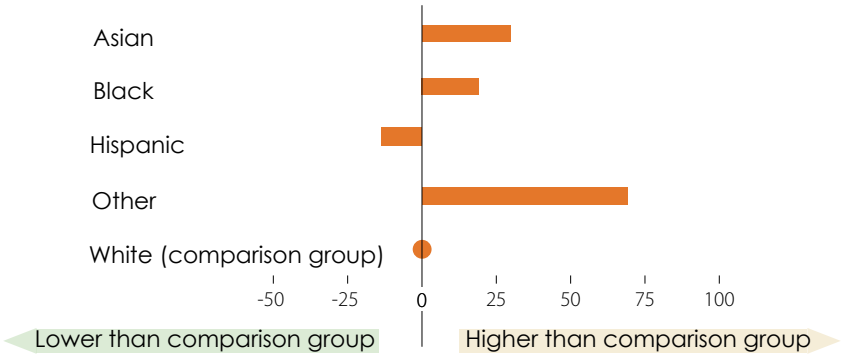
* Indicates statistical significance

Figure 6

In CARE-LA, the Hispanic/Latino populations were observed to have lower levels (29% lower) than the White population, a pattern that has also been seen nationally. Additionally, the Other race category had levels 160% higher than the White category in CARE-2. Similar to national trends, levels were higher in females than males, by 92% in CARE-LA and 29% in CARE-2. Levels were higher in older age categories in both studies. In CARE-LA, the 40-59 and 60+ age categories were similar, with both 105% higher than the youngest age category (18-39 years old). In CARE-2, the relationship increased across the age groups: urinary cadmium levels were 96% higher in the 40-59 age category and 250% higher in the 60+ age category compared with the youngest age category. No trends by education or income were observed.

Differences in Cadmium (Blood) — CARE-2

Adjusted Percent Change (%) by Race/Ethnicity



* Indicates statistical significance

Figure 7

Average concentrations and comparisons with U.S. levels

The geometric mean concentration of blood lead was 0.768 µg/dL in CARE-LA and 0.661 µg/dL in CARE-2. CARE-2 levels were 23% lower than national levels, while CARE-LA levels did not differ significantly from either national or CARE-2 levels (Figure 8).

In total, four participants across the two regions (one in CARE-LA and three in CARE-2) exceeded the lead LOC of 4.5 µg/dL. This represents <1% of the population in each region.

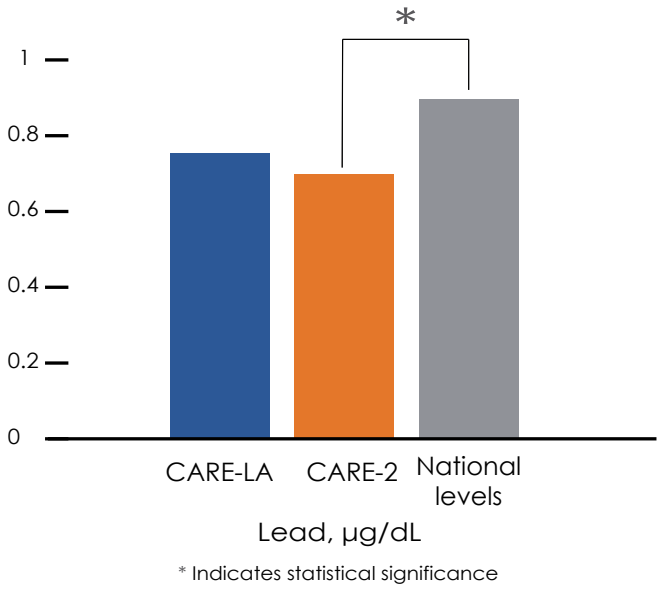


Figure 8

Notable demographic trends

While national data consistently show differences in blood lead concentrations by race/ethnicity, with the highest concentrations in Asian populations, no significant differences by race/ethnicity were seen in either CARE region. Females have lower blood lead levels in national data, and this trend was reflected in CARE-2 (27% lower) but not in CARE-LA. Similar to increases with age seen in adults in national data, blood lead levels increased with age in both CARE regions: lead levels in the 60+ age category were 127% higher than the youngest age category (18-39 years old) in CARE-LA (Figure 9) and 158% higher in CARE-2 (Figure 10). No trends by education or income were observed.

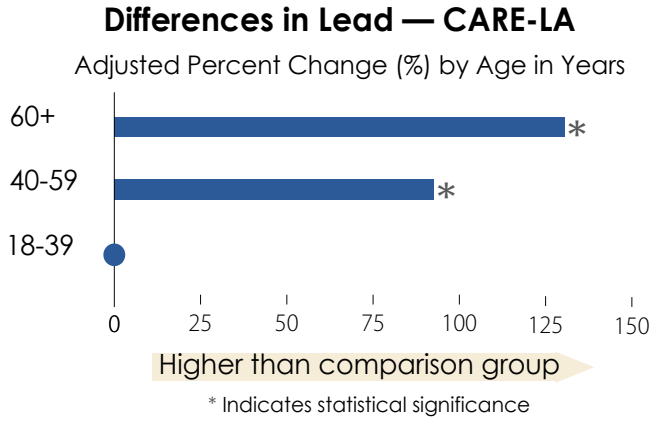


Figure 9

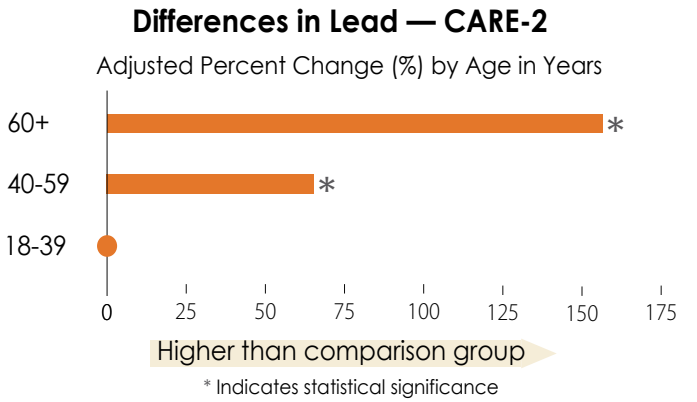


Figure 10

Mercury is measured in both blood and urine because of the way different forms of mercury are metabolized in the body. Blood mercury levels generally reflect exposures to organic mercury, while urinary mercury levels are more reflective of inorganic mercury exposures. Both organic and inorganic mercury can impact health.

Average concentrations and comparisons with U.S. levels

The geometric mean concentration of blood mercury was 0.975 µg/L in CARE-LA and 0.719 µg/L in CARE-2. CARE-LA levels were 35% higher than national levels, while CARE-2 levels were not significantly different from CARE-LA or national levels (Figure 11).

In CARE-LA, approximately 3% of those in the category of "pregnant or may become pregnant" had a blood mercury level at or above the LOC for this higher risk population (5.8 µg/L). In CARE-2, 9% of this population was at or above the LOC.

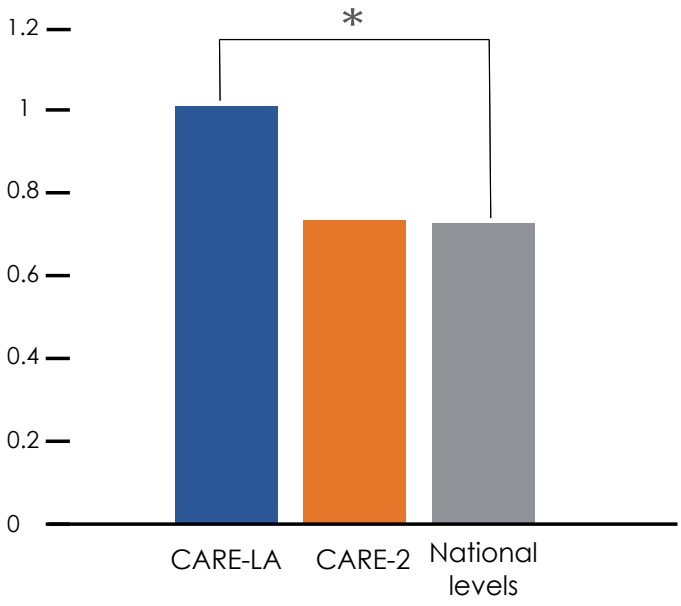


Figure 11

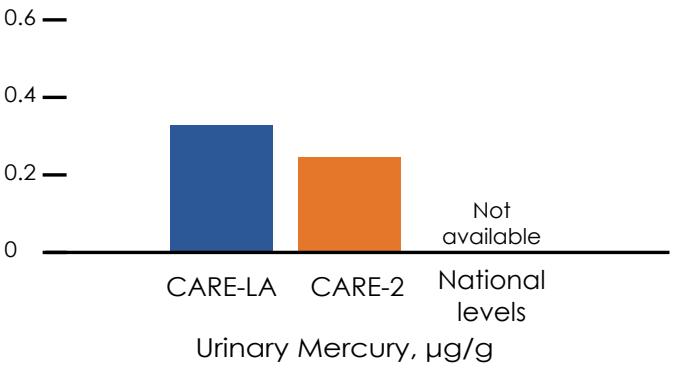


Figure 12

The geometric mean concentration of urinary mercury was 0.262 µg/g creatinine in CARE-LA and 0.216 µg/g creatinine in CARE-2. These values were not significantly different (Figure 12).

No national value is available for comparison because too many samples in the national data had undetectable levels of mercury. Only one participant across the two regions had a urinary mercury concentration at or above the LOC of 10 µg/L.

Notable demographic trends

National data consistently find Asian populations to have the highest blood mercury concentrations of any race/ethnicity group. This trend was reflected in CARE-LA and CARE-2: the Asian population had levels 156% higher than the White population in CARE-LA and 135% higher in CARE-2 (Figures 13 and 14). Similar to national data, there were no significant differences between males and females in the two CARE regions. In CARE-2, the middle age category (40-59 years old) had blood mercury levels 74% higher than the youngest age category (18-39 years old). Blood mercury levels were higher in middle income categories for both regions: the $25K-$75K and $75K-$150K categories in CARE-LA, and the $75K-$150K category in CARE-2. No trends by education were observed.

As with blood mercury, urine mercury has also been found to be highest in Asian populations in national data. Both CARE-LA and CARE-2 reflected this general trend, significantly in CARE-2, where the Asian population had levels 151% higher than the White population. Though national trends show higher concentrations among females, no significant gender differences were seen in either of these CARE regions.

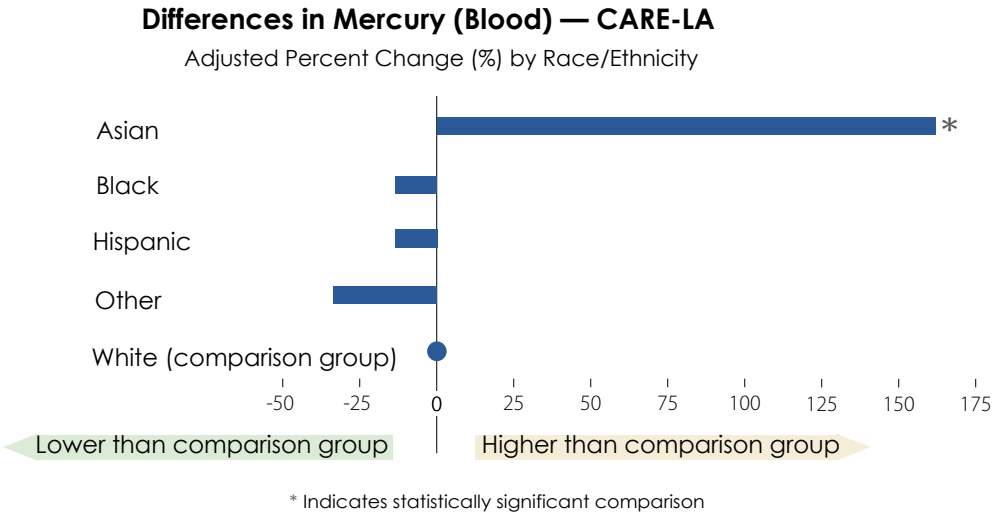


Figure 13

Similar to the pattern seen with blood mercury, the middle age category (40-59 years old) had the highest urinary mercury levels in CARE-2, with levels 54% higher than the 18-39 age category. Income was associated with urine mercury levels in CARE-2; levels generally decreased with income, with the lowest levels found in the highest income category (more than $150k). No trends by education were observed.

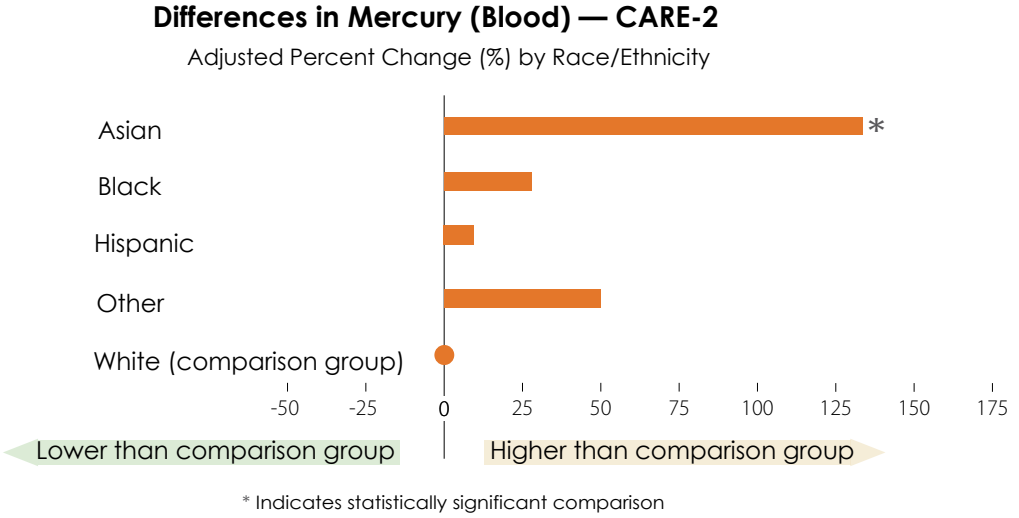


Figure 14

PFASs

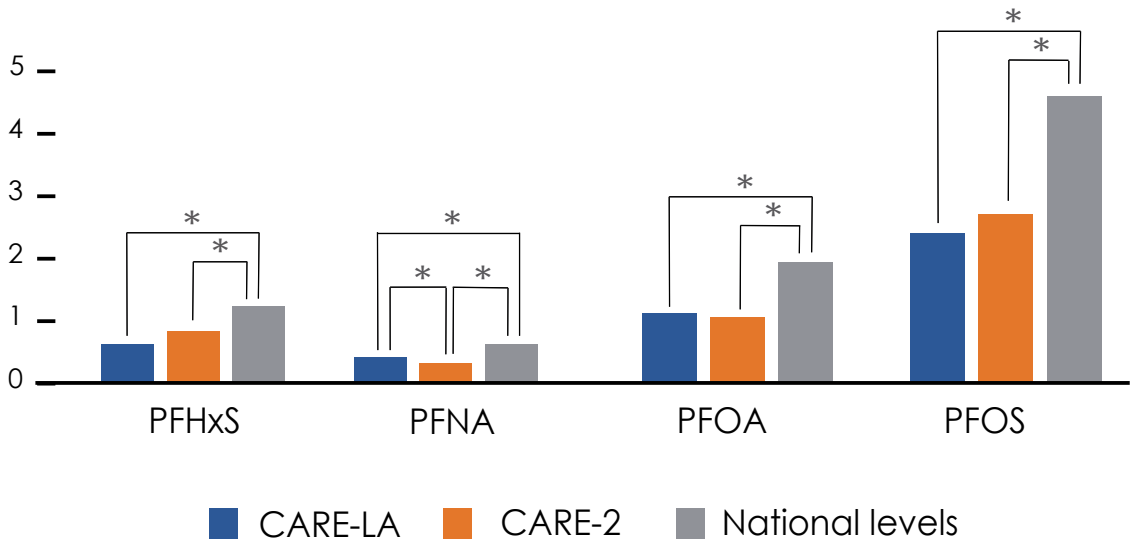
Twelve PFASs were measured in both CARE-LA and CARE-2. Information on sources and potential health effects of PFASs can be found in our fact sheets in Appendix A and in the "Chemicals Measured in the CARE Study" section of this report. For the analysis of trends in this section, we have focused on the five PFASs with detection frequencies over 65%: PFOA, PFOS, PFHxS, PFNA, and Me-PFOSA-AcOH.

PFASs were detected in all CARE-LA participants and all but one CARE-2 participants. On average, CARE participants had seven PFASs detected in their blood, with five (PFOA, PFOS, PFHxS, PFNA, and Me-PFOSA-AcOH) observed in over 90% of participants.

Average concentrations and comparisons with U.S. levels

PFOS, one of the first and most abundantly used PFASs, had the highest concentration of the PFASs measured in CARE-LA and CARE-2. The geometric mean for PFOS was 2.20 ng/ml for CARE-LA and 2.41 ng/ml for CARE-2. The next highest levels were observed for PFOA, with geometric means of 1.04 ng/ml for CARE-LA and 0.987 ng/ml for CARE-2. The third highest was PFHxS, with geometric means of 0.689 and 0.798 ng/ml in CARE-LA and CARE-2 respectively. Other PFASs were measured at levels less than half of the PFHxS levels. Two PFASs were significantly lower in CARE-2 than in CARE-LA: Me-PFOSA-AcOH and PFNA.

In general, PFAS concentrations for CARE-LA and CARE-2 were lower than national levels. Comparisons with national geometric mean concentrations were possible for four PFASs: PFHxS, PFNA, PFOA, and PFOS (Figure 15). PFOS demonstrated the strongest difference in both CARE-LA (50% lower) and CARE-2 (46% lower).



* Indicates statistically significant comparison

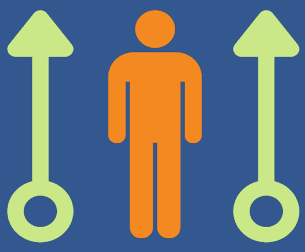
Figure 15

Notable demographic trends

For these trends, we have focused on the five PFASs with detection frequencies over 65% in CARE-LA and CARE-2. We have also included some information on trends for PFUnDA, which was above the 65% detection threshold only for CARE-LA.

Concentrations of several legacy PFASs have been observed to be declining in national biomonitoring data, related to the discontinuation of some PFAS manufacturing in the U.S. and many other countries. Since these PFASs accumulate in the body and are slowly eliminated from the body, concentrations tend to be higher in older age groups. This national trend was observed in these two CARE regions. When compared with the youngest age category (18-39 years old), the 60+ age category was 76-185% higher in CARE-LA and 66-193% higher in CARE-2 across PFASs.

National data and other studies have shown that males tend to have higher concentrations of many PFASs than females, likely related to biological elimination mechanisms of menstruation, childbirth, and breastfeeding. This trend was observed in these two CARE regions, where PFAS levels were higher in males than females, most notably with PFHxS, which was 72% higher among males in CARE-LA and 98% higher among males in CARE-2.



Men had higher PFAS levels than women

Racial and ethnic differences have been observed in national and California populations, with Asian populations often higher than other race/ethnicity groups, and Hispanic/Latino populations often lower. The most notable differences between Asian and White populations were for PFUnDA (171% higher in CARE-LA) and PFOS (68% higher in CARE-LA and 147% higher in CARE-2) (Figures 16 and 17). The Hispanic/Latino population had lower levels than the White population in CARE-LA, most notably for PFHxS (26% lower). In CARE-2, Me-PFOSA-AcOH concentrations were 80% higher in the Other race category compared with the White category.

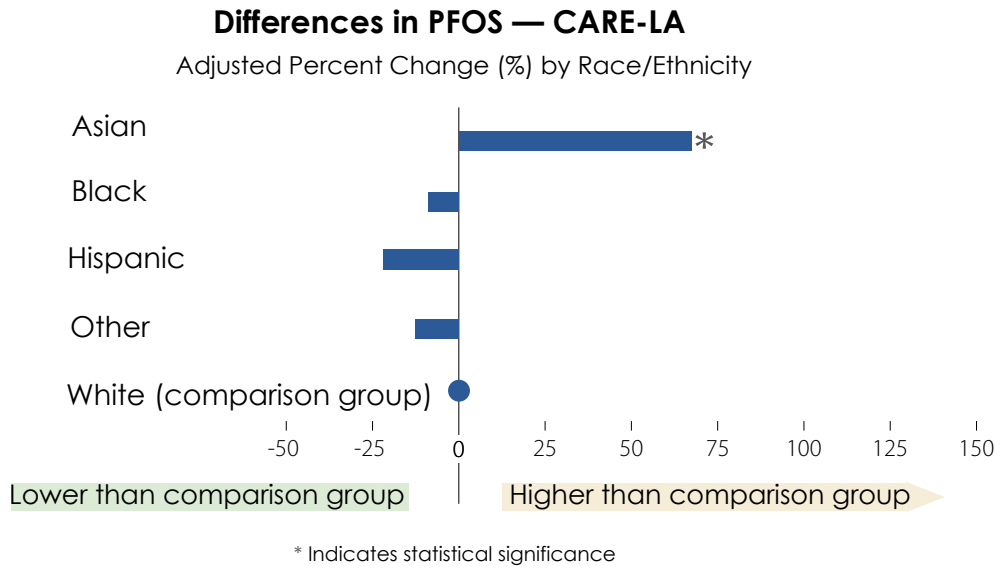


Figure 16

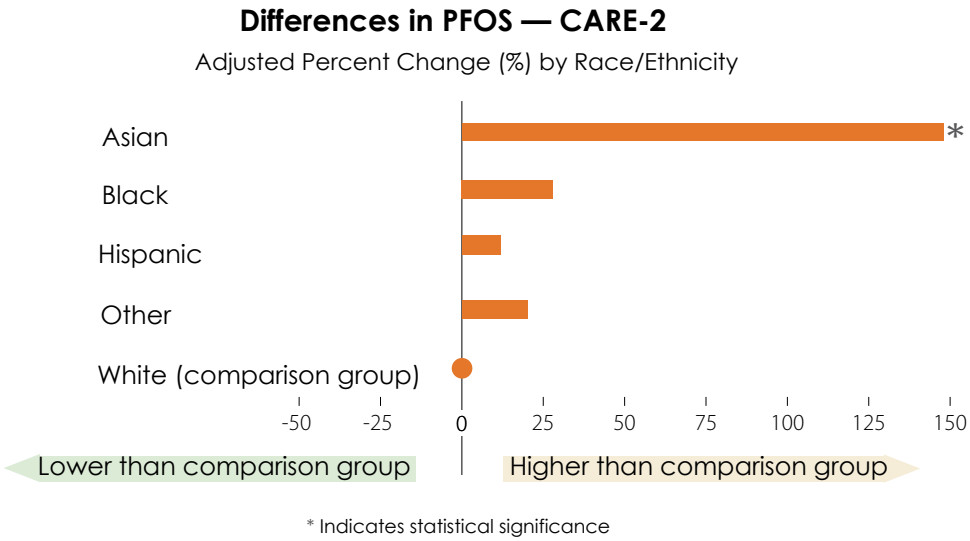


Figure 17

Some PFAS concentrations were found to be higher in participants with more education. Most notably, CARE-LA participants who had completed high school had levels of PFOA up to 61% higher than those who did not complete high school. PFAS concentrations tended to increase with income level, though they were highest in the middle income categories. For example, PFHxS levels in CARE-LA were 65-84% higher for the middle two income categories ($25K-75K and $75K-150K) compared with the lowest income category (less than $25K).

Additional chemicals

Environmental phenols and metabolites of 1-nitropyrene (biomarkers of exposure to diesel exhaust) were measured in urine samples from subsets of participants in CARE-LA and CARE-2. Sample selection for these analyses was based on several factors, including participant consent, sample collection date, and available sample volume. For more information on sample selection for these additional chemicals, refer to Appendix C.

These data have not been weighted because they are smaller subsets of the larger studies; therefore, descriptive statistics should be viewed as solely reflective of the study participants and not the general regional population. For a detailed summary of results, refer to Appendix I for phenols and Appendix J for 1-NP metabolites. Information on sources and potential health effects of these chemicals can be found in our fact sheets in Appendix A and in the "Chemicals Measured in the CARE Study" section of this report.

Environmental phenols

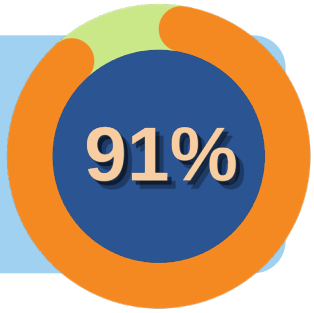
In CARE-LA, 60 urine samples from female participants were analyzed for 10 phenols. The detection frequencies varied among phenols: 95% for both benzophenone-3 (BP-3) and methyl paraben; 82% for triclosan; 77% for bisphenol S (BPS); and 67% for propyl paraben. The remaining phenols were detected in less than half of the selected participants, including 47% for bisphenol A (BPA).

In CARE-2, 151 urine samples from 76 male and 75 female participants were analyzed for eight phenols. As with CARE-LA, the highest detection frequencies were observed with BP-3 (96%) and methyl paraben (94%). Other frequently detected phenols included BPA (70%), BPS (65%), and propyl paraben (60%). The remaining phenols were detected in less than half of the participants, including 45% for triclosan.

1-Nitropyrene (1-NP) metabolites (diesel exhaust biomarkers)

In CARE-LA, two 1-NP metabolites, 6-OHNP and 8-OHNP, were measured in a subset of 153 participants. At least one 1-NP metabolite was detected in 95% of the selected participants (91% for 6-OHNP and 87% for 8-OHNP).

In CARE-2, we measured 6-OHNP and 8-OHNP in a subset of 158 participants. At least one metabolite was detected in 91% of these participants (89% for 6-OHNP and 76% for 8-OHNP).



Putting biomonitoring data to use

As with all Biomonitoring California studies, data from the CARE Study is used to inform individual study participants as well as communities, researchers, and policy makers. Individual participants benefit from learning the specific levels of chemicals we measured in their biological samples and the overall levels of chemical exposures in their communities. Community advocates and researchers use our study data to compare chemical exposures among different groups of Californians. Finally, CARE study data can be used to demonstrate how chemical exposures change over time and how they differ by region in California.

Reporting back to study participants

The principle of "Right to Know" is built into Biomonitoring California's founding legislation. Participants have the right to know what chemicals they have been exposed to, which can empower them to make or advocate for changes to reduce their exposures. The Program must ensure that results materials are understandable and culturally appropriate, and that uncertainties inherent in the information are clearly described.

Reporting overall study findings

We provide public access to summary findings for all of our studies. These results are presented in public meetings, on our website at www.biomonitoring.ca.gov/explore-results, and in reports and publications about our studies. Summary statistics can be used to compare findings between studies. In the case of a surveillance study like the CARE Study, the summary statistics are used to compare the populations of different regions with each other.

Biomonitoring data: A piece of the environmental health puzzle

Biomonitoring plays just one part in understanding how chemical exposures can affect human health, including how population levels compare with levels associated with measurable health impacts. Researchers can use Biomonitoring California data to assess how exposures have changed over time and in relation to changing policies, consumer behaviors, and larger phenomena such as climate change. This allows for examination of the impacts of factors such as diet, consumer product usage, occupation, and residence on chemical levels.

Biomonitoring data can also identify communities or demographic groups that are particularly exposed. For example, the CARE Study data reveal elevated levels of several chemicals in Asian populations in the regions studied. Identifying differences in exposures by race/ethnicity and other demographics is an important step towards understanding why these disparities exist, with the potential to reveal effects of societal inequities and to inform policy and behavioral changes to reduce these disparities.

CARE Study LA

CALIFORNIA REGIONAL EXPOSURE STUDY

Findings from Los Angeles County

Everyone comes into contact with chemicals every day, no matter where they are – at home, in school, or at work.

What is the California Regional Exposure (CARE) Study?

The CARE Study is part of the State of California's efforts to reduce exposures to harmful chemicals. In this study, we measure chemicals in Californians by testing blood and urine samples from volunteers across the state. We also collect information that tells us about how people come into contact with (or are "exposed to") these chemicals.

CARE Study participants get their test results along with fact sheets about the chemicals, including possible health concerns and ways to reduce their contact with harmful chemicals. Summaries of the study findings are also shared with community groups, scientists, policy makers, and the general public.

Results from the CARE Study are also used to:

- Identify and inform individuals and communities with higher chemical exposures
- Support communities in reducing their exposures
- Improve public and environmental health policies in California

What is Exposure?

Exposure means to come into contact with something.

We study people's chemical exposures by looking for chemicals in blood and urine samples, and measuring how much is there.

We also use surveys (questions about where people go, what they eat and drink, the products they use, and their jobs and hobbies) to try to understand how people have been exposed to the chemicals we found in their bodies.

The CARE Study focuses on one region of the state at a time. Our first region was Los Angeles (LA) County.

The CARE Study in LA County (CARE-LA)

CARE-LA took place from February to June 2018. 430 people participated in the study.

All participants were tested for 22 potentially harmful chemicals: 10 metals and 12 perfluoroalkyl and polyfluoroalkyl substances (PFASs).

Most participants gave us permission to use their samples for additional testing. We tested 60 female participants for additional chemicals found in plastics and personal care products like shampoo and sunscreen. We also tested 159 participants for a chemical found in diesel exhaust.

For more information on the CARE Study, visit www.cdph.ca.gov/CARE

BIOMONITORING CALIFORNIA
MEASURING CHEMICALS IN CALIFORNIANS

California Department of PublicHealth

The CARE Study also collected questionnaire data from individual participants, which allows for examination of the impacts of factors such as diet, consumer product usage, occupation, and residence on chemical levels. These data will be shared in future Biomonitoring California materials and are also available to researchers interested in collaborating with the Program.

Informing and supporting state policies and programs

California has many state programs with the mutual goal of reducing the human health impacts of chemical exposures. Biomonitoring data are used by other programs to illustrate the extent to which the population is exposed; identify disproportionately exposed individuals or communities; and inform and evaluate public health and environmental policies. In conjunction with information from individual participants – such as residence, occupation, and consumer product choices – biomonitoring can be used to determine the contribution of different exposure sources, which can help identify priorities for exposure reduction. Some examples of how biomonitoring data are used include:

Identification and intervention for highly exposed individuals

Biomonitoring California engages with individual participants who have elevated levels of arsenic, cadmium, lead, or mercury, notifying them of their elevation(s) and offering potential ways to reduce their exposures. In collaboration with CDPH's Occupational Lead Poisoning Prevention Program, the Program provides education on exposure reduction to participants with elevated lead levels.

Determination of trends and sources of exposure

The Program regularly meets with staff from the Air Resources Board, OEHHA, the Water Board, and other programs to discuss approaches to understanding and mitigating PFAS exposures. In addition, our data are available to researchers who monitor time trends to evaluate the impact of statewide laws and regulations, such as Proposition 65, which requires businesses to warn Californians about exposures to carcinogens and reproductive toxicants.

Assessment of exposures to personal care product chemicals

Measuring phenols like BPA and methyl paraben in a large number of participants reveals the extent to which consumers are being exposed to these endocrine-disrupting chemicals. Because many of these exposures come from personal care products, this lends support to the continued efforts of CDPH's Safe Cosmetics Program, which requires companies to report chemical ingredients that have been identified as causing cancer or reproductive toxicity. These data are made available to consumers, and together with other educational efforts helps them identify and avoid potentially harmful ingredients in everyday products. The Safe Cosmetics Program also studies differences in chemical exposures by race/ethnicity. The information collected by these efforts helps inform our Program priorities and study design.

Finding safer alternatives for the marketplace

The Safer Consumer Products (SCP) program at DTSC has a process to identify harmful chemicals used in consumer products and works towards better alternatives. By sharing data collected in our studies, Biomonitoring California provides SCP with information on common exposures across the population. For example, ongoing high detection frequencies of PFASs across the three CARE Study regions lend support to SCP's recent focus on PFASs used in carpets or rugs, and in treatments used on textiles and leathers.

Conclusions

The CARE Study has demonstrated several findings about chemical exposures that may guide the path forward for both our Program and the field of environmental health:

- Exposures to multiple harmful chemicals are nearly ubiquitous across the populations studied.
- Exposures in California are distinct from national measurements.
- There are disparities in chemical exposures in California, which may contribute to disparities in health outcomes.

Ongoing surveillance provides a way to examine important issues around chemical exposures and resultant health implications at a population level. As the CARE Study has shown, virtually all of us have harmful chemicals in our bodies. However, not all sectors of the population are equally exposed, with some communities more highly exposed because of where they live or the products they use. Biomonitoring California is committed to measuring and revealing these patterns; further data analysis will help identify exposure sources and potential mitigation strategies, particularly in our most impacted communities.

The CARE Study focused on several important chemical groups. However, these are only a small fraction of the many chemicals that Californians are exposed to, and new chemicals are being introduced on an ongoing basis. For example, the CARE Study measured exposures to older PFASs, but many new substitute PFASs are being used in products and entering the environment and our bodies.

There are many outstanding questions about how people are exposed to chemicals and how the levels measured in the CARE Study compare with levels likely to elicit adverse health effects. There is also much that is not known about how exposures to multiple chemicals impact health, or how stress or other conditions might alter the impact of chemical exposures.

Biomonitoring is a unique way to identify and quantify chemical exposures. By quantifying the extent of chemical exposures in our population, we can better understand how chemical exposures impact our health and help build a more equitable and healthier state for all Californians.

For more information, visit the CARE Study website:

www.biomonitoring.ca.gov/care

CARE-LA and CARE-2 were supported in part by the Centers for Disease Control and Prevention cooperative agreement #U88EH001148.

Appendices

Appendix A: Chemical fact sheets

BIOMONITORING CALIFORNIA

Antimony Fact Sheet

Antimony is a metal that is found in nature. One chemical compound of antimony, called antimony trioxide, is added to flame retardants to make them more effective. Antimony compounds are also used to make some types of plastics, glass, pigments, and electronic components. Antimony can be mixed with other metals to make alloys that are resistant to wear and corrosion.

Antimony is found in

- Flame retardants used in a wide variety of products, including:
  - Children's products, such as sleepwear and other clothing, car seats, and toys.
  - Plastic items, such as car dashboards, coatings on electric wires, electrical tape, components of some small appliances like toasters, some tarps, and vinyl flooring.
  - Upholstery fabric, drapes, rugs, and carpeting.
- Polyethylene terephthalate (PET) plastic used to make a wide variety of food and drink containers, like water and soda bottles; microwavable and ovenproof plastic trays; storage bags; and plastic jars.
- Metal alloys used in various products, such as car batteries, pipe fittings, bullets, and metal solder for electronics and plumbing.
- Pewter items, such as plates, beer mugs, and jewelry.
- Fluorescent light bulb glass; optical glass used in eyeglasses, cameras, and microscopes; and glass screens in old televisions.
- Some yellow and white pigments used in paint, printing ink, plastic, rubber, and ceramic.

Possible health concerns

Some forms of antimony:

- May contribute to respiratory problems.
- May affect the heart.
- May increase cancer risk.

Possible ways to reduce exposure

- Because antimony can come out of products and collect in dust:
  - Wash your and your child's hands often, especially before preparing or eating food.
  - Clean your floors regularly, using a wet mop or HEPA vacuum if possible, and use a damp cloth to dust.
- Avoid drinking water from plastic water bottles left in hot places, such as a car or garage.
- Choose glass or stainless steel containers to store food and drinks, and avoid using plastic containers or trays to prepare food in the microwave or the oven.
- Look for furniture that has "TB117-2013" labels, the new California flammability standard that can be met without using chemical flame retardants. The label should indicate if the furniture contains flame retardants or not.
- Avoid used furniture with "TB-117" labels, which is more likely to contain chemical flame retardants.

BIOMONITORING CALIFORNIA

Arsenic Fact Sheet

Arsenic is found in soil and water in some areas, and in some foods. It occurs naturally and from human activity. Arsenic compounds were used extensively as pesticides and wood preservatives in the past, but these uses have mostly been phased out. There are different forms of arsenic, some of which may cause health problems, and others that are not a health concern.

Arsenic is found in

- Some foods, including:
  - Seafood, especially shellfish. The form of arsenic in seafood is not considered to be a health concern.
  - Rice and foods with rice-based ingredients, such as some hot and cold cereals, some infant formulas, and rice cakes. Rice plants can take up arsenic from water or soil.
  - Hijiki seaweed (short, black, noodle-like seaweed).
- Drinking water sources in some places, such as parts of the Central Valley and some areas in Southern California.
- Some pressure-treated wood used in outdoor structures, such as decks and playground equipment. Arsenic-treated wood was phased out in 2004.
- Cigarette and other tobacco smoke.
- Some herbal medicines and other traditional remedies, especially from China and India.
- Some herbicides in limited use at golf courses, cotton farms, and sod-growing facilities.

Possible health concerns

Some forms of arsenic:

- May harm the developing fetus.
- May harm the nervous system and affect learning in children.
- May contribute to cardiovascular disease and affect lung function.
- Can increase cancer risk.

Possible ways to reduce exposure to forms of arsenic that may affect health

- Include plenty of variety in your and your child's diet.
- If you have an infant, breastfeed if you can. Include alternatives to rice-based foods in your infant's diet.
- Do not burn older pressure-treated wood (manufactured before 2004), and avoid using it for home projects.
- Have children wash their hands after they play on or around older wooden play structures or decks. If you own such a structure or deck, apply a sealant or coating every one to two years.
- Because arsenic can collect in dust:
  - Wash your and your child's hands often, especially before preparing or eating food.
  - Clean your floors regularly, using a wet mop or HEPA vacuum if possible, and use a damp cloth to dust.
- If your water comes from a private well, have it tested for metals, including arsenic. (If your water comes from a public water supplier, it is already tested regularly for arsenic.)

For more information:

Tips from the US Food and Drug Administration on reducing arsenic exposures:
https://www.fda.gov/food/environmental-contaminants-food/what-you-can-do-limit-exposure-arsenic

Cadmium Fact Sheet

Cadmium is a metal that is found in nature and is used in many industries and products.

Cadmium is found in

- Cigarette and other tobacco smoke.
- Some cheap metal jewelry, including some charms.
- Rechargeable batteries labeled NiCd or NiCad.
- Metal plating and solder.
- Some red, yellow, and orange decorative paints, which may be used on glassware and pottery.
- Some foods, including:
  - Fish and shellfish from contaminated water.
  - Potatoes, root vegetables, leafy greens, fruit, and rice grown in contaminated soil.
  - Certain organ meat, such as liver and kidney.

Possible health concerns

Cadmium:

- May harm the developing infant and child.
- May harm the reproductive system in men.
- Can damage the lungs and kidneys.
- Can increase cancer risk.
- Can weaken bones.

Possible ways to reduce exposure

- Do not smoke or allow others to smoke in your home or car, or around your child.
- Do not let children wear or play with cheap metal jewelry or charms.
- Do not let children handle rechargeable batteries labeled NiCd or NiCad.
- Properly recycle batteries (see below).
- If you do any welding or metalworking, or work with cadmium in other ways:
  - Be sure that your work area is well ventilated, and use proper protective equipment.
  - Follow other safe work practices, including washing hands frequently, keeping work dust out of your home, and washing work clothes separately.
  - Keep children away from welding fumes and other metal vapors and dusts.
- Because cadmium can collect in dust:
  - Wash your and your child's hands often, especially before preparing or eating food.
  - Clean your floors regularly, using a wet mop or HEPA vacuum if possible, and use a damp cloth to dust.
- Include plenty of variety in your and your child's diet. Eat a well-balanced diet with enough iron, which can help reduce the amount of cadmium that your body absorbs.

For more information:

Cadmium fact sheet: www.atsdr.cdc.gov/toxfaqs/tfacts5.pdf

Battery recycling location: Visit https://recyclenation.com/ and enter "Batteries (Rechargeable)" and your zip code in the search box

call 1-800-RECYCLING (1-800-732-9254)

Cobalt Fact Sheet

Cobalt is part of vitamin B12, which is essential to keep the body's nervous system and red blood cells healthy. It is safe to ingest cobalt when it is part of vitamin B12, and it is normal and healthy to have some cobalt in your body as a result. Cobalt metal and cobalt compounds other than vitamin B12 can be toxic. Cobalt metal is used in alloys that resist wear and corrosion. Some blue pigments in paint, glass, and other products contain cobalt compounds.

Cobalt metal and cobalt compounds, other than vitamin B12, are found in

- Metal alloys used in a variety of applications, such as:
  - Some artificial joints for the hip and knee.
  - Hard metal tools, including cobalt-tungsten carbide tools, for drilling, cutting, and grinding hard materials like stone or concrete.
  - Some rechargeable batteries.
- Blue pigments used for many products, including paint, glass, candles, and dish detergents.

Possible health concerns of cobalt metal and cobalt compounds, other than vitamin B12

Cobalt metal and cobalt compounds, other than vitamin B12:

- Can harm the heart, thyroid, and nervous system.
- Can cause sensitivity in the lungs and skin, including allergies.
- May increase cancer risk.

Possible ways to reduce exposure to cobalt metal and cobalt compounds, other than vitamin B12

- If you have a metal hip or knee replacement, follow your doctor's advice for monitoring metals, including cobalt, in your blood.
- If you work with cobalt or cobalt-based tools, like cobalt-tungsten carbide tools:
  - Be sure that your work area is well ventilated, and use proper protective equipment.
  - Follow other safe work practices, including washing hands frequently, keeping work dust out of your home, and washing work clothes separately.
- Avoid taking dietary supplements containing cobalt in forms other than vitamin B12.

Lead Fact Sheet

Lead is a metal that is found in nature and is used in many industries and products.

Lead is widespread in the environment and is found in

- Chipped and peeling paint and dust in and around homes built before 1978 (when lead was banned in house paint).
- Bare soil around homes built before 1978, or near roadways.
- Job sites or hobby areas, such as construction and painting sites, shooting ranges, and recycling facilities for electronics, batteries, and scrap metal.
- Some candies and spices from Mexico and Asia.
- Some traditional remedies, especially brightly colored remedies like Azarcón and Greta.
- Many consumer products, including:
  - Some ceramic dishes and pottery, and some pewter and crystal pitchers and goblets.
  - Some baby bibs, electrical cords, purses, garden hoses, and other products made of vinyl or imitation leather.
  - Some toys, art supplies, costume jewelry, cosmetics, and hair dyes.
  - Some brass faucets, fishing weights and sinkers, and curtain weights.

Possible health concerns

Lead:

- Can affect brain development and contribute to learning problems in infants and young children.
- Can increase blood pressure, decrease kidney and brain function, and cause reproductive problems.
- May increase cancer risk.

Possible ways to reduce exposure

- Keep children away from chipped and peeling paint. Use a certified professional if you plan to permanently remove or seal lead-based paint.
- Cover bare soil with grass, bark, or gravel, especially around homes built before 1978 and homes near roadways.
- If you work with lead or do house renovation, use proper protective equipment. Follow other safe work practices, including washing hands frequently, keeping work dust out of your home, and washing work clothes separately.
- Use cold water for drinking and cooking to reduce the release of lead from some faucets and old pipes.
- Because lead can collect in dust:
  - Wash your and your child's hands often, especially before preparing or eating food.
  - Clean your floors regularly, using a wet mop or HEPA vacuum if possible, and use a damp cloth to dust.
- Eat a well-balanced diet with enough calcium, iron, and vitamin C, which can help reduce the amount of lead that your body absorbs.

For more information:

California's Childhood Lead Poisoning Prevention Program at (510) 620-5600, or go to:
https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/CLPPB/Pages/CLPPBhome.aspx

California's Occupational Lead Poisoning Prevention Program at (510) 620-5740, or go to:
https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/OHB/OLPPP/Pages/OLPPP.aspx

BIOMONITORING CALIFORNIA

Manganese Fact Sheet

Manganese is an essential nutrient that we get mainly from food. It is normal and healthy to have some manganese in your body. Manganese is also a metal used in many industries and products. You might be exposed to higher levels of manganese through jobs that involve working with metals, such as welding.

Manganese is found in	• Certain foods, such as nuts, grains, beans, and leafy green vegetables. • Some drinking water sources. • Certain metal alloys, such as steel. • Some welding rods. • Certain chemicals used in agriculture to kill fungus.
Manganese is an essential nutrient	• Some manganese is needed to support many important processes in the body, such as building bones and healing wounds.
Possible health concerns of too much manganese	Too much manganese: • May be associated with learning and behavior problems in children. • Can harm memory, thinking, mood, coordination, and balance in adults.

Possible ways to avoid exposure to too much manganese	• Eat a well-balanced diet with enough iron, which can help you maintain a healthy level of manganese.
	• If you do any welding or metalworking, or work with manganese in other ways:
	  ○ Be sure that your work area is well ventilated, and use proper protective equipment.
	  ○ Follow other safe work practices, including washing hands frequently, keeping work dust out of your home, and washing work clothes separately.
	  ○ Keep children away from welding fumes and other metal vapors and dusts.

For more information:

Manganese fact sheet: www.atsdr.cdc.gov/toxfaqs/tfacts151.pdf

Mercury Fact Sheet

Mercury is a metal that is found in nature. It is released into the environment when coal is burned, by some industries, and from past use in gold mines. Mercury builds up in certain types of fish.

Mercury is found in

- Certain types of fish and seafood. This is the most common source of exposure to mercury.
- Some imported face creams used for skin lightening, anti-aging, or acne.
- Some herbal medicines and other traditional remedies, especially from China and India.
- Silver-colored dental fillings.
- Glass thermometers, older barometers, and blood pressure gauges.
- Fluorescent lights, including compact fluorescent light (CFL) bulbs.

Possible health concerns

Mercury:

- Can affect brain development and cause learning and behavior problems in infants and children who were exposed in the womb.
- Can harm the nervous system and kidneys.
- May affect the heart.
- May increase cancer risk.

Possible ways to reduce exposure

- Choose fish that are lower in mercury, such as salmon, tilapia, trout, canned light tuna, sardines, anchovies, and oysters.
- Avoid fish that are high in mercury, such as shark, swordfish, orange roughy, bluefin and bigeye tuna, tilefish, king mackerel, and marlin.
- Do not use imported face creams for skin lightening, anti-aging, or acne unless you are certain that they do not contain mercury.
- Properly recycle CFL bulbs (see below).
- Properly clean up broken thermometers, CFL bulbs, and other items containing mercury (see below). Do not let children play with silver liquid from items like mercury thermometers.

For more information:

Information on mercury for people who catch and eat fish: https://oehha.ca.gov/fish/mercury-fish-and-shellfish; or call OEHHA at (916) 324-7572

Guide for choosing fish that are lower in mercury: https://oehha.ca.gov/sites/default/files/media/downloads/fish/fact-sheet/2011commfishguidecolor.pdf

Concerns about mercury exposure - contact the California Poison Control System hotline: https://calpoison.org/ or 1-800-222-1222

Fact sheet on mercury in your environment, with information on cleaning up mercury spills: https://www.epa.gov/mercury

For CFL recycling locations: visit https://recyclenation.com/ and enter “Compact Fluorescent Lights” and your zip code in the search box; or call 1-800-RECYCLING (1-800-732-9254)

Molybdenum Fact Sheet

Molybdenum is an essential nutrient that we get mainly from food. It is normal and healthy to have some molybdenum in your body. Molybdenum is also a metal used in various industries and products. For example, a compound called molybdenum trioxide is used to make metal alloys like steel more durable. Molybdenum trioxide is also used as a flame retardant in some plastics, such as polyvinyl chloride (PVC). You might be exposed to higher levels of molybdenum or molybdenum compounds through certain jobs, like working with steel.

Molybdenum is found in	• Certain foods, including legumes (beans, lentils, and peanuts), nuts, rice, and liver.
	• Some dietary supplements.
	• Metal alloys used in a variety of applications, including:
	  ○ Some artificial joints for the hip and knee.
	  ○ Welding supplies and equipment.
	• Flame retardants in some plastics, such as polyvinyl chloride (PVC) plastic.

Molybdenum is an essential nutrient	• A small amount of molybdenum is needed to support many important processes in the body, such as metabolism and protecting cells from damage.

Possible health concerns of too much molybdenum, or of molybdenum trioxide	• Too much molybdenum:
	  ○ May cause gout-like symptoms, such as joint pain.
	  ○ Might contribute to reproductive problems.
	• Molybdenum trioxide may increase cancer risk.

Possible ways to avoid exposure to too much molybdenum, or to molybdenum trioxide	• If you work with molybdenum or molybdenum trioxide, or do any welding or metalworking:
	  ○ Be sure that your work area is well ventilated, and use proper protective equipment.
	  ○ Follow other safe work practices, including washing hands frequently, keeping work dust out of your home, and washing work clothes separately.
	  ○ Keep children away from welding fumes and other metal vapors and dusts.
	• If you have a metal hip or knee replacement, follow your doctor's advice for monitoring metals, including molybdenum, in your blood.

BIOMONITORING CALIFORNIA

Thallium Fact Sheet

Thallium is a metal that is found in nature. It is used in various specialized applications in electronics, medicine, and research. Historically, it was used as a rat poison, but this use was banned in 1972 because thallium is very toxic to humans. Thallium is released into the environment at very low levels from raw materials used by some industries, such as oil and gas operations, cement plants, and steel manufacturers.

Thallium is found in

- Components used in electronics, such as semiconductors.
- Some drinking water sources, such as well water that has been affected by industrial or wastewater discharges. This could include discharges from some oil and gas operations.
- Air and dust near certain industrial facilities that can release thallium, such as cement plants and steel manufacturers.
- Cigarette and other tobacco smoke.

Possible health concerns

Thallium is highly toxic and can harm many important processes in the body. Thallium:

- Can harm the nervous system.
- Can damage vision.
- Can cause hair loss.

Possible ways to reduce exposure

- If your water comes from a private well, have it tested for metals, including thallium. (If your water comes from a public water supplier, it is already tested regularly for thallium.)
- If you work with materials that contain thallium or at facilities where thallium may be released into the air, follow all occupational safety guidelines for your industry.

BIOMONITORING CALIFORNIA

Uranium Fact Sheet

Natural uranium is a weakly radioactive metal that is found in many types of rock, and low levels of it can end up in some drinking water sources and foods. Enriched uranium is derived from natural uranium, but is much more radioactive. Enriched uranium is used as fuel in nuclear power plants and in nuclear weapons. Depleted uranium, a byproduct of uranium processing, is used in military and medical applications. Depleted uranium can have toxic effects similar to natural uranium, but is less radioactive.

Uranium is found in	• Drinking water sources in some places, such as parts of the Central Valley and some areas in Southern California. • Some foods, such as root vegetables and leafy greens, grown in areas that have uranium in the soil or water. • Radiation-shielding equipment made with depleted uranium, used in medical and other applications. • Specialized ammunition and other military equipment made with depleted uranium.
Possible health concerns	Uranium: • Can cause kidney damage. • Can increase cancer risk.
Possible ways to reduce exposure	• If your water comes from a private well, have it tested for metals, including uranium. (If your water comes from a public water supplier, it is already tested regularly for uranium.) • If you work with uranium, follow all occupational safety guidelines for your industry.

BIOMONITORING CALIFORNIA

Perfluoroalkyl and Polyfluoroalkyl Substances (PFASs) Fact Sheet

PFASs are used to make various products resistant to oil, stains, grease, and water. These chemicals are very long lasting and have spread through the environment.

PFASs are found in

- Some food, such as:
  - Some meat and seafood, because some PFASs in the environment can accumulate in animals, fish, and shellfish.
  - Some vegetables grown with water that contains PFASs.
  - Food in certain grease-repellent packaging, including some fast-food wrappers, microwave popcorn bags, take-out boxes, and cardboard containers for frozen foods.
- Some textiles, such as stain-resistant carpets, water-repellent outdoor fabrics, and leather.
- Certain stain- and water-repellent sprays; sealants for granite and other natural stone tiles or countertops; cleaning products; lubricants; polishes; and waxes.
- Some personal care products, such as some skin creams, eye makeup, and dental floss.
- Some nonstick cookware.
- Drinking water sources affected by releases of PFASs into the environment.

Possible health concerns

Some PFASs:

- May harm the fetus and child, including effects on growth and development.
- May affect the immune system and liver function.
- May increase the risk of thyroid disease.
- May interfere with the body's natural hormones.
- May increase cancer risk.

Possible ways to reduce exposure

- Include plenty of variety in your and your child's diet, and limit how often you eat foods in grease-repellent wrappers and containers.
- Avoid products labeled as stain- or water-resistant, such as carpets, furniture, and clothing.
- Check labels of household and personal care products, and avoid those with "fluoro" ingredients. Contact the manufacturer if you can't find the ingredients on the label.
- If you choose to use protective sprays, sealants, polishes, waxes, or similar products, make sure you have enough ventilation and follow other safety precautions.
- Because PFASs can come out of products and collect in dust:
  - Wash your and your child's hands often, especially before preparing or eating food.
  - Clean floors regularly, using a wet mop or HEPA vacuum if possible, and use a damp cloth to dust.

Benzophenone-3 (BP-3; Oxybenzone) Fact Sheet

Benzophenone-3 (BP-3; oxybenzone) is used in many sunscreens and some other personal care products to protect skin from sun damage. BP-3 is also added to packaging and some consumer products, such as cosmetics and paints, to protect the products from sun damage.

BP-3 is found in	• Many sunscreens. • Sun-protective personal care products, such as some lotions, lip balms, and cosmetics. • Some perfumes, shampoos, conditioners, and nail polish. • Plastic packaging for some food and consumer products. • Some protective coatings, such as varnish and oil-based paint.
Possible health concerns	• BP-3 may interfere with the body's natural hormones.
Possible ways to reduce exposure	• Wash off sunscreen and sun-protective products once you are out of the sun. • Eat more fresh food and less packaged food, which might help reduce exposure to BP-3 from some plastic packaging.
Importance of sun safety	Sun exposure is known to damage skin and increase cancer risk. Applying a broad spectrum sunscreen is one of the most important ways to protect against the sun's ultraviolet (UV) rays. You should also: • Reduce or avoid exposure to direct sunlight when UV rays are strongest, usually between 10 am and 4 pm. When possible, stay in the shade. • Wear protective clothing, including a wide-brimmed hat and sunglasses, and long sleeves and long pants if possible.

For more information:

Sun safety tips: http://www.healthychildren.org/English/safety-prevention/at-play/Pages/Sun-Safety.aspx

BIOMONITORING CALIFORNIA

Bisphenol A (BPA) Fact Sheet

Bisphenol A (BPA) is used to make a hard plastic called polycarbonate. Until recently, BPA was also widely used to make the protective coatings inside food and drink cans, but US manufacturers have been phasing it out in response to consumer demand and scientific findings of serious health concerns. BPA may be in adhesives used to bond fabrics, such as for "no-stitch" clothing. It is also still used in some types of paper receipts.

BPA is found in

- Hard polycarbonate plastic in a variety of items, such as:
  - Some kitchenware, like plates, mugs, and storage bottles.
  - Eyeglass lenses, and screens for cell phones and laptop computers.
  - Safety equipment, like helmets and protective visors.
  - Parts for cars, light fixtures, and medical devices.
- Some protective coatings inside food cans; on household appliances; inside metal drinking water pipes; and on laminate flooring and concrete.
- Some clothing, including baby socks, blankets, and onesies.
- Some dental sealants.
- Some receipts printed on smooth shiny paper, such as from cash registers or gas pumps.
- Building materials, like sealants, adhesives, and grout.

Possible health concerns

BPA:

- May harm the reproductive system in women.
- May interfere with the body's natural hormones.
- May affect the fetus and infant, including possible changes in development and behavior.
- Might increase cancer risk.

Possible ways to reduce exposure

- Eat more fresh food and less canned food.
- Use glass or stainless steel containers for food and drinks.
- Request an electronic receipt, or no receipt, when possible. If you work as a cashier or otherwise frequently handle receipts, wear nitrile gloves.
- Because BPA can come out of products and collect in dust:
  - Wash your and your child's hands often, especially before preparing or eating food.
  - Clean your floors regularly, using a wet mop or HEPA vacuum if possible, and use a damp cloth to dust.

BIOMONITORING CALIFORNIA

Bisphenol F (BPF) Fact Sheet

Bisphenol F (BPF) is used to make hard plastic parts for household appliances, vehicles, and other items. It is also used in protective coatings, like linings in some drink cans and dental sealants. BPF can be formed from a naturally occurring chemical in yellow/white mustard seeds during production of some yellow mustard.

BPF is found in	• Some protective coatings used inside drink cans; on laminate flooring and concrete; and inside water tanks. • Hard plastic parts used in various items, such as household appliances; cars, airplanes, and other vehicles; and medical devices. • Some dental sealants. • Some yellow mustard. • Building materials, like sealants, adhesives, and grout.
Possible health concerns	• BPF may interfere with the body's natural hormones.

Possible ways to reduce exposure	• Avoid canned drinks.
	• If you eat mustard, choose a variety of types and brands. BPF hasn't been found in any mustard made from brown or black seeds, and it's not in all types of yellow mustard. Because it's formed during production and is not intentionally added, BPF won't be listed on the ingredient label.
	• Because BPF can come out of products and collect in dust:
	  ○ Wash your and your child's hands often, especially before preparing or eating food.
	  ○ Clean your floors regularly, using a wet mop or HEPA vacuum if possible, and use a damp cloth to dust.

BIOMONITORING CALIFORNIA

Bisphenol S (BPS) Fact Sheet

Bisphenol S (BPS) is part of polyethersulfone (PES) plastic, which is used to make hard plastic items and synthetic fibers for clothing and other textiles. BPS may also be used to make colors last longer in some fabrics. It is a common replacement for BPA in some types of paper receipts, and is also in protective coatings inside some food cans. Consumer products marketed as "BPA-free" might contain BPS.

BPS is found in

- Hard PES plastic in a variety of items, such as:
  - Baby bottles.
  - Microwave-safe dishes and containers.
  - Parts of electronics, like screens for mobile phones and calculators.
  - Heat-resistant parts used in automobile engines, industrial machinery, medical equipment, and other applications.
- Some clothing, including baby socks and onesies, sportswear, and raingear.
- Fabrics used for blankets, curtains, pillows, and furniture upholstery.
- Coatings in some food cans and nonstick pans.
- Some receipts printed on smooth shiny paper, such as from cash registers or gas pumps.

Possible health concerns

BPS:

- May interfere with the body's natural hormones.
- Might affect the reproductive system.
- Might harm the developing fetus and infant.

Possible ways to reduce exposure

- Eat less canned food and more fresh food.
- Choose glass or stainless steel containers for storing food and drinks.
- Avoid microwaving plastic containers.
- Breastfeed your infant if you can. For bottle-feeding, use glass bottles.
- Read labels on clothing and other fabrics, and avoid items made from "polyethersulfone" or "PES" fabric.
- Choose an electronic receipt, or no receipt, when possible. If you work as a cashier or otherwise frequently handle receipts, wear nitrile gloves.
- Because BPS can come out of products and collect in dust:
  - Wash your and your child's hands often, especially before preparing or eating food.
  - Clean your floors regularly, using a wet mop or HEPA vacuum if possible, and use a damp cloth to dust.

BIOMONITORING CALIFORNIA

Parabens Fact Sheet

Parabens are used as preservatives in many personal care products, and in some medications and foods. They are also used as antimicrobials in some paper products, like baby wipes, and some natural and synthetic fabrics.

Parabens are found in

- Personal care products, including some:
  - Cosmetics, such as mascara, eye shadow, lipstick, and foundation.
  - Facial cleansers and scrubs.
  - Moisturizers, lotions, and sunscreens.
  - Shampoos, conditioners, and shaving creams.
- Baby products, such as some lotions, baby wipes, and diaper rash ointments.
- Some household products, such as some stain removers and pet shampoos.
- Some clothing and other textiles, such as some sportswear, bedding, and upholstery fabric.
- Some over-the-counter and prescription medications.
- Some food, such as some jams and jellies; sauces and syrups; and packaged tortillas, trail mix, and baked goods.

Possible health concerns

Some parabens:

- May interfere with the body's natural hormones.
- Might decrease fertility.

Possible ways to reduce exposure

- Check labels on personal care products and other items, and avoid those with "paraben" in the ingredient names.
- Consider choosing cosmetics, personal care products, and baby products that use natural preservatives, such as vitamin C (label might list "ascorbate" or "ascorbic" ingredients).
- Try natural oils for skin and hair, such as coconut oil, olive oil, and sunflower seed oil.
- For infants, consider using plain washcloths instead of baby wipes, and wash their skin with ordinary soap and water.
- Because parabens can come out of products and collect in dust:
  - Wash your and your child's hands often, especially before preparing or eating food.
  - Clean your floors regularly, using a wet mop or HEPA vacuum if possible, and use a damp cloth to dust.

BIOMONITORING CALIFORNIA

Triclocarban Fact Sheet

Triclocarban is used to kill bacteria. It was previously a common ingredient in bar soaps labeled as "antibacterial" or "antimicrobial," but this use was banned by the US Food and Drug Administration (FDA) as of September 2017. This is because there are no extra health benefits of using soap with triclocarban compared to ordinary soap, and the wide use of antibacterials poses health concerns. Some other personal care products, like cosmetics, as well as some clothing and pet grooming sprays, may still contain triclocarban.

Triclocarban is found in	• Some deodorant bar soap made prior to the FDA ban. • Some personal care products, like cosmetics. • Some clothing, such as pantyhose. • One type of pet grooming spray used to reduce scratching and biting of irritated skin.
Possible health concerns	Triclocarban: • May interfere with the body's natural hormones. • May make it harder for antibiotics to fight infections. This is because overuse of triclocarban and other antibacterials may cause changes in bacteria that make them harder to kill.
Possible ways to reduce exposure	• Avoid consumer products and personal care products labeled "antibacterial" or "antimicrobial." • Check labels on personal care products and pet sprays, and avoid those that list triclocarban as an ingredient. • If you can't tell from the label whether a product contains triclocarban, contact the manufacturer.

For More Information:

FDA consumer information: https://www.fda.gov/consumers/consumer-updates/skip-antibacterial-soap-use-plain-soap-and-water

BIOMONITORING CALIFORNIA

Triclosan Fact Sheet

Triclosan is used to kill bacteria. It was previously a common ingredient in liquid soaps labeled as "antibacterial" or "antimicrobial," but this use was banned by the US Food and Drug Administration (FDA) as of September 2017. This is because there are no extra health benefits of using soap with triclosan compared to ordinary soap, and the wide use of antibacterials poses health concerns. Triclosan is still used in other personal care products, such as some toothpaste and cosmetics, although certain companies are phasing it out. It is also added to many household products and building materials.

Triclosan is found in

- Consumer products, including:
  - Housewares, such as cutting boards, serving utensils, storage containers, humidifiers, and vacuum cleaners.
  - Home furnishings, such as mattress and pillow covers, shower curtains, and rugs.
  - Children's toys and sporting goods, such as exercise, playground, camping, and boating equipment.
- Some personal care products, including some toothpaste and cosmetics like blush and eyeshadow; and combs, brushes, and razors.
- Building materials, such as some countertops, caulking, concrete, tiles, flooring, and bathroom fixtures.

Possible health concerns

Triclosan:

- May interfere with the body's natural hormones.
- May make it harder for antibiotics to fight infections. This is because overuse of triclosan and other antibacterials may cause changes in bacteria that make them harder to kill.

Possible ways to reduce exposure

- Avoid personal care products that list triclosan on the label, unless you have a medical reason for using them. For example, toothpaste with triclosan may help prevent gingivitis (inflammation of the gums).
- Avoid products labeled "antibacterial" or "antimicrobial."
- For housewares and other consumer products, look for untreated materials, which could include wood, glass, stainless steel, and natural fabrics like wool. If you can't tell whether a product has been treated with triclosan or other antibacterials, contact the manufacturer.

For More Information:

FDA consumer information: https://www.fda.gov/consumers/consumer-updates/skip-antibacterial-soap-use-plain-soap-and-water

Diesel Exhaust Fact Sheet

BIOMONITORING CALIFORNIA

Diesel exhaust is a mixture of thousands of chemicals, including 1-nitropyrene (1-NP). These chemicals are released as gases or particles (such as black soot) from vehicles and machinery that run on diesel fuel. Vehicles that run on biodiesel, a plant-based alternative to diesel fuel, produce similar exhaust.

Diesel exhaust comes from	• On-road vehicles that run on diesel fuel, such as semi-trailer trucks, light-duty trucks, and some buses and passenger cars. • Diesel-powered freight and passenger trains, and cargo and cruise ships. • Heavy-duty equipment, such as bulldozers and tractors, used for construction, agriculture, landscaping, mining, and similar types of work. • Diesel-powered generators.
Possible health concerns	Diesel exhaust: • Can make asthma worse and contribute to other respiratory diseases, like chronic obstructive pulmonary disease (COPD). • May harm the lungs and lower resistance to respiratory infections. • May make allergic reactions to dust, pollen, and other allergens worse. • Can make existing heart conditions worse. • Can increase cancer risk.

Possible ways to reduce exposure	• When walking, riding a bike, or exercising outdoors, choose areas away from roadways whenever possible, or side streets with less traffic. Avoid busy highways and paths near train routes.
	• When in heavy traffic, keep vehicle windows closed and put the air on recirculate (look for this symbol or check your manual: ).
	• Always start and operate diesel engines in a well-ventilated area.
	• If you have a diesel car or truck, don't idle inside garages, especially garages attached to your home.
	• If you have a backup or portable diesel-powered generator, put it well away from your home, to make sure that exhaust does not come in through open windows or doors.
	• If possible, use a high-efficiency filter in your home's central heating and air system.
	• Consider buying a portable air cleaner (or "air purifier") that can remove small particles from the air in your home (see below).
	• Because chemicals from diesel exhaust can collect in dust:
	  ○ Wash your and your child's hands often, especially before preparing or eating food.
	  ○ Clean your floors regularly, using a wet mop or HEPA vacuum cleaner if possible, and use a damp cloth to dust.
	• Report diesel trucks in California if they are:
	  ○ Idling where "No idling" signs are posted, or idling for more than five minutes.
	  ○ Not following designated truck routes.
	Call 1-800-363-7664 or fill out the form at this link: www.arb.ca.gov/enf/complaints/icv.htm.

For more information:

Air cleaners for the home: www.epa.gov/sites/production/files/2018-07/documents/guide_to_air_cleaners_in_the_home_2nd_edition.pdf

Diesel exhaust in California: ww2.arb.ca.gov/resources/overview-diesel-exhaust-and-health

Appendix B: Level of Concern (LOC) definitions and follow-up protocols

Biomonitoring California's levels of concern (LOCs) provide context for both individual results and summary statistics; they also provide a framework for additional follow-up for highly exposed participants. Results above an LOC trigger specific protocols that can include additional analyses, such as speciation of arsenic; notification about potential health concerns, if appropriate; a follow-up telephone survey to help identify potential sources of exposure and discuss ways to possibly reduce exposures; and clinical follow-up with technical assistance, when warranted. The Program's LOC protocol is reviewed and updated periodically, taking into consideration the latest guidance and recommendations from federal and state agencies as well as other organizations.

At the time the CARE Study was conducted, the Program had identified levels of concern (LOCs) for arsenic, cadmium, lead, and mercury. With a few exceptions explained below, LOCs were adopted from values used by CDC.

Arsenic

We use ≥ 50 µg/L as the LOC for total urinary arsenic, taken from CDC's case definition.[1] Though CDC interprets this as the case definition for inorganic arsenic, the value they provide is for the total urinary arsenic concentration. Total arsenic concentrations include both organic species (primarily arsenobetaine) and inorganic species; only the latter are considered to be a health concern.

We have adopted an LOC of ≥ 20 µg/L for urinary inorganic arsenic concentrations. Urinary inorganic arsenic concentrations are defined as the sum of the concentrations of four arsenic species: dimethylarsinic acid (DMA), monomethylarsonic acid (MMA), arsenic (V) acid, and arsenous (III) acid. At the time that our program adopted the LOC of ≥ 20 µg/L, no federal or state value existed for inorganic arsenic concentrations. Instead, our LOC was based on the cut point identified by Caldwell et al. (2009) and corresponds roughly to the 95th percentile from NHANES 2003-2004.[2] Although CDC protocols call for speciation of arsenic in cases with total arsenic ≥ 50 µg/L, we conservatively speciated arsenic in all CARE Study samples with a total arsenic level ≥ 19.5 µg/L, to identify any samples which, after rounding, had an inorganic arsenic level above the LOC.

Notification of elevated results occurred for all participants with total arsenic levels in urine ≥ 50 µg/L, regardless of speciation results. Follow-up, including a voluntary exposure survey, was conducted for participants with inorganic arsenic levels in urine ≥ 20 µg/L, even if their total arsenic levels were below 50 µg/L. The flow chart below provides more details.

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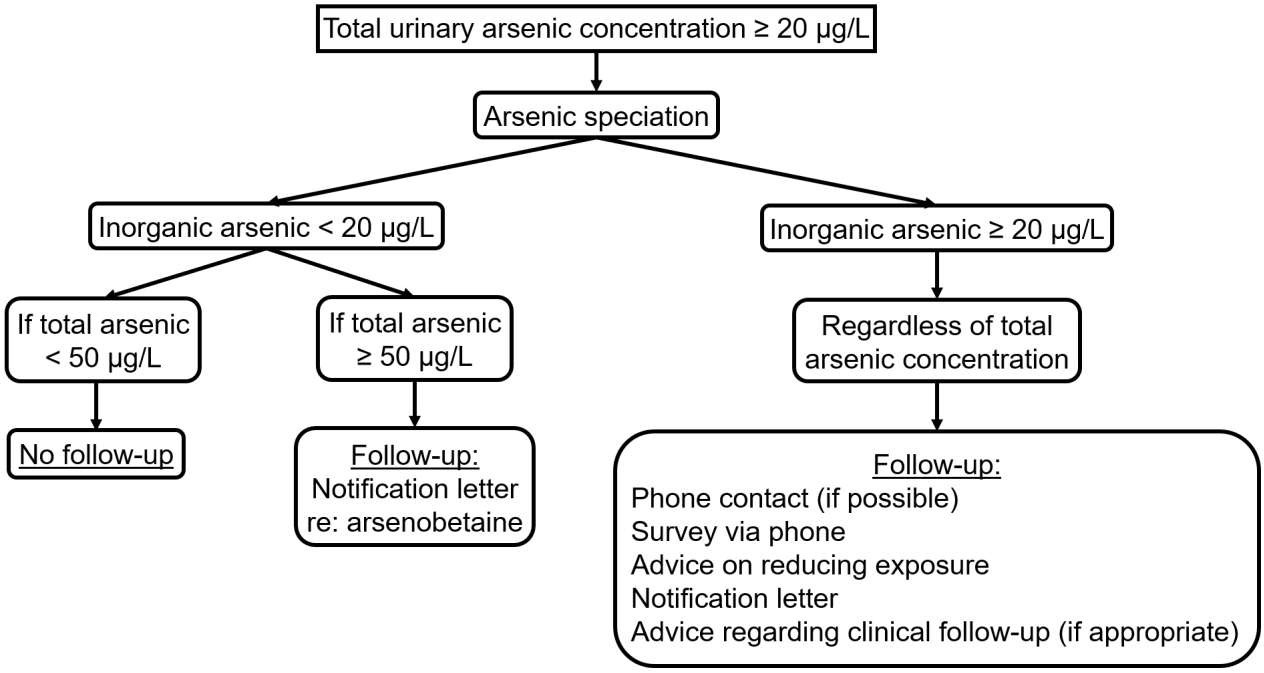
[1] Centers for Disease Control and Prevention (CDC). Case Definitions for Chemical Poisoning. MMWR. Recomm. Rep. 2005, 54, 5–6. Accessed July 14, 2025.

[2] Caldwell KL, Jones RL, Verdon CP, et al. Levels of urinary total and speciated arsenic in the US population: National Health and Nutrition Examination Survey 2003-2004. *J Expo Sci Environ Epidemiol*. 2009;19(1):59-68.doi: 10.1038/jes.2008.32.

Flow chart of arsenic follow-up protocol



Cadmium

We adopted a urinary cadmium LOC of >3 µg/g creatinine based on the Occupational Safety and Health Administration (OSHA) trigger level for medical surveillance.[3]

Our LOC for blood cadmium is ≥ 5 µg/L. This was based on the OSHA trigger level for medical surveillance (>5 µg/L), which is also used by the CDC. The Program chose the slightly more conservative ≥ 5 µg/L that is used by other entities such as the Mayo Clinic.[4]

Participants with urinary or blood cadmium levels above the corresponding LOCs were notified in writing of their elevated results, with follow-up phone contact to identify possible exposure sources and discuss ways to possibly reduce their cadmium exposures.

Lead

The Program chose ≥ 4.5 µg/dL as the LOC for blood lead. This level was selected in conjunction with CDPH's Occupational Lead Poisoning Prevention Program (OLPPP), which recommended maintaining blood lead levels below 5 µg/dL at the time the CARE Study was conducted.[5] The National Institute for Occupational Safety and Health (NIOSH) currently uses 5 µg/dL as the case definition of an elevated blood lead level for surveillance.[6] We chose the more conservative ≥ 4.5 µg/dL to account for results that round up to 5. For CARE-LA, the LOC was ≥ 4.5 µg/dL for those who were

[3] https://www.osha.gov/Publications/osha3136.pdf. Accessed July 14, 2025.
[4] https://www.mayocliniclabs.com/test-catalog/Clinical+and+Interpretive/8582. Accessed July 14, 2025.
[5] https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/OHB/OLPPP/Pages/LeadandHealth.aspx. Accessed July 14, 2025.
[6] https://www.cdc.gov/niosh/lead/bll-reference/?CDC_AAref_Val=https://www.cdc.gov/niosh/topics/lead/referencebloodlevelsforadults.html. Accessed July 14, 2025.

pregnant or may become pregnant, and ≥ 9.5 µg/L for all other adults. For CARE-2 and CARE-3, we chose the more conservative ≥ 4.5 µg/dL for all adults.

CARE Study staff followed up with participants who had blood lead levels between 4.5 and 9.5 µg/dL. This included written notification and phone contact to identify possible exposure sources and discuss ways participants might reduce exposures to lead. Study participants with blood lead levels ≥ 9.5 µg/dL received follow-up from staff at the CDPH Occupational Lead Poisoning Prevention Program (OLPPP), as part of its well-established blood lead surveillance and case investigation services. More information about OLPPP's follow-up protocols can be found in their report, *Blood Lead Levels in California Workers*.[7]

Mercury

The program has adopted two LOCs for blood mercury: ≥ 5.8 µg/L for those who are pregnant or may become pregnant, and ≥10 µg/L for all other adults. The higher value is based on the CDC case definition.[8] The lower value is based on *Methods and rationale for derivation of a reference dose for methylmercury by the U.S. EPA*[9], which CDC has used as a trigger for follow-up in NHANES.

We followed up with all CARE Study participants ≥ 5.8 µg/L to avoid assumptions about sex and fertility, and because the information may be pertinent to more vulnerable members of the household, such as children. Follow-up included written notification, phone contact, and a voluntary exposure survey.

For CARE-LA, the LOC for urinary mercury was ≥ 20 µg/L. For CARE-2 and CARE-3, we lowered the LOC to ≥10 µg/L, based on CDC's updated case definition.[10] All participants above their study's respective LOC for urinary mercury received the same follow-up described above for participants with elevated blood mercury.

[7] https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/OHB/OLPPP/CDPH%20Document%20Library/CABLLReport2012-14.pdf. Accessed July 14, 2025.

[8] Centers for Disease Control and Prevention (CDC). Case Definitions for Chemical Poisoning. MMWR. Recomm. Rep. 2005, 54, 11–13. Accessed July 14, 2025.

[9] Rice DC, Schoeny R, Mahaffey K. Methods and rationale for derivation of a reference dose for methylmercury by the U.S. EPA. Risk Anal. 2003; 23(1):107-15. PMID: 12635727. doi: 10.1111/1539-6924.00294.

[10] Centers for Disease Control and Prevention (CDC). Case Definitions for Chemical Poisoning. MMWR. Recomm. Rep. 2005, 54, 11–13. Accessed July 14, 2025.

Follow-up actions for elevated levels of metals in blood and urine

Blood metals	Blood levels that trigger early follow-up	Notification letter	Phone contact that includes survey/discussion to identify possible exposure sources
Cadmium	≥ 5 µg/L	X	X
Lead	4.5 to < 9.5 µg/dL	X	X
Lead	≥ 9.5 µg/dL	Follow-up by the CDPH Occupational Lead Poisoning Prevention Program	Follow-up by the CDPH Occupational Lead Poisoning Prevention Program
Mercury	≥ 5.8 µg/L	X	X
Urine metals	**Urine levels that trigger early follow-up**	**Notification letter**	**Phone contact that includes survey/discussion to identify possible exposure sources**
Total arsenic	≥ 50 µg/L	X	N/A
Inorganic arsenic	≥ 19.5 µg/L	X	X
Cadmium	> 3 µg/g creatinine	X	X
Mercury	≥ 10 µg/L	X	X

Appendix C: Detailed methods

Data Collection

Study Design – The California Regional Exposure (CARE) Study is a series of cross-sectional biomonitoring studies that used a quota sampling approach based on the intersection of geography, race/ethnicity, and gender to represent specific regions of California. These regions include Los Angeles County (CARE-LA; Feb – June 2018); Riverside, San Bernardino, Imperial, Mono, and Inyo counties (CARE-2; Feb – April 2019); and San Diego and Orange counties (CARE-3; Feb – Mar 2020), which was ended prematurely due to the COVID-19 pandemic. Eligibility was limited to adults (18 and older) who had lived in their region for at least 12 months. Those who consented to participate completed two exposure questionnaires and provided blood and urine samples. The CARE Study protocol was approved by the California Committee for the Protection of Human Subjects.

Staff and Locations – The CARE Study was planned and enacted by Biomonitoring California staff alongside temporary field staff and in coordination with community partners. Field offices for sample processing and storage were set up at central locations in each region. Additional temporary satellite offices were set up for CARE-2 to accommodate sample collection from more remote areas.

Quota Determination – Quotas were based on population data available for each region. Geographic sub-regions (or zones) were identified to provide adequate geographic coverage of the region and ensure that areas with differing characteristics would not be entirely subsumed by dense population centers. CARE-LA's eight zones were delineated by service planning areas used by the county for health care planning purposes. CARE-2's five zones were delineated by zip-code boundaries, and CARE-3's five zones were delineated by census county subdivisions and census tracts. Race/ethnicity population estimates of these zones were taken from LA County Internal Services Department for CARE-LA and the American Community Survey (ACS) for CARE-2 and CARE-3 and were collapsed into five mutually exclusive categories (Asian, Black, Hispanic/Latino, White, Other). Gender was evenly divided between females and males in each stratum. Recruitment goals were calculated for each quota sampling group (bin) based on a total goal of 500 participants in CARE-LA and 350 participants each in CARE-2 and CARE-3. To allow for better statistical estimates for small sub-populations, we increased the minimum goals for certain groups above those dictated by population size. In CARE-LA, we set a goal of 60 Black participants and 20 participants in the Other race category. In CARE-2, we set a goal of 20 participants living across Inyo and Mono counties, and 30 participants living in Imperial County.

Participant Recruitment and Selection – Participants were recruited from the general population of each region. Outreach strategies were designed to attract a diverse pool of individuals to be screened and selected to participate in accordance with quota sampling goals. Mass mailings were distributed to a broad, randomly selected segment of the population. Mail codes in each zone (obtained from Melissa Global Intelligence) were divided into quartiles by median household income, and then randomly selected

from each zone-quartile. All households within selected mail codes were then included in the mass mailing. For CARE-2 and CARE-3, selection was limited to mail codes within a 90-minute drive from field offices. The goal during mail code selection was to reach approximately 70,000 households per region, though address errors reduced the true number of contacts.

In addition to the mass mailing, study information was posted on Craigslist; shared through professional networks; distributed at public events; and posted in community spaces. Outreach material included information about the study's purpose and directed individuals to complete the screening questionnaire to indicate their interest in participating. Financial incentives ($20 for CARE-LA and $50 for CARE-2 and CARE-3) were provided for participation and were advertised in outreach materials for CARE-2 and CARE-3.

A standardized protocol was used to assign potential participants to quota bins, including multiracial individuals and those who indicated other gender identities. We performed multiple rounds of selection taking into account varying enrollment and completion rates over the course of the study. In bins with high levels of interest, participants were selected at random, and participation was restricted to one person per household.

When quota bin goals were not being met, we conducted additional outreach. In CARE-LA, we worked with community organizations to recruit among their memberships. In CARE-2, we advertised on Craigslist for specific demographic groups. This targeted outreach accounted for 24% of CARE-LA participants and 7.8% of CARE-2 participants.

Accessibility and Inclusion – All study materials were available in English and Spanish, with additional language support available as needed. Participants could choose to complete consent forms and exposure surveys on mailed paper forms or through a secure digital portal. Sample collection appointments were available at a wide variety of times and locations, including at participants' homes.

Questionnaires – Participant information was collected at three timepoints. Key demographic information was collected on the screening questionnaire. Exposure Survey 1, which addressed long-term exposures and general frequency of exposures, could be completed any time before sample collection. Exposure Survey 2 was completed at sample collection and addressed recent, short-term exposures. Together, a wide range of information on potential exposure sources was captured, including housing, water, diet, occupation, hobbies, consumer products, smoking, wildfires, and air pollution. These surveys also collected data on reproductive history and additional demographics. Examples of these questionnaires are available on the Biomonitoring California website: https://biomonitoring.ca.gov/sites/default/files/downloads/CARE2Surveys.pdf. Examination of the data collected in exposure questionnaires is ongoing. For more information about continuing work, or to request access to data, please contact Biomonitoring California at biomonitoring@oehha.ca.gov.

Sample Collection – Samples were typically collected within three weeks of participant enrollment. Sample collection was conducted at field offices, events in public locations (e.g. libraries and community centers), and at participants' homes. Urine and blood samples were collected during the same appointment. Participants were provided instructions and specimen cups for self-collection of urine. Whole blood and serum samples were collected by licensed phlebotomists. Sample collection materials (e.g., cups and tubes) were specifically selected and treated to reduce the risk of contamination. Field blanks were collected daily for each bathroom used for urine collection. Samples were stored in temporary coolers immediately after collection (urine in Credo Cubes frozen at -20° C, and blood samples in a cooler with gel packs frozen at -4° C). At the end of the day, serum samples were centrifuged, and all samples were stored in a -20° C freezer. Batches of samples were shipped overnight on dry ice (urine and serum) or frozen gel packs (whole blood) to the Environmental Health Laboratory at the CDPH Richmond Campus.

Subsample Selection – All participants were evaluated for exposures to metals and PFASs. In addition, some participants were evaluated for exposures to environmental phenols and 1-nitropyrene. Selection of participants for these additional subsets depended on criteria such as participant consent for additional analyses, the total volume of the samples, and timing of sample collection.

Environmental Phenols

- Phenols analyses in CARE-LA were conducted on 60 female participants. Selection was limited to female participants who had consented to additional analyses and divided approximately evenly between four race/ethnicity groups (Asian, Black, Hispanic or Latino, White).
- Phenols analyses in CARE-2 were conducted on 151 participants. Selection was limited to those who consented to additional analyses and was proportional to original quota sampling goals for race and gender.
- Phenols analyses in CARE-3 were conducted on all 90 participants who completed the study.

1-Nitropyrene (1-NP) metabolites

- 1-NP metabolite analyses in CARE-LA were conducted on 159 participants. Selection was limited to those who consented to additional analyses; completed the study between February and mid-May; and provided at least 80mL of urine. Preference was given to those who reported living near or working with diesel powered equipment. Due to laboratory analytic issues, the number of reportable values varied by metabolite; as a result, the CARE-LA subset only includes data from 153 participants.
- 1-NP metabolite analyses in CARE-2 were conducted on 159 participants. To reduce the impact of seasonal variation, selection was limited to those who consented to additional analyses; completed the study in February or March; and provided at least 80mL of urine. We randomly selected the 159 participants from the 173

participants who met these eligibility criteria. Due to the laboratory analytic issues mentioned above, the CARE-2 subset only includes data from 158 participants.
- 1-NP analyses were not conducted in CARE-3.

Laboratory Methods

Analyses were conducted by the Environment Health Laboratory (EHL) at CDPH; the Environmental Chemistry Laboratory (ECL) at DTSC; and the Simpson Laboratory at the University of Washington (UW).

Medium	Analyte	Analytic Method	References	Laboratory
Whole Blood	Metals	Samples analyzed by inductively coupled plasma mass spectrometry (ICP-MS)	Similar to Choe and Gajek 2016[1] Gajek et al. 2012[2]	EHL
Urine	Metals	Samples analyzed by ICP-MS	Choe and Gajek 2016[3]	EHL
Urine	Arsenic speciation	Samples analyzed by high-performance liquid chromatography (HPLC) and ICP-MS	Similar to Sen et al. 2015[4]	EHL
Serum	PFASs	Samples analyzed with HPLC tandem mass spectrometry	Based off Kuklenyik et al. 2004[5]	ECL
Urine	Phenols	Samples analyzed using isotope dilution liquid chromatography tandem mass spectrometry	Gavin et al. 2013[6]	EHL
Urine	1-NP Metabolites	Samples analyzed with HPLC tandem mass spectrometry	Miller-Schulze et al. 2016[7] Toriba et al. 2007[8]	UW

[1] Choe KY, Gajek R. Determination of trace elements in human urine by ICP-MS using sodium chloride as a matrix-matching component in calibration. Anal Methods. 2016; 8:6754-6763. doi: 10.1039/C6AY01877G.
[2] Gajek R, Barley F, She J. Determination of essential and toxic metals in blood by ICP-MS with calibration in synthetic matrix. Anal Methods. 2013; 5:2193–202. doi:10.1039/C3AY26036D.
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[7] Miller-Schulze JP, Paulsen M, Kameda T, et al. Nitro-PAH exposures of occupationally-exposed traffic workers and associated urinary 1-nitropyrene metabolite concentrations. J Environ Sci. 2016; 49:213-221. doi:10.1016/j.jes.2016.06.007.
[8] Toriba A, Kitaoka H, Dills RL, et al. Identification and Quantification of 1-Nitropyrene Metabolites in Human Urine as a Proposed Biomarker for Exposure to Diesel Exhaust. Chem Res Toxicol. 2007; 20(7):999-1007. doi:10.1021/tx700015q.

Data Analysis

Weights – We weighted PFASs and metals data to be more representative of the region's general population. Due to smaller sample sizes, we did not conduct weighting for subsamples (phenols and 1-NP) or the CARE-3 dataset.

Weights were computed to account for the selection of multiple adults per household and calibrated to benchmark data using iterative proportional fitting.[9] Benchmark values were taken from the American Community Survey (2018 1-year estimates for CARE-LA; 2019 5-year estimates for CARE-2), and incorporated data on sex, age, race/ethnicity, education, geography, income, and household size. Extreme weights were trimmed to improve the stability of survey estimates. Statistical analyses accounted for the weights using survey procedures, specifying geographic strata and household clusters.

Prior to calculating weights, missing demographic data were imputed using hot-deck procedure in SAS software (SAS Institute Inc., Cary, NC, USA). Data that fell outside of ACS benchmark categories (i.e., other gender identities) were treated as missing. Variables with few missing values (race/ethnicity, education, gender; all missing less than 1% for CARE-LA and less than 2% for CARE-2) were imputed first, using cells indexed by age and geography. The hot-deck procedure was then indexed by age, geography, and the previously imputed variables and applied to household size (missing in <5% of unweighted records) and income (missing in 13% of unweighted records).

Imputed values were used in all analyses. Due to the higher level of missingness in income data, results reported on associations with income should be interpreted with caution.

Distributions – We calculated basic distribution statistics (geometric means and 50th and 95th percentiles) for all analytes. For metals and PFAS data from CARE-LA and CARE-2, statistics are provided for weighted and unweighted data. For analytes measured only in subsamples (phenols and 1-NP) and CARE-3, distribution statistics are unweighted. Unweighted data in this report should be viewed as representative of the sample rather than the underlying population.

For laboratory results below the limit of detection (LOD), we substituted the value LOD/√2. When a large proportion of samples are below the LOD, geometric means estimates are less reliable; thus we have not reported geometric means or model estimates when the detection frequency is less than 65%.

Distribution statistics for urinary metals and phenols are provided in units of micrograms per liter (µg/L) of urine and in units of micrograms per gram of creatinine (µg/g creatinine) to account for the individual's level of hydration at sample collection.

[9] Weights and imputations by Marketing Systems Group

Distribution statistics for 1-NP metabolites are provided in picograms per liter (pg/L) of urine and are adjusted for specific gravity to account for variation in hydration.

Comparisons to NHANES and between CARE regions – We compared the geometric means for four metals (arsenic, cadmium, lead, and mercury) and PFASs measured across CARE-LA, CARE-2, and NHANES.

There are population and temporal difference between these three data sources, so comparisons should take study design and sample collection dates into account. The most recent national data available at the time of this report are from the NHANES 2017-2018 cycle, which is used as comparison for CARE-LA (2018) and CARE-2 (2019).

Two sample t-tests were used to compare the difference in log-transformed means, and the comparisons were provided as percent differences in geometric means where significant at $p<0.05$. Where LODs differed between studies, percent differences were based on recalculated geometric means, applying the higher LOD to both datasets.

Distributions and adjusted percent change by demographic characteristics – Weighted distributions (geometric means and 50th and 95th percentiles) were calculated for selected analytes across five demographic variables: gender, race/ethnicity, age, education, and income.

- Gender was treated as a binary variable. In CARE-LA, participants were asked to report gender identity, but not sex assigned at birth; CARE-LA weights were benchmarked with information on sex from ACS, and therefore necessitated the reassignment of three participants who selected "other gender identity" into binary sex categories through imputation. In CARE-2, participants were asked to report both gender identity and sex assigned at birth.
- Race/ethnicity was analyzed using five mutually exclusive categories: Asian (single identification); Black (single identification); Hispanic or Latino (any race); White (single identification); and Other (including non-Hispanic multi-racial, American Indian or Alaskan Native, and Native Hawaiian or Other Pacific Islander). Appendix D delineates additional ways of categorizing participants' racial and ethnic identifications.
- Age was analyzed using three categories: 18-39 years; 40-59 years; and 60 years or older.
- Educational attainment was analyzed using four categories: no high school degree; high school diploma/General Educational Development (GED) diploma; college, some college or trade/technical school; and graduate degree.
- Household income was analyzed using four categories: ≤$25,000; $25,001-$75,000; $75,001-$150,000; and >$150,000

To determine differences between demographic groups, we used multi-variable linear regression models on log-transformed analyte concentrations, adjusting for the demographic factors listed above. For urinary analytes, log-transformed creatinine concentrations were included as a variable in the models. We report adjusted percent differences for demographic characteristics that are calculated by exponentiating the

beta estimate, subtracting 1, and multiplying by 100. For simplicity of presentation, a single reference group for each demographic comparison is provided.

Level of concern (LOC) exceedances – For analytes with specified LOCs (arsenic, cadmium, lead, and mercury), we present the numbers and weighted percentages of CARE-LA and CARE-2 participants who had a result over the LOC. For CARE-3, we present an unweighted percentage, since data from that region are limited.

Appendix D: Additional Race and Ethnicity Information

Recognizing that it is in the best interest of the State to respect, embrace, and understand the full diversity of its residents, the State of California passed Assembly Bill (AB) 532 (Government Code section 8310.9) in 2016, mandating comprehensive new requirements on the collection and reporting of race and ethnicity data by January 2022. Previously, many State forms required respondents to choose only a single ethnicity or race, forcing the sizable population of Californians with mixed race and/or ethnicity to deny part of their heritage and underrepresenting the true numbers of people who identify with various racial and ethnic groups. The new AB 532 reporting requirements allow state demographics to be examined on the basis of various tabulations:

- People who identify as a single ethnic or racial designation
- People who identify as multiple ethnic or racial designations
- People with a particular racial designation alone or in combination with other ethnic or racial designations

CARE Study participants were asked to indicate all racial or ethnic designations they identified with, and additional enumerations of these designations are provided in the following table.

Table D1: Racial and/or Ethnic Designations for CARE-LA (N = 430[1]) and CARE-2 (N = 359[1])

Participants who identified as a single race/ethnicity, not in combination with any other ethnic or racial designation	**CARE-LA Number**	**CARE-LA Percent (%)**	**CARE-2 Number**	**CARE-2 Percent (%)**
American Indian or Alaskan Native	2	<1	4	1
Asian	70	16	22	6
Black or African American	48	11	16	4
Hispanic or Latino[2]	127	30	139	39
Native Hawaiian or Other Pacific Islander	1	<1	0	0
White	129	30	131	36
Participants who identified as multiple ethnic or racial designations	**CARE-LA Number**	**CARE-LA Percent (%)**	**CARE-2 Number**	**CARE-2 Percent (%)**
Hispanic or Latino and one race[2]	26	6	22	6
Hispanic or Latino multiracial[2]	3	<1	5	1
Non-Hispanic multiracial[3]	22	5	13	4
Participants who identified as any of these ethnic or racial designations, either alone or in combination	**CARE-LA Number**	**CARE-LA Percent (%)**	**CARE-2 Number**	**CARE-2 Percent (%)**
American Indian or Alaskan Native	15	3	11	3
Asian	87	20	27	8
Black or African American	63	15	26	7
Hispanic or Latino	156	36	166	46
Native Hawaiian or Other Pacific Islander	1	<1	4	1
White	163	38	161	45

[1]Two individuals in CARE-LA and seven individuals in CARE-2 provided no race or ethnicity designations; therefore, numbers and percentages do not always equal the total sample population.
[2]CARE Study participants were asked their race and ethnicity in a single question, without a separate question about Hispanic or Latino ethnicity. Therefore, it is possible for a participant to have indicated "Hispanic or Latino" alone and no racial category.
[3]Includes individuals who identified as mixed/biracial without indicating particular racial designations.

Appendix E: Metal Concentrations in CARE-LA

The following tables present results for the 10 metals measured in CARE-LA in blood, and in urine with and without adjustment for hydration using creatinine measurements. Tables E1-E3 provide concentrations for all metals, weighted to the underlying population. Tables E4-E6 provide weighted concentrations and adjusted percent change stratified by demographic factors for metals with known levels of concern (arsenic, cadmium, lead, and mercury). Tables E7-E9 provide unweighted concentrations for all metals measured in CARE-LA. Geometric means (GMs) were not calculated for metals with a detection frequency less than 65% and are indicated with an asterisk (*). Some percentiles were below the limit of detection (LOD). Sample sizes listed in stratified tables include missing data that has been imputed. Adjusted percent changes reflect the percent difference from the referent category after adjusting for other demographic factors listed in the table. Please refer to Appendix C for detailed methods.

Table E1: CARE-LA blood metal concentrations (in µg/L for cadmium, manganese, and mercury, and µg/dL for lead), weighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	95th percentile	Total	LOD
Cadmium	99.6	0.258 (0.232, 0.286)	0.248	0.785	425	0.0750
Lead	100	0.768 (0.683, 0.862)	0.730	2.32	425	0.0250
Manganese	100	10.6 (10.1, 11.2)	10.4	20.3	425	0.750
Mercury	92.9	0.975 (0.794, 1.20)	1.04	6.02	425	0.125

Table E2: CARE-LA urinary metal concentrations (in µg/L), weighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	95th percentile	Total	LOD
Antimony	26.2	*	<LOD	0.101	428	0.0300
Arsenic	100	8.06 (6.69, 9.71)	7.91	67.2	428	0.100
Cadmium	100	0.153 (0.130, 0.182)	0.169	0.743	428	0.0100
Cobalt	100	0.217 (0.184, 0.256)	0.210	1.37	428	0.0100
Manganese	15.2	*	<LOD	0.174	428	0.100
Mercury	97.1	0.202 (0.159, 0.256)	0.232	2.63	428	0.0100
Molybdenum	100	36.0 (30.5, 42.5)	39.6	160	428	0.300
Thallium	99.8	0.154 (0.134, 0.178)	0.169	0.527	428	0.0100
Uranium	48.6	*	<LOD	0.116	428	0.0100

Table E3: CARE-LA urinary metal concentrations (µg/g creatinine), weighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	95th percentile	Total	LOD (µg/L)
Antimony	26.6	*	<LOD	0.180	426	0.0300
Arsenic	100	10.6 (9.06, 12.3)	9.14	59.7	426	0.100
Cadmium	100	0.199 (0.175, 0.227)	0.187	0.691	426	0.0100
Cobalt	100	0.284 (0.251, 0.321)	0.262	1.18	426	0.0100
Manganese	15.4	*	<LOD	0.611	426	0.100
Mercury	97.3	0.262 (0.218, 0.314)	0.277	1.73	426	0.0100
Molybdenum	100	47.1 (41.7, 53.2)	44.9	194	426	0.300
Thallium	100	0.200 (0.183, 0.218)	0.197	0.491	426	0.0100

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	95th percentile	Total	LOD (µg/L)
Uranium	49.3	*	<LOD	0.116	426	0.0100

Table E4: CARE-LA blood metal concentrations (in µg/L for cadmium and mercury, and µg/dL for lead) and adjusted percent change by demographic characteristics, weighted

Analyte	Demographic Characteristic	Sample Size	GM (95% CI)	50th percentile	95th percentile	Adjusted Percent Change (95% CI)
Cadmium	Overall	425	0.258 (0.232, 0.286)	0.248	0.785	
	18-39 Years	147	0.221 (0.194, 0.253)	0.213	0.579	ref
	40-59 Years	175	0.287 (0.232, 0.356)	0.291	1.13	46.6 (15.7, 85.7)
	60 Years or over	103	0.285 (0.243, 0.334)	0.250	0.676	21.7 (-0.588, 49.0)
	Male	162	0.223 (0.193, 0.257)	0.213	0.794	ref
	Female	263	0.300 (0.260, 0.347)	0.306	0.745	51.6 (29.0, 78.2)
	White	127	0.255 (0.212, 0.307)	0.231	1.08	ref
	Asian	70	0.316 (0.262, 0.381)	0.307	0.739	32.2 (7.56, 62.6)
	Black	49	0.364 (0.264, 0.503)	0.323	1.32	45.1 (5.20, 100)
	Hispanic or Latino	154	0.220 (0.188, 0.257)	0.201	0.702	-11.4 (-31.2, 14.2)
	Other	25	0.405 (0.255, 0.644)	0.299	1.16	60.9 (2.76, 152)
	No high school degree	42	0.255 (0.193, 0.336)	0.242	0.719	ref
	High school diploma/GED	23	0.271 (0.186, 0.396)	0.283	1.11	10.1 (-29.1, 70.9)
	College, some college, or trade/ technical school	240	0.254 (0.230, 0.281)	0.240	0.682	24.5 (-10.6, 73.4)
	Graduate degree	120	0.259 (0.221, 0.303)	0.234	0.753	23.7 (-15.2, 80.4)
	Income ≤ $25,000	108	0.329 (0.252, 0.429)	0.319	1.15	ref
	Income $25,001-$75,000	154	0.229 (0.194, 0.270)	0.211	0.719	-36.9 (-52.6, -15.9)
	Income $75,001-$150,000	121	0.240 (0.202, 0.285)	0.240	0.656	-35.9 (-52.9, -12.6)
	Income >$150,000	42	0.274 (0.232, 0.323)	0.237	0.641	-28.4 (-46.3, -4.66)
Lead	Overall	425	0.768 (0.683, 0.862)	0.730	2.32	
	18-39 Years	147	0.490 (0.426, 0.564)	0.489	1.13	ref
	40-59 Years	175	0.938 (0.758, 1.16)	0.911	3.28	88.1 (45.9, 143)
	60 Years or over	103	1.18 (1.05, 1.33)	1.23	2.19	127 (86.3, 177)
	Male	162	0.831 (0.729, 0.946)	0.866	2.14	ref
	Female	263	0.707 (0.582, 0.859)	0.610	3.17	-5.41 (-20.3, 12.3)
	White	127	0.900 (0.753, 1.08)	0.956	2.14	ref
	Asian	70	0.878 (0.647, 1.19)	0.742	2.73	31.5 (-0.382, 73.5)
	Black	49	1.06 (0.743, 1.50)	1.24	3.75	10.5 (-16.9, 46.9)
	Hispanic or Latino	154	0.603 (0.511, 0.712)	0.595	1.84	-18.4 (-35.6, 3.50)
	Other	25	1.19 (0.737, 1.91)	1.03	2.23	30.8 (-13.9, 98.5)
	No high school degree	42	0.853 (0.671, 1.08)	0.653	2.80	ref

Analyte	Demographic Characteristic	Sample Size	GM (95% CI)	50th percentile	95th percentile	Adjusted Percent Change (95% CI)
	High school diploma/GED	23	0.850 (0.561, 1.29)	0.850	2.66	3.83 (-31.9, 58.3)
	College, some college, or trade/ technical school	240	0.715 (0.621, 0.822)	0.694	2.05	-11.9 (-35.6, 20.6)
	Graduate degree	120	0.769 (0.633, 0.935)	0.902	1.44	-10.3 (-36.5, 26.6)
	Income ≤ $25,000	108	0.897 (0.715, 1.13)	0.975	2.33	ref
	Income $25,001-$75,000	154	0.707 (0.587, 0.852)	0.626	2.33	-11.6 (-31.2, 13.7)
	Income $75,001-$150,000	121	0.693 (0.522, 0.921)	0.650	2.81	-14.9 (-33.9, 9.43)
	Income >$150,000	42	0.877 (0.723, 1.06)	0.950	1.46	-12.0 (-34.2, 17.7)
Mercury	Overall	425	0.975 (0.794, 1.20)	1.04	6.02	
	18-39 Years	147	1.01 (0.723, 1.42)	1.03	5.68	ref
	40-59 Years	175	0.803 (0.542, 1.19)	0.766	13.4	-18.6 (-51.5, 36.4)
	60 Years or over	103	1.15 (0.841, 1.57)	1.51	4.86	29.8 (-16.1, 101)
	Male	162	1.05 (0.773, 1.43)	1.04	8.41	ref
	Female	263	0.900 (0.689, 1.18)	1.02	5.51	-15.7 (-41.5, 21.5)
	White	127	0.988 (0.676, 1.44)	1.16	5.46	ref
	Asian	70	2.38 (1.66, 3.42)	3.13	7.53	156 (47.2, 344)
	Black	49	0.826 (0.506, 1.35)	0.731	2.89	-12.1 (-51.3, 58.8)
	Hispanic or Latino	154	0.777 (0.561, 1.07)	0.653	5.60	-11.6 (-49.4, 54.4)
	Other	25	0.671 (0.324, 1.39)	0.591	3.34	-31.0 (-73.4, 78.5)
	No high school degree	42	0.681 (0.505, 0.916)	0.629	1.91	ref
	High school diploma/GED	23	0.957 (0.477, 1.92)	0.784	7.72	17.6 (-47.6, 164)
	College, some college, or trade/ technical school	240	1.01 (0.767, 1.33)	1.15	7.27	-17.1 (-51.9, 42.8)
	Graduate degree	120	1.52 (1.11, 2.08)	1.71	9.60	15.8 (-44.9, 143)
	Income ≤ $25,000	108	0.588 (0.401, 0.861)	0.444	3.60	ref
	Income $25,001-$75,000	154	1.07 (0.773, 1.49)	1.12	9.34	123 (30.6, 282)
	Income $75,001-$150,000	121	1.12 (0.745, 1.69)	1.20	5.51	104 (22.4, 239)
	Income >$150,000	42	1.22 (0.706, 2.11)	1.35	7.11	82.9 (-11.2, 277)

Table E5: CARE-LA urinary metal concentrations (in µg/L) by demographic characteristics, weighted

Analyte	Demographic Characteristic	Sample Size	GM (95% CI)	50th percentile	95th percentile
Arsenic	Overall	428	8.06 (6.69, 9.71)	7.91	67.2
	18-39 Years	148	7.42 (5.30, 10.4)	7.87	45.9
	40-59 Years	177	7.36 (5.76, 9.40)	6.85	62.4
	60 Years or over	103	10.1 (7.17, 14.3)	8.91	83.6

Analyte	Demographic Characteristic	Sample Size	GM (95% CI)	50th percentile	95th percentile
	Male	165	10.2 (7.97, 12.9)	8.69	95.7
	Female	263	6.34 (4.91, 8.19)	6.15	43.3
	White	129	6.89 (4.98, 9.55)	6.20	86.7
	Asian	71	16.7 (11.8, 23.7)	14.4	121
	Black	49	9.91 (5.58, 17.6)	8.45	57.3
	Hispanic or Latino	154	6.58 (4.89, 8.85)	6.95	43.0
	Other	25	13.4 (8.15, 22.1)	8.69	59.3
	No high school degree	42	7.59 (5.33, 10.8)	6.51	27.1
	High school diploma/GED	24	5.16 (3.56, 7.48)	5.23	18.6
	College, some college, or trade/ technical school	240	9.30 (6.99, 12.4)	9.26	94.9
	Graduate degree	122	9.48 (6.71, 13.4)	12.8	51.6
	Income ≤ $25,000	108	4.96 (3.74, 6.56)	4.89	21.9
	Income $25,001-$75,000	155	9.19 (6.37, 13.3)	9.19	96.6
	Income $75,001-$150,000	122	8.19 (5.76, 11.6)	8.71	62.8
	Income >$150,000	43	11.0 (8.05, 14.9)	10.4	63.3
Cadmium	Overall	428	0.153 (0.130, 0.182)	0.169	0.743
	18-39 Years	148	0.110 (0.0821, 0.148)	0.106	0.663
	40-59 Years	177	0.179 (0.141, 0.228)	0.191	0.664
	60 Years or over	103	0.209 (0.159, 0.275)	0.199	1.02
	Male	165	0.153 (0.123, 0.190)	0.189	0.474
	Female	263	0.154 (0.119, 0.199)	0.154	1.01
	White	129	0.154 (0.119, 0.201)	0.158	0.634
	Asian	71	0.192 (0.141, 0.261)	0.187	0.758
	Black	49	0.189 (0.0928, 0.385)	0.306	0.962
	Hispanic or Latino	154	0.130 (0.0986, 0.170)	0.132	0.669
	Other	25	0.326 (0.174, 0.610)	0.285	1.33
	No high school degree	42	0.180 (0.126, 0.258)	0.166	0.471
	High school diploma/GED	24	0.138 (0.0829, 0.230)	0.169	0.572
	College, some college, or trade/ technical school	240	0.152 (0.122, 0.189)	0.169	0.927
	Graduate degree	122	0.150 (0.108, 0.209)	0.158	0.628
	Income ≤ $25,000	108	0.133 (0.0833, 0.212)	0.145	0.974
	Income $25,001-$75,000	155	0.155 (0.117, 0.207)	0.166	0.791
	Income $75,001-$150,000	122	0.134 (0.105, 0.170)	0.143	0.469

Analyte	Demographic Characteristic	Sample Size	GM (95% CI)	50th percentile	95th percentile
	Income >$150,000	43	0.221 (0.166, 0.295)	0.307	0.493
Mercury	Overall	428	0.202 (0.159, 0.256)	0.232	2.63
	18-39 Years	148	0.218 (0.138, 0.343)	0.261	2.94
	40-59 Years	177	0.166 (0.116, 0.237)	0.152	2.69
	60 Years or over	103	0.227 (0.168, 0.306)	0.309	0.859
	Male	165	0.232 (0.174, 0.310)	0.267	2.09
	Female	263	0.175 (0.121, 0.253)	0.160	2.89
	White	129	0.180 (0.125, 0.259)	0.239	1.25
	Asian	71	0.260 (0.168, 0.403)	0.270	1.83
	Black	49	0.159 (0.0845, 0.298)	0.250	0.605
	Hispanic or Latino	154	0.202 (0.132, 0.311)	0.180	3.20
	Other	25	0.363 (0.150, 0.882)	0.230	2.50
	No high school degree	42	0.176 (0.111, 0.280)	0.153	2.57
	High school diploma/GED	24	0.251 (0.126, 0.499)	0.233	3.70
	College, some college, or trade/ technical school	240	0.197 (0.141, 0.274)	0.261	2.08
	Graduate degree	122	0.199 (0.148, 0.266)	0.189	1.05
	Income ≤ $25,000	108	0.136 (0.0928, 0.199)	0.105	1.02
	Income $25,001-$75,000	155	0.250 (0.157, 0.397)	0.291	2.95
	Income $75,001-$150,000	122	0.197 (0.125, 0.313)	0.230	2.29
	Income >$150,000	43	0.220 (0.153, 0.316)	0.231	0.961

Table E6: CARE-LA urinary metal concentrations (in µg/g creatinine) and adjusted percent change by demographic characteristics, weighted

Analyte	Demographic Characteristic	Sample Size	GM (95% CI)	50th percentile	95th percentile	Adjusted Percent Change (95% CI)
Arsenic	Overall	426	10.6 (9.06, 12.3)	9.14	59.7	
	18-39 Years	147	8.90 (6.94, 11.4)	7.41	57.6	ref
	40-59 Years	177	10.7 (8.36, 13.8)	8.82	61.1	23.9 (-10.6, 71.7)
	60 Years or over	102	13.4 (10.4, 17.3)	11.7	59.7	55.6 (10.3, 120)
	Male	165	10.2 (8.37, 12.4)	8.10	64.4	ref
	Female	261	10.9 (8.75, 13.7)	11.5	58.1	-1.32 (-24.5, 28.9)
	White	128	10.4 (7.91, 13.7)	7.44	66.1	ref
	Asian	71	20.8 (14.4, 30.1)	16.4	105	136 (54.9, 258)
	Black	49	11.8 (8.20, 17.1)	14.5	42.5	20.8 (-26.7, 99.1)
	Hispanic or Latino	153	8.37 (6.67, 10.5)	7.50	50.1	-11.6 (-39.0, 28.2)
	Other	25	11.4 (7.22, 18.1)	6.86	41.1	30.1 (-17.5, 105)
	No high school degree	42	10.2 (7.05, 14.6)	11.3	49.3	ref

Analyte	Demographic Characteristic	Sample Size	GM (95% CI)	50th percentile	95th percentile	Adjusted Percent Change (95% CI)
	High school diploma/GED	24	7.01 (4.57, 10.7)	5.31	37.5	-38.7 (-59.5, -7.25)
	College, some college, or trade/ technical school	238	11.9 (9.73, 14.5)	9.81	66.9	-6.48 (-37.9, 40.9)
	Graduate degree	122	12.8 (9.78, 16.7)	8.65	58.2	0.565 (-39.0, 65.9)
	Income ≤ $25,000	107	8.19 (6.16, 10.9)	7.13	30.3	ref
	Income $25,001-$75,000	154	11.3 (8.21, 15.5)	9.11	66.9	42.1 (-1.88, 106)
	Income $75,001-$150,000	122	11.9 (8.87, 16.0)	9.18	95.8	36.9 (-0.651, 88.6)
	Income >$150,000	43	10.5 (8.15, 13.5)	9.71	51.3	0.599 (-30.4, 45.3)
Cadmium	Overall	426	0.199 (0.175, 0.227)	0.187	0.691	
	18-39 Years	147	0.131 (0.111, 0.156)	0.124	0.461	ref
	40-59 Years	177	0.262 (0.220, 0.312)	0.225	0.770	105 (61.5, 160)
	60 Years or over	102	0.272 (0.225, 0.329)	0.233	0.836	105 (62.6, 158)
	Male	165	0.154 (0.133, 0.178)	0.145	0.580	ref
	Female	261	0.263 (0.214, 0.324)	0.263	0.928	92.2 (59.9, 131)
	White	128	0.230 (0.193, 0.274)	0.187	0.762	ref
	Asian	71	0.239 (0.175, 0.326)	0.218	0.681	26.4 (1.38, 57.6)
	Black	49	0.225 (0.158, 0.323)	0.194	0.671	-4.71 (-30.3, 30.2)
	Hispanic or Latino	153	0.164 (0.132, 0.203)	0.177	0.601	-29.3 (-45.2, -8.80)
	Other	25	0.277 (0.162, 0.474)	0.224	0.930	12.0 (-24.5, 66.1)
	No high school degree	42	0.241 (0.191, 0.304)	0.211	0.608	ref
	High school diploma/GED	24	0.188 (0.120, 0.294)	0.183	0.664	-12.4 (-42.3, 32.9)
	College, some college, or trade/ technical school	238	0.190 (0.163, 0.221)	0.171	0.739	-3.60 (-28.8, 30.6)
	Graduate degree	122	0.203 (0.159, 0.258)	0.193	0.661	-3.16 (-31.1, 36.2)
	Income ≤ $25,000	107	0.218 (0.154, 0.307)	0.218	0.694	ref
	Income $25,001-$75,000	154	0.187 (0.150, 0.232)	0.183	0.899	-20.3 (-42.5, 10.3)
	Income $75,001-$150,000	122	0.195 (0.154, 0.246)	0.178	0.595	-17.4 (-39.7, 13.1)
	Income >$150,000	43	0.212 (0.170, 0.264)	0.195	0.550	-24.9 (-45.3, 2.98)
Mercury	Overall	426	0.262 (0.218, 0.314)	0.277	1.73	
	18-39 Years	147	0.261 (0.190, 0.358)	0.277	1.72	ref
	40-59 Years	177	0.242 (0.171, 0.343)	0.252	2.14	-11.4 (-42.6, 36.8)
	60 Years or over	102	0.288 (0.230, 0.360)	0.271	1.06	38.6 (-5.24, 103)
	Male	165	0.233 (0.185, 0.292)	0.239	1.16	ref
	Female	261	0.296 (0.223, 0.394)	0.337	1.82	26.4 (-11.3, 80.2)
	White	128	0.262 (0.196, 0.350)	0.287	1.15	ref
	Asian	71	0.324 (0.214, 0.490)	0.408	1.09	29.6 (-19.3, 108)

Analyte	Demographic Characteristic	Sample Size	GM (95% CI)	50th percentile	95th percentile	Adjusted Percent Change (95% CI)
	Black	49	0.189 (0.134, 0.267)	0.238	0.405	-37.8 (-63.3, 5.25)
	Hispanic or Latino	153	0.257 (0.186, 0.356)	0.247	2.11	-7.65 (-43.9, 52.1)
	Other	25	0.309 (0.136, 0.701)	0.175	1.66	8.12 (-56.7, 170)
	No high school degree	42	0.236 (0.154, 0.361)	0.224	1.71	ref
	High school diploma/GED	24	0.341 (0.206, 0.564)	0.287	2.22	41.7 (-28.8, 182)
	College, some college, or trade/ technical school	238	0.245 (0.194, 0.310)	0.243	1.69	-15.5 (-52.4, 50.1)
	Graduate degree	122	0.268 (0.179, 0.401)	0.315	1.10	-0.151 (-49.7, 98.4)
	Income ≤ $25,000	107	0.224 (0.165, 0.302)	0.214	1.10	ref
	Income $25,001-$75,000	154	0.298 (0.212, 0.420)	0.330	2.13	54.5 (-6.80, 156)
	Income $75,001-$150,000	122	0.288 (0.200, 0.412)	0.293	1.68	36.0 (-11.7, 109)
	Income >$150,000	43	0.210 (0.147, 0.302)	0.214	0.650	-2.84 (-42.5, 64.3)

Table E7: CARE-LA blood metal concentrations (in µg/L for cadmium, manganese, and mercury, and µg/dL for lead), unweighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	95th percentile	Total	LOD
Cadmium	99.3	0.301 (0.283, 0.320)	0.292	0.884	425	0.0750
Lead	100	0.783 (0.739, 0.831)	0.755	2.16	425	0.0250
Manganese	100	10.3 (9.99, 10.6)	9.94	18.7	425	0.750
Mercury	94.8	1.05 (0.937, 1.17)	1.12	6.17	425	0.125

Table E8: CARE-LA urinary metal concentrations (in µg/L), unweighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	95th percentile	Total	LOD
Antimony	24.5	*	<LOD	0.0957	428	0.0300
Arsenic	100	8.21 (7.29, 9.26)	8.37	66.0	428	0.100
Cadmium	100	0.169 (0.152, 0.189)	0.187	0.951	428	0.0100
Cobalt	100	0.213 (0.192, 0.237)	0.226	1.40	428	0.0100
Manganese	15.2	*	<LOD	0.211	428	0.100
Mercury	97.7	0.181 (0.159, 0.206)	0.215	1.48	428	0.0100
Molybdenum	100	29.1 (26.3, 32.3)	34.0	152	428	0.300
Thallium	99.8	0.161 (0.148, 0.175)	0.182	0.586	428	0.0100
Uranium	49.3	*	<LOD	0.103	428	0.0100

Table E9: CARE-LA urinary metal concentrations (in µg/g creatinine), unweighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	95th percentile	Total	LOD (µg/L)
Antimony	24.6	*	<LOD	0.196	426	0.0300
Arsenic	100	12.1 (10.9, 13.3)	9.80	88.7	426	0.100
Cadmium	100	0.249 (0.231, 0.267)	0.242	0.826	426	0.0100

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	95th percentile	Total	LOD (µg/L)
Cobalt	100	0.312 (0.287, 0.338)	0.275	1.41	426	0.0100
Manganese	15.3	*	<LOD	0.714	426	0.100
Mercury	97.9	0.266 (0.240, 0.293)	0.275	1.32	426	0.0100
Molybdenum	100	42.7 (40.0, 45.6)	41.3	139	426	0.300
Thallium	100	0.236 (0.223, 0.250)	0.223	0.677	426	0.0100
Uranium	49.5	*	<LOD	0.0973	426	0.0100

Appendix F: Metal concentrations in CARE-2

The following tables present results for the 10 metals measured in CARE-2 in blood, and in urine with and without adjustment for hydration using creatinine measurements. Tables F1-F3 provide concentrations for all metals, weighted to the underlying population. Tables F4-F6 provide weighted concentrations and adjusted percent change stratified by demographic factors for metals with known levels of concern (arsenic, cadmium, lead, and mercury). Tables F7-F9 provide unweighted concentrations for all metals measured in CARE-2. Geometric means (GMs) were not calculated for metals with a detection frequency less than 65% and are indicated with an asterisk (*). Some percentiles were below the limit of detection (LOD). Sample sizes listed in stratified tables include missing data that has been imputed. Adjusted percent changes reflect the percent difference from the referent category after adjusting for other demographic factors listed in the table. Please refer to Appendix C for detailed methods.

Table F1: CARE-2 blood metal concentrations (in µg/L for cadmium, manganese, and mercury, and µg/dL for lead), weighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	95th percentile	Total	LOD
Cadmium	99.1	0.275 (0.246, 0.307)	0.266	0.793	359	0.0750
Lead	100	0.661 (0.591, 0.739)	0.712	1.80	359	0.0250
Manganese	100	10.1 (9.71, 10.6)	9.96	15.9	359	0.250
Mercury	94.8	0.719 (0.581, 0.889)	0.778	6.12	359	0.0750

Table F2: CARE-2 urinary metal concentrations (in µg/L), weighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	95th percentile	Total	LOD
Antimony	19.2	*	<LOD	0.343	357	0.0500
Arsenic	100	6.40 (5.16, 7.96)	6.27	42.1	357	0.100
Cadmium	95.1	0.172 (0.145, 0.205)	0.186	0.901	357	0.0300
Cobalt	92.9	0.182 (0.154, 0.215)	0.200	1.05	357	0.0300
Manganese	15.4	*	<LOD	0.212	357	0.100
Mercury	91.6	0.165 (0.138, 0.197)	0.168	0.922	357	0.0300
Molybdenum	100	33.5 (28.2, 39.8)	35.6	168	357	0.300
Thallium	100	0.148 (0.130, 0.169)	0.158	0.472	357	0.0100
Uranium	49.6	*	<LOD	0.0805	357	0.0100

Table F3: CARE-2 urinary metal concentrations (in µg/g creatinine), weighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	95th percentile	Total	LOD (µg/L)
Antimony	19.2	*	<LOD	0.309	357	0.0500
Arsenic	100	8.40 (7.10, 9.94)	6.86	50.4	357	0.100
Cadmium	95.1	0.226 (0.195, 0.262)	0.227	1.05	357	0.0300
Cobalt	92.9	0.238 (0.209, 0.272)	0.200	1.11	357	0.0300
Manganese	15.4	*	<LOD	0.555	357	0.100
Mercury	91.6	0.216 (0.184, 0.254)	0.213	1.34	357	0.0300
Molybdenum	100	43.9 (38.8, 49.7)	42.9	161	357	0.300
Thallium	100	0.194 (0.177, 0.214)	0.182	0.525	357	0.0100

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	95th percentile	Total	LOD (µg/L)
Uranium	49.6	*	<LOD	0.112	357	0.0100

Table F4: CARE-2 blood metal concentrations (in µg/L for cadmium and mercury, and µg/dL for lead) and adjusted percent change by demographic characteristics, weighted

Analyte	Demographic Characteristic	Sample Size	GM (95% CI)	50th percentile	95th percentile	Adjusted Percent Change (95% CI)
Cadmium	Overall	359	0.275 (0.246, 0.307)	0.266	0.793	
	18-39 Years	102	0.231 (0.190, 0.280)	0.239	0.802	ref
	40-59 Years	142	0.265 (0.220, 0.320)	0.229	0.709	18.3 (-9.04, 53.9)
	60 Years or over	115	0.373 (0.325, 0.430)	0.375	0.892	69.9 (33.7, 116)
	Male	157	0.266 (0.223, 0.316)	0.262	0.802	ref
	Female	202	0.284 (0.247, 0.326)	0.277	0.724	9.41 (-10.2, 33.4)
	White	131	0.308 (0.262, 0.362)	0.315	0.710	ref
	Asian	22	0.346 (0.249, 0.481)	0.341	0.658	32.7 (-3.26, 81.9)
	Black	17	0.334 (0.227, 0.491)	0.305	1.01	23.4 (-19.5, 89.1)
	Hispanic or Latino	170	0.232 (0.197, 0.272)	0.228	0.785	-16.7 (-34.5, 5.94)
	Other	19	0.463 (0.276, 0.776)	0.507	0.930	69.9 (-2.97, 197)
	No high school degree	20	0.251 (0.185, 0.341)	0.236	0.713	ref
	High school diploma/GED	55	0.313 (0.250, 0.392)	0.297	0.798	17.5 (-13.7, 59.9)
	College, some college, or trade/ technical school	216	0.270 (0.233, 0.312)	0.262	0.713	-3.63 (-28.9, 30.7)
	Graduate degree	68	0.239 (0.176, 0.323)	0.250	0.880	-23.6 (-47.9, 11.9)
	Income ≤ $25,000	103	0.307 (0.254, 0.370)	0.308	0.775	ref
	Income $25,001-$75,000	160	0.274 (0.231, 0.327)	0.265	0.726	-9.52 (-29.3, 15.7)
	Income $75,001-$150,000	73	0.258 (0.205, 0.325)	0.230	0.765	-8.17 (-31.4, 22.9)
	Income >$150,000	23	0.272 (0.197, 0.375)	0.280	0.685	-3.82 (-34.0, 40.1)
Lead	Overall	359	0.661 (0.591, 0.739)	0.712	1.80	
	18-39 Years	102	0.447 (0.376, 0.532)	0.454	1.20	ref
	40-59 Years	142	0.682 (0.577, 0.806)	0.696	1.49	64.8 (28.6, 111)
	60 Years or over	115	1.12 (0.997, 1.25)	1.10	2.12	158 (109, 220)
	Male	157	0.799 (0.689, 0.926)	0.856	2.04	ref
	Female	202	0.557 (0.480, 0.645)	0.602	1.50	-27.1 (-38.5, -13.7)
	White	131	0.780 (0.646, 0.942)	0.811	2.12	ref
	Asian	22	0.664 (0.428, 1.03)	0.488	1.56	22.7 (-10.0, 67.3)
	Black	17	0.598 (0.380, 0.941)	0.599	1.35	12.0 (-18.7, 54.4)
	Hispanic or Latino	170	0.593 (0.505, 0.696)	0.625	1.47	-9.30 (-27.8, 13.9)
	Other	19	0.779 (0.564, 1.08)	0.869	1.65	21.2 (-11.6, 66.1)
	No high school degree	20	0.749 (0.573, 0.979)	0.658	1.73	ref

Analyte	Demographic Characteristic	Sample Size	GM (95% CI)	50th percentile	95th percentile	Adjusted Percent Change (95% CI)
	High school diploma/GED	55	0.709 (0.553, 0.908)	0.804	1.85	-1.19 (-26.1, 32.2)
	College, some college, or trade/ technical school	216	0.617 (0.530, 0.718)	0.691	1.65	-14.5 (-35.9, 14.0)
	Graduate degree	68	0.630 (0.508, 0.781)	0.782	1.45	-17.9 (-43.4, 19.2)
	Income ≤ $25,000	103	0.616 (0.480, 0.791)	0.631	1.63	ref
	Income $25,001-$75,000	160	0.706 (0.597, 0.834)	0.666	1.85	16.3 (-7.86, 46.7)
	Income $75,001-$150,000	73	0.675 (0.544, 0.839)	0.794	1.48	18.5 (-10.8, 57.4)
	Income >$150,000	23	0.575 (0.410, 0.808)	0.576	1.63	-13.7 (-43.1, 30.8)
Mercury	Overall	359	0.719 (0.581, 0.889)	0.778	6.12	
	18-39 Years	102	0.618 (0.442, 0.865)	0.491	6.27	ref
	40-59 Years	142	0.865 (0.593, 1.26)	1.01	7.79	74.1 (7.83, 181)
	60 Years or over	115	0.697 (0.484, 1.00)	0.767	4.62	40.8 (-10.3, 121)
	Male	157	0.669 (0.488, 0.917)	0.690	5.03	ref
	Female	202	0.767 (0.578, 1.02)	0.869	6.22	13.5 (-26.9, 76.3)
	White	131	0.682 (0.466, 0.998)	0.729	6.18	ref
	Asian	22	1.81 (1.21, 2.71)	1.67	9.94	135 (24.9, 342)
	Black	17	0.824 (0.520, 1.31)	0.788	1.81	31.2 (-22.1, 121)
	Hispanic or Latino	170	0.630 (0.458, 0.867)	0.616	5.41	8.81 (-34.6, 81.1)
	Other	19	0.928 (0.494, 1.75)	1.16	2.88	51.9 (-32.9, 244)
	No high school degree	20	0.528 (0.360, 0.775)	0.454	2.00	ref
	High school diploma/GED	55	0.679 (0.464, 0.995)	0.497	4.92	39.8 (-23.5, 156)
	College, some college, or trade/ technical school	216	0.772 (0.547, 1.09)	0.865	7.92	40.1 (-14.0, 128)
	Graduate degree	68	0.992 (0.719, 1.37)	1.01	4.21	100 (-11.3, 353)
	Income ≤ $25,000	103	0.496 (0.368, 0.668)	0.443	3.41	ref
	Income $25,001-$75,000	160	0.652 (0.497, 0.857)	0.636	5.26	28.8 (-14.0, 92.8)
	Income $75,001-$150,000	73	1.09 (0.730, 1.63)	1.19	6.54	81.7 (8.97, 203)
	Income >$150,000	23	0.629 (0.258, 1.54)	0.934	7.01	-18.3 (-73.8, 155)

Table F5: CARE-2 urinary metal concentrations (in µg/L) by demographic characteristics, weighted

Analyte	Demographic Characteristic	Sample Size	GM (95% CI)	50th percentile	95th percentile
Arsenic	Overall	357	6.40 (5.16, 7.96)	6.27	42.1
	18-39 Years	101	6.15 (4.41, 8.58)	6.01	33.3
	40-59 Years	141	7.62 (5.04, 11.5)	6.43	91.0
	60 Years or over	115	5.38 (3.82, 7.57)	6.30	32.8

Analyte	Demographic Characteristic	Sample Size	GM (95% CI)	50th percentile	95th percentile
	Male	156	6.01 (4.57, 7.90)	5.54	43.9
	Female	201	6.79 (4.89, 9.41)	6.67	33.2
	White	131	4.88 (3.75, 6.35)	4.92	30.1
	Asian	22	12.3 (6.03, 25.2)	7.96	90.5
	Black	17	7.96 (5.07, 12.5)	7.39	30.5
	Hispanic or Latino	168	6.41 (4.47, 9.19)	6.04	30.7
	Other	19	14.5 (5.47, 38.6)	14.3	48.9
	No high school degree	20	7.07 (2.70, 18.6)	4.57	686
	High school diploma/GED	54	6.01 (4.19, 8.61)	4.36	27.4
	College, some college, or trade/ technical school	215	6.41 (5.00, 8.20)	7.20	37.1
	Graduate degree	68	6.60 (4.17, 10.4)	6.59	49.5
	Income ≤ $25,000	102	6.26 (4.73, 8.28)	6.28	25.3
	Income $25,001-$75,000	159	6.73 (4.36, 10.4)	5.71	99.2
	Income $75,001-$150,000	73	7.18 (4.85, 10.6)	7.29	49.3
	Income >$150,000	23	4.41 (2.83, 6.87)	5.08	10.4
Cadmium	Overall	357	0.172 (0.145, 0.205)	0.186	0.901
	18-39 Years	101	0.115 (0.0853, 0.155)	0.132	0.624
	40-59 Years	141	0.201 (0.163, 0.247)	0.206	0.648
	60 Years or over	115	0.252 (0.177, 0.360)	0.284	1.14
	Male	156	0.163 (0.121, 0.219)	0.188	1.04
	Female	201	0.181 (0.150, 0.218)	0.182	0.740
	White	131	0.160 (0.123, 0.208)	0.181	0.900
	Asian	22	0.241 (0.137, 0.424)	0.313	0.796
	Black	17	0.166 (0.114, 0.243)	0.134	0.714
	Hispanic or Latino	168	0.161 (0.124, 0.208)	0.160	0.651
	Other	19	0.536 (0.216, 1.33)	0.950	2.03
	No high school degree	20	0.177 (0.0996, 0.314)	0.233	0.658
	High school diploma/GED	54	0.186 (0.123, 0.282)	0.203	1.19
	College, some college, or trade/ technical school	215	0.168 (0.139, 0.203)	0.160	0.811
	Graduate degree	68	0.148 (0.104, 0.209)	0.149	0.475
	Income ≤ $25,000	102	0.185 (0.134, 0.255)	0.187	0.843
	Income $25,001-$75,000	159	0.175 (0.126, 0.241)	0.202	1.12
	Income $75,001-$150,000	73	0.155 (0.114, 0.211)	0.136	0.660

Analyte	Demographic Characteristic	Sample Size	GM (95% CI)	50th percentile	95th percentile
	Income >$150,000	23	0.191 (0.134, 0.272)	0.200	0.521
Mercury	Overall	357	0.165 (0.138, 0.197)	0.168	0.922
	18-39 Years	101	0.161 (0.122, 0.212)	0.206	0.812
	40-59 Years	141	0.204 (0.149, 0.281)	0.180	1.47
	60 Years or over	115	0.128 (0.0952, 0.172)	0.144	0.733
	Male	156	0.148 (0.111, 0.199)	0.144	0.855
	Female	201	0.182 (0.148, 0.223)	0.170	1.32
	White	131	0.106 (0.0796, 0.142)	0.0832	0.852
	Asian	22	0.307 (0.191, 0.495)	0.349	2.48
	Black	17	0.130 (0.0931, 0.182)	0.115	0.409
	Hispanic or Latino	168	0.204 (0.158, 0.264)	0.209	1.33
	Other	19	0.248 (0.109, 0.566)	0.434	0.597
	No high school degree	20	0.248 (0.142, 0.434)	0.244	1.68
	High school diploma/GED	54	0.149 (0.102, 0.218)	0.166	0.738
	College, some college, or trade/ technical school	215	0.151 (0.121, 0.188)	0.145	0.906
	Graduate degree	68	0.186 (0.128, 0.270)	0.160	0.946
	Income ≤ $25,000	102	0.193 (0.132, 0.282)	0.241	1.74
	Income $25,001-$75,000	159	0.146 (0.108, 0.198)	0.151	1.26
	Income $75,001-$150,000	73	0.192 (0.145, 0.256)	0.202	0.834
	Income >$150,000	23	0.128 (0.0738, 0.223)	0.126	0.662

Table F6: CARE-2 urinary metal concentrations (in µg/g creatinine) and adjusted percent change by demographic characteristics, weighted

Analyte	Demographic Characteristic	Sample Size	GM (95% CI)	50th percentile	95th percentile	Adjusted Percent Change (95% CI)
Arsenic	Overall	357	8.40 (7.10, 9.94)	6.86	50.4	
	18-39 Years	101	7.13 (5.71, 8.91)	6.13	34.3	ref
	40-59 Years	141	8.91 (6.35, 12.5)	6.89	57.5	59.3 (6.47, 138)
	60 Years or over	115	9.83 (7.36, 13.1)	8.13	69.5	41.7 (-5.27, 112)
	Male	156	7.39 (6.01, 9.08)	6.70	40.2	ref
	Female	201	9.43 (7.29, 12.2)	7.36	54.7	19.4 (-13.4, 64.7)
	White	131	8.63 (6.81, 10.9)	6.83	49.7	ref
	Asian	22	17.7 (12.4, 25.4)	18.4	56.1	114 (31.9, 247)
	Black	17	7.50 (4.37, 12.9)	5.96	48.2	-6.43 (-50.9, 78.2)
	Hispanic or Latino	168	7.43 (5.65, 9.77)	6.13	41.1	-3.08 (-33.5, 41.3)
	Other	19	10.6 (6.17, 18.4)	10.8	20.3	86.8 (-12.5, 299)
	No high school degree	20	9.22 (4.46, 19.1)	6.51	235	ref

Analyte	Demographic Characteristic	Sample Size	GM (95% CI)	50th percentile	95th percentile	Adjusted Percent Change (95% CI)
	High school diploma/GED	54	7.38 (5.61, 9.71)	6.68	24.0	-14.2 (-58.2, 76.1)
	College, some college, or trade/ technical school	215	8.58 (7.05, 10.4)	6.66	55.1	6.05 (-48.9, 120)
	Graduate degree	68	9.57 (6.58, 13.9)	7.70	42.2	39.7 (-33.8, 195)
	Income ≤ $25,000	102	8.36 (6.40, 10.9)	7.53	42.0	ref
	Income $25,001-$75,000	159	8.55 (6.11, 12.0)	6.97	54.3	-1.90 (-36.9, 52.6)
	Income $75,001-$150,000	73	9.43 (7.07, 12.6)	7.47	53.7	-8.97 (-40.2, 38.6)
	Income >$150,000	23	6.13 (4.53, 8.30)	4.25	20.8	-54.0 (-69.8, -30.0)
Cadmium	Overall	357	0.226 (0.195, 0.262)	0.227	1.05	
	18-39 Years	101	0.133 (0.108, 0.165)	0.113	0.511	ref
	40-59 Years	141	0.235 (0.191, 0.288)	0.234	0.881	96.0 (49.7, 157)
	60 Years or over	115	0.461 (0.365, 0.582)	0.468	1.55	250 (161, 370)
	Male	156	0.201 (0.157, 0.256)	0.164	1.03	ref
	Female	201	0.252 (0.210, 0.301)	0.241	1.40	29.4 (2.29, 63.7)
	White	131	0.282 (0.223, 0.357)	0.271	1.03	ref
	Asian	22	0.347 (0.161, 0.747)	0.241	1.59	86.7 (10.9, 214)
	Black	17	0.157 (0.123, 0.200)	0.131	0.457	-13.4 (-37.0, 19.0)
	Hispanic or Latino	168	0.186 (0.152, 0.228)	0.188	0.951	-1.72 (-26.0, 30.4)
	Other	19	0.393 (0.257, 0.601)	0.434	0.940	160 (34.9, 401)
	No high school degree	20	0.231 (0.153, 0.347)	0.215	0.984	ref
	High school diploma/GED	54	0.229 (0.158, 0.330)	0.182	1.46	22.5 (-20.7, 89.4)
	College, some college, or trade/ technical school	215	0.225 (0.188, 0.269)	0.250	1.02	8.32 (-27.5, 61.8)
	Graduate degree	68	0.214 (0.155, 0.295)	0.192	0.760	-17.9 (-50.0, 34.8)
	Income ≤ $25,000	102	0.246 (0.177, 0.342)	0.236	1.01	ref
	Income $25,001-$75,000	159	0.222 (0.174, 0.283)	0.173	1.24	-11.0 (-35.2, 22.2)
	Income $75,001-$150,000	73	0.204 (0.155, 0.269)	0.232	0.647	-15.2 (-39.7, 19.4)
	Income >$150,000	23	0.266 (0.181, 0.389)	0.257	0.902	-12.1 (-43.8, 37.4)
Mercury	Overall	357	0.216 (0.184, 0.254)	0.213	1.34	
	18-39 Years	101	0.186 (0.141, 0.246)	0.213	1.15	ref
	40-59 Years	141	0.239 (0.180, 0.316)	0.200	1.19	54.2 (5.43, 125)
	60 Years or over	115	0.234 (0.181, 0.303)	0.187	1.36	25.4 (-12.0, 78.6)
	Male	156	0.182 (0.143, 0.231)	0.220	1.10	ref
	Female	201	0.252 (0.204, 0.312)	0.212	1.59	27.4 (-4.52, 70.0)
	White	131	0.188 (0.148, 0.239)	0.182	0.779	ref
	Asian	22	0.442 (0.297, 0.658)	0.362	1.39	151 (55.5, 304)

Analyte	Demographic Characteristic	Sample Size	GM (95% CI)	50th percentile	95th percentile	Adjusted Percent Change (95% CI)
	Black	17	0.123 (0.0776, 0.194)	0.128	0.355	-21.6 (-48.7, 19.9)
	Hispanic or Latino	168	0.236 (0.184, 0.303)	0.213	1.61	46.0 (-1.61, 117)
	Other	19	0.182 (0.109, 0.303)	0.247	0.452	69.0 (-20.1, 258)
	No high school degree	20	0.324 (0.206, 0.510)	0.219	1.41	ref
	High school diploma/GED	54	0.183 (0.131, 0.256)	0.221	0.700	-26.9 (-57.7, 26.4)
	College, some college, or trade/ technical school	215	0.202 (0.164, 0.249)	0.187	1.44	-18.2 (-50.6, 35.4)
	Graduate degree	68	0.269 (0.180, 0.403)	0.299	1.15	19.4 (-39.3, 135)
	Income ≤ $25,000	102	0.258 (0.188, 0.355)	0.261	1.14	ref
	Income $25,001-$75,000	159	0.186 (0.145, 0.238)	0.160	1.18	-32.0 (-53.1, -1.59)
	Income $75,001-$150,000	73	0.253 (0.184, 0.347)	0.270	1.58	-17.2 (-45.6, 26.2)
	Income >$150,000	23	0.178 (0.120, 0.266)	0.133	0.647	-51.2 (-73.5, -9.89)

Table F7: CARE-2 blood metal concentrations (in µg/L for cadmium, manganese, and mercury, and µg/dL for lead), unweighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	95th percentile	Total	LOD
Cadmium	98.3	0.270 (0.251, 0.290)	0.265	0.809	359	0.0750
Lead	100	0.676 (0.632, 0.723)	0.717	1.81	359	0.0250
Manganese	100	10.2 (9.91, 10.6)	10.2	16.4	359	0.250
Mercury	95.0	0.651 (0.575, 0.738)	0.676	5.02	359	0.0750

Table F8: CARE-2 urinary metal concentrations (in µg/L), unweighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	95th percentile	Total	LOD
Antimony	17.6	*	<LOD	0.168	357	0.0500
Arsenic	100	6.01 (5.32, 6.78)	6.19	49.2	357	0.100
Cadmium	95.0	0.178 (0.159, 0.199)	0.185	1.12	357	0.0300
Cobalt	94.1	0.193 (0.173, 0.216)	0.192	1.21	357	0.0300
Manganese	19.0	*	<LOD	0.310	357	0.100
Mercury	87.1	0.155 (0.136, 0.177)	0.159	1.29	357	0.0300
Molybdenum	100	30.9 (27.8, 34.4)	34.4	140	357	0.300
Thallium	99.7	0.148 (0.136, 0.161)	0.166	0.469	357	0.0100
Uranium	53.2	*	0.0109	0.108	357	0.0100

Table F9: CARE-2 urinary metal concentrations (in µg/g creatinine), unweighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	95th percentile	Total	LOD (µg/L)
Antimony	17.6	*	<LOD	0.305	357	0.0500
Arsenic	100	8.04 (7.27, 8.88)	6.49	50.5	357	0.100
Cadmium	95.0	0.238 (0.219, 0.259)	0.241	0.914	357	0.0300

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	95th percentile	Total	LOD (µg/L)
Cobalt	94.1	0.258 (0.236, 0.283)	0.225	1.18	357	0.0300
Manganese	19.0	*	<LOD	0.754	357	0.100
Mercury	87.1	0.208 (0.185, 0.233)	0.201	1.35	357	0.0300
Molybdenum	100	41.4 (38.7, 44.2)	42.4	116	357	0.300
Thallium	99.7	0.198 (0.186, 0.212)	0.190	0.569	357	0.0100
Uranium	53.2	*	0.0187	0.129	357	0.0100

Appendix G: PFAS concentrations in CARE-LA

The following tables present results for the 12 PFASs measured in CARE-LA. Table G1 provides concentrations for all PFASs, weighted to the underlying population. Table G2 provides weighted concentrations and adjusted percent changes stratified by demographic factors for PFASs with detection frequencies over 65%. Table G3 provides unweighted concentrations for all PFASs measured in CARE-LA. Geometric means (GMs) were not calculated for PFASs with a detection frequency less than 65% and are indicated with an asterisk (*). Some percentiles were below the limit of detection (LOD). Sample sizes listed in stratified tables include missing data that have been imputed. Adjusted percent changes reflect the percent difference from the referent category after adjusting for other demographic factors listed in the table. Please refer to Appendix C for detailed methods and the "Acronyms and abbreviations" section (page 3) for full chemical names.

Table G1: CARE-LA serum PFAS concentrations (in ng/mL), weighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	95th percentile	Total	LOD
Et-PFOSA-AcOH	35.7	*	<LOD	0.0554	425	0.0115
Me-PFOSA-AcOH	100	0.0678 (0.0589, 0.0780)	0.0558	0.340	425	0.0114
PFBS	5.5	*	<LOD	0.0357	425	0.0303
PFDA	62.3	*	0.0795	0.321	425	0.0560
PFDoA	0.3	*	<LOD	<LOD	425	0.110
PFHpA	52.0	*	0.0280	0.0981	425	0.0256
PFHxS	98.5	0.689 (0.585, 0.813)	0.787	2.39	425	0.0177
PFNA	96.9	0.298 (0.263, 0.339)	0.320	1.16	425	0.0424
PFOA	99.8	1.04 (0.920, 1.17)	1.17	3.06	425	0.0606
PFOS	98.0	2.20 (1.87, 2.60)	2.38	8.78	425	0.0615
PFOSA	26.7	*	<LOD	0.0611	425	0.0144
PFUnDA	77.6	0.0721 (0.0619, 0.0840)	0.0735	0.350	425	0.0285

Table G2: CARE-LA serum PFAS concentrations (in ng/mL) and adjusted percent change by demographic characteristics, weighted

Analyte	Demographic Characteristic	Sample Size	GM (95% CI)	50th percentile	95th percentile	Adjusted Percent Change (95% CI)
Me-PFOSA-AcOH	Overall	425	0.0678 (0.0589, 0.0780)	0.0558	0.340	
	18-39 Years	147	0.0520 (0.0437, 0.0619)	0.0495	0.202	ref
	40-59 Years	175	0.0596 (0.0468, 0.0759)	0.0542	0.266	33.7 (-0.986, 80.4)
	60 Years or over	103	0.116 (0.0889, 0.151)	0.0893	0.588	107 (47.0, 190)
	Male	162	0.0723 (0.0587, 0.0891)	0.0565	0.457	ref
	Female	263	0.0634 (0.0526, 0.0764)	0.0550	0.279	1.78 (-20.2, 29.8)
	White	127	0.0814 (0.0651, 0.102)	0.0703	0.363	ref
	Asian	70	0.0775 (0.0514, 0.117)	0.0572	0.277	18.0 (-22.4, 79.5)
	Black	49	0.131 (0.0793, 0.218)	0.106	0.984	51.5 (-6.87, 146)
	Hispanic or Latino	154	0.0493 (0.0411, 0.0592)	0.0484	0.197	-16.4 (-39.5, 15.5)
	Other	25	0.0962 (0.0492, 0.188)	0.0567	0.360	43.2 (-38.1, 231)

Analyte	Demographic Characteristic	Sample Size	GM (95% CI)	50th percentile	95th percentile	Adjusted Percent Change (95% CI)
	No high school degree	42	0.0471 (0.0327, 0.0679)	0.0443	0.259	ref
	High school diploma/GED	23	0.0691 (0.0469, 0.102)	0.0510	0.271	35.7 (-19.2, 128)
	College, some college, or trade/ technical school	240	0.0763 (0.0648, 0.0899)	0.0618	0.464	47.2 (-2.77, 123)
	Graduate degree	120	0.0670 (0.0516, 0.0871)	0.0561	0.335	27.1 (-26.1, 119)
	Income ≤ $25,000	108	0.0708 (0.0505, 0.0991)	0.0595	0.276	ref
	Income $25,001-$75,000	154	0.0617 (0.0493, 0.0772)	0.0509	0.428	-8.35 (-34.1, 27.5)
	Income $75,001-$150,000	121	0.0728 (0.0559, 0.0950)	0.0560	0.356	3.56 (-26.2, 45.3)
	Income >$150,000	42	0.0707 (0.0510, 0.0980)	0.0584	0.235	-11.4 (-44.2, 40.7)
PFHxS	Overall	425	0.689 (0.585, 0.813)	0.787	2.39	
	18-39 Years	147	0.523 (0.392, 0.696)	0.577	1.95	ref
	40-59 Years	175	0.636 (0.498, 0.813)	0.759	2.27	29.1 (-16.1, 98.7)
	60 Years or over	103	1.14 (0.886, 1.45)	1.10	4.30	105 (45.2, 191)
	Male	162	0.940 (0.718, 1.23)	1.02	2.75	ref
	Female	263	0.499 (0.420, 0.593)	0.550	1.62	-41.8 (-56.4, -22.3)
	White	127	0.987 (0.786, 1.24)	0.915	3.53	ref
	Asian	70	0.884 (0.729, 1.07)	0.879	2.27	14.3 (-14.3, 52.5)
	Black	49	0.791 (0.500, 1.25)	0.806	2.68	-15.9 (-43.8, 25.9)
	Hispanic or Latino	154	0.473 (0.356, 0.630)	0.550	1.95	-25.8 (-44.0, -1.56)
	Other	25	1.17 (0.711, 1.92)	1.18	2.38	35.0 (-7.87, 97.7)
	No high school degree	42	0.406 (0.229, 0.718)	0.465	1.93	ref
	High school diploma/GED	23	0.660 (0.498, 0.875)	0.757	1.61	39.9 (-30.0, 180)
	College, some college, or trade/ technical school	240	0.788 (0.648, 0.958)	0.788	2.55	32.3 (-31.9, 157)
	Graduate degree	120	0.920 (0.727, 1.16)	0.951	2.47	37.0 (-33.0, 180)
	Income ≤ $25,000	108	0.475 (0.296, 0.762)	0.684	1.78	ref
	Income $25,001-$75,000	154	0.689 (0.572, 0.829)	0.722	2.40	64.7 (10.6, 145)
	Income $75,001-$150,000	121	0.822 (0.635, 1.06)	0.903	2.39	83.5 (21.4, 178)
	Income >$150,000	42	0.847 (0.524, 1.37)	0.882	6.22	45.4 (-16.0, 152)
PFNA	Overall	425	0.298 (0.263, 0.339)	0.320	1.16	
	18-39 Years	147	0.233 (0.191, 0.284)	0.300	0.609	ref
	40-59 Years	175	0.286 (0.227, 0.360)	0.287	1.44	40.1 (2.35, 91.8)
	60 Years or over	103	0.452 (0.381, 0.536)	0.461	1.26	103 (54.8, 167)
	Male	162	0.328 (0.270, 0.398)	0.355	1.13	ref
	Female	263	0.271 (0.230, 0.319)	0.275	1.17	-10.5 (-29.3, 13.2)

Analyte	Demographic Characteristic	Sample Size	GM (95% CI)	50th percentile	95th percentile	Adjusted Percent Change (95% CI)
	White	127	0.361 (0.304, 0.428)	0.368	1.09	ref
	Asian	70	0.504 (0.385, 0.658)	0.436	1.33	71.4 (25.5, 134)
	Black	49	0.309 (0.233, 0.409)	0.345	0.570	-9.22 (-31.1, 19.6)
	Hispanic or Latino	154	0.224 (0.182, 0.277)	0.233	0.644	-12.9 (-35.6, 17.8)
	Other	25	0.266 (0.187, 0.381)	0.286	0.612	-18.3 (-52.5, 40.5)
	No high school degree	42	0.206 (0.148, 0.285)	0.249	0.543	ref
	High school diploma/GED	23	0.274 (0.175, 0.430)	0.209	1.37	31.0 (-25.8, 131)
	College, some college, or trade/ technical school	240	0.330 (0.292, 0.374)	0.343	0.901	27.5 (-15.9, 93.2)
	Graduate degree	120	0.385 (0.313, 0.473)	0.366	1.06	30.2 (-17.6, 106)
	Income ≤ $25,000	108	0.219 (0.150, 0.318)	0.274	1.11	ref
	Income $25,001-$75,000	154	0.283 (0.238, 0.335)	0.287	0.918	35.5 (-1.29, 85.9)
	Income $75,001-$150,000	121	0.344 (0.287, 0.413)	0.356	0.834	57.0 (15.3, 114)
	Income >$150,000	42	0.399 (0.292, 0.547)	0.373	1.73	44.1 (0.830, 106)
PFOA	Overall	425	1.04 (0.920, 1.17)	1.17	3.06	
	18-39 Years	147	0.855 (0.705, 1.04)	0.955	2.03	ref
	40-59 Years	175	0.954 (0.785, 1.16)	1.14	2.70	29.0 (-1.96, 69.7)
	60 Years or over	103	1.52 (1.26, 1.82)	1.39	3.53	82.4 (38.2, 141)
	Male	162	1.19 (1.01, 1.41)	1.32	3.02	ref
	Female	263	0.897 (0.754, 1.07)	0.983	2.89	-16.6 (-32.6, 3.11)
	White	127	1.38 (1.21, 1.59)	1.40	3.45	ref
	Asian	70	1.54 (1.14, 2.07)	1.41	4.96	35.6 (-3.21, 89.9)
	Black	49	1.01 (0.821, 1.25)	0.999	2.31	-24.6 (-42.9, -0.509)
	Hispanic or Latino	154	0.757 (0.624, 0.919)	0.859	1.78	-22.0 (-39.2, 0.0103)
	Other	25	1.18 (1.03, 1.36)	1.19	1.78	-2.57 (-32.0, 39.7)
	No high school degree	42	0.617 (0.444, 0.857)	0.620	1.47	ref
	High school diploma/GED	23	1.08 (0.751, 1.56)	1.19	3.38	61.3 (1.60, 156)
	College, some college, or trade/ technical school	240	1.15 (1.03, 1.30)	1.23	3.13	47.1 (-0.393, 117)
	Graduate degree	120	1.34 (1.12, 1.61)	1.40	2.93	60.3 (5.07, 145)
	Income ≤ $25,000	108	0.837 (0.576, 1.22)	0.975	4.90	ref
	Income $25,001-$75,000	154	1.03 (0.901, 1.18)	1.06	2.99	28.3 (-2.64, 69.0)
	Income $75,001-$150,000	121	1.14 (0.923, 1.40)	1.41	2.45	31.2 (-6.67, 84.3)
	Income >$150,000	42	1.20 (0.889, 1.61)	1.37	2.89	10.7 (-22.0, 57.0)
PFOS	Overall	425	2.20 (1.87, 2.60)	2.38	8.78	

Analyte	Demographic Characteristic	Sample Size	GM (95% CI)	50th percentile	95th percentile	Adjusted Percent Change (95% CI)
	18-39 Years	147	1.54 (1.17, 2.01)	1.95	4.61	ref
	40-59 Years	175	1.96 (1.56, 2.47)	2.07	7.16	43.3 (-7.45, 122)
	60 Years or over	103	4.27 (3.39, 5.37)	3.95	12.0	185 (90.6, 326)
	Male	162	2.64 (2.02, 3.45)	2.95	10.2	ref
	Female	263	1.82 (1.49, 2.22)	1.73	6.07	-23.1 (-42.8, 3.38)
	White	127	2.97 (2.40, 3.67)	3.41	11.0	ref
	Asian	70	3.62 (2.43, 5.40)	3.05	26.4	68.5 (6.65, 166)
	Black	49	2.83 (1.91, 4.21)	2.77	8.09	-7.84 (-37.4, 35.6)
	Hispanic or Latino	154	1.48 (1.13, 1.93)	1.65	5.34	-24.1 (-45.6, 5.99)
	Other	25	2.20 (1.73, 2.81)	2.01	5.83	-15.3 (-47.5, 36.5)
	No high school degree	42	1.41 (0.829, 2.40)	1.57	5.65	ref
	High school diploma/GED	23	2.10 (1.26, 3.52)	2.01	9.90	31.9 (-35.9, 171)
	College, some college, or trade/ technical school	240	2.46 (2.11, 2.85)	2.60	8.47	17.7 (-36.2, 117)
	Graduate degree	120	2.89 (2.24, 3.74)	2.92	11.7	29.8 (-32.9, 151)
	Income ≤ $25,000	108	1.63 (0.899, 2.95)	2.21	26.1	ref
	Income $25,001-$75,000	154	2.14 (1.79, 2.55)	2.21	7.92	53.2 (-0.247, 135)
	Income $75,001-$150,000	121	2.64 (2.16, 3.24)	2.70	8.52	76.2 (11.7, 178)
	Income >$150,000	42	2.60 (1.81, 3.75)	2.75	11.3	23.1 (-26.1, 105)
PFUnDA	Overall	425	0.0721 (0.0619, 0.0840)	0.0735	0.350	
	18-39 Years	147	0.0625 (0.0493, 0.0792)	0.0593	0.286	ref
	40-59 Years	175	0.0627 (0.0481, 0.0816)	0.0540	0.335	18.5 (-17.1, 69.3)
	60 Years or over	103	0.104 (0.0801, 0.136)	0.109	0.502	75.6 (23.5, 150)
	Male	162	0.0723 (0.0586, 0.0892)	0.0766	0.339	ref
	Female	263	0.0719 (0.0574, 0.0901)	0.0676	0.354	10.1 (-14.8, 42.4)
	White	127	0.0840 (0.0650, 0.108)	0.102	0.339	ref
	Asian	70	0.198 (0.140, 0.280)	0.198	0.685	171 (69.1, 335)
	Black	49	0.0662 (0.0465, 0.0943)	0.0838	0.165	-17.2 (-44.6, 23.8)
	Hispanic or Latino	154	0.0496 (0.0413, 0.0595)	0.0450	0.197	-25.6 (-49.4, 9.16)
	Other	25	*	0.0580	0.185	-31.5 (-67.9, 46.1)
	No high school degree	42	0.0502 (0.0387, 0.0652)	0.0470	0.132	ref
	High school diploma/GED	23	*	0.0398	0.402	-5.19 (-46.6, 68.5)
	College, some college, or trade/ technical school	240	0.0779 (0.0645, 0.0941)	0.0901	0.349	5.80 (-28.3, 56.0)
	Graduate degree	120	0.131 (0.105, 0.164)	0.120	0.432	52.6 (-10.9, 161)
	Income ≤ $25,000	108	0.0554 (0.0377, 0.0815)	0.0436	0.681	ref

Analyte	Demographic Characteristic	Sample Size	GM (95% CI)	50th percentile	95th percentile	Adjusted Percent Change (95% CI)
	Income $25,001-$75,000	154	0.0627 (0.0507, 0.0776)	0.0674	0.274	13.1 (-20.7, 61.2)
	Income $75,001-$150,000	121	0.0847 (0.0633, 0.113)	0.0852	0.327	38.5 (-2.19, 96.2)
	Income >$150,000	42	0.106 (0.0701, 0.160)	0.100	0.388	19.1 (-27.3, 95.2)

Table G3: CARE-LA serum PFAS concentrations (in ng/mL), unweighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	95th percentile	Total	LOD
Et-PFOSA-AcOH	31.3	*	<LOD	0.0457	425	0.0115
Me-PFOSA-AcOH	100	0.0681 (0.0630, 0.0736)	0.0562	0.341	425	0.0114
PFBS	4.9	*	<LOD	<LOD	425	0.0303
PFDA	69.2	0.0967 (0.0894, 0.105)	0.0891	0.394	425	0.0560
PFDoA	1.6	*	<LOD	<LOD	425	0.110
PFHpA	52.5	*	0.0270	0.0962	425	0.0256
PFHxS	98.8	0.613 (0.559, 0.672)	0.680	2.33	425	0.0177
PFNA	97.2	0.300 (0.278, 0.323)	0.324	0.924	425	0.0424
PFOA	99.3	1.04 (0.972, 1.12)	1.13	3.06	425	0.0606
PFOS	97.9	2.13 (1.92, 2.35)	2.43	8.33	425	0.0615
PFOSA	25.4	*	<LOD	0.0481	425	0.0144
PFUnDA	82.4	0.0829 (0.0756, 0.0909)	0.0842	0.381	425	0.0285

Appendix H: PFAS concentrations in CARE-2

The following tables present results for the 12 PFASs measured in CARE-2. Table H1 provides concentrations for all PFASs, weighted to the underlying population. Table H2 provides weighted concentrations and adjusted percent changes stratified by demographic factors for PFASs with detection frequencies over 65%. Table H3 provides unweighted concentrations for all PFASs measured in CARE-2. Geometric means (GMs) were not calculated for PFASs with a detection frequency less than 65% and are indicated with an asterisk (*). Some percentiles were below the limit of detection (LOD). Sample sizes listed in stratified tables include missing data that have been imputed. Adjusted percent changes reflect the percent difference from the referent category after adjusting for other demographic factors listed in the table. Please refer to Appendix C for detailed methods and the "Acronyms and abbreviations" section (page 3) for full chemical names.

Table H1: CARE-2 serum PFAS concentrations (in ng/mL), weighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	95th percentile	Total	LOD
Et-PFOSA-AcOH	16.4	*	<LOD	0.0312	358	0.0115
Me-PFOSA-AcOH	81.2	0.0344 (0.0298, 0.0397)	0.0355	0.204	358	0.0114
PFBS	9.8	*	<LOD	0.0379	357	0.0303
PFDA	63.3	*	0.0768	0.252	358	0.0560
PFDoA	0.01	*	<LOD	<LOD	358	0.110
PFHpA	43.6	*	<LOD	0.101	358	0.0256
PFHxS	99.8	0.798 (0.669, 0.953)	0.837	3.20	358	0.0177
PFNA	89.5	0.211 (0.181, 0.246)	0.256	0.775	358	0.0424
PFOA	98.8	0.987 (0.866, 1.12)	1.13	2.53	358	0.0606
PFOS	98.5	2.41 (2.05, 2.82)	2.88	7.14	357	0.0615
PFOSA	14.9	*	<LOD	0.0329	358	0.0144
PFUnDA	61.3	*	0.0416	0.258	358	0.0285

Table H2: CARE-2 serum PFAS concentrations (in ng/mL) and adjusted percent change by demographic characteristics, weighted

Analyte	Demographic Characteristic	Sample Size	GM (95% CI)	50th percentile	95th percentile	Adjusted Percent Change (95% CI)
Me-PFOSA-AcOH	Overall	358	0.0344 (0.0298, 0.0397)	0.0355	0.204	
	18-39 Years	102	0.0292 (0.0233, 0.0368)	0.0304	0.120	ref
	40-59 Years	142	0.0324 (0.0258, 0.0408)	0.0389	0.0882	30.2 (-8.69, 85.7)
	60 Years or over	114	0.0471 (0.0347, 0.0639)	0.0402	0.342	65.7 (11.0, 147)
	Male	157	0.0342 (0.0274, 0.0427)	0.0332	0.224	ref
	Female	201	0.0345 (0.0286, 0.0416)	0.0365	0.143	7.51 (-21.6, 47.5)
	White	130	0.0409 (0.0316, 0.0529)	0.0416	0.235	ref
	Asian	22	0.0259 (0.0183, 0.0366)	0.0339	0.0475	-26.9 (-56.3, 22.4)
	Black	17	0.0374 (0.0216, 0.0646)	0.0378	0.110	-2.80 (-46.1, 75.2)
	Hispanic or Latino	170	0.0303 (0.0244, 0.0377)	0.0309	0.117	-10.2 (-37.5, 29.1)
	Other	19	0.0592 (0.0443, 0.0792)	0.0491	0.170	79.9 (13.9, 184)

Analyte	Demographic Characteristic	Sample Size	GM (95% CI)	50th percentile	95th percentile	Adjusted Percent Change (95% CI)
	No high school degree	20	0.0271 (0.0188, 0.0391)	0.0298	0.0662	ref
	High school diploma/GED	55	0.0373 (0.0282, 0.0494)	0.0346	0.133	43.9 (-14.2, 141)
	College, some college, or trade/ technical school	216	0.0352 (0.0286, 0.0433)	0.0364	0.235	51.9 (-6.96, 148)
	Graduate degree	67	0.0349 (0.0230, 0.0530)	0.0367	0.104	59.0 (-18.9, 212)
	Income ≤ $25,000	103	0.0385 (0.0294, 0.0505)	0.0353	0.226	ref
	Income $25,001-$75,000	160	0.0362 (0.0288, 0.0456)	0.0334	0.234	-5.33 (-35.2, 38.2)
	Income $75,001-$150,000	72	0.0316 (0.0239, 0.0417)	0.0365	0.186	-20.6 (-48.5, 22.5)
	Income >$150,000	23	0.0302 (0.0192, 0.0475)	0.0326	0.0932	-40.0 (-69.6, 18.4)
PFHxS	Overall	358	0.798 (0.669, 0.953)	0.837	3.20	
	18-39 Years	102	0.492 (0.358, 0.676)	0.547	2.48	ref
	40-59 Years	142	0.890 (0.701, 1.13)	0.959	2.57	88.9 (25.5, 184)
	60 Years or over	114	1.40 (1.14, 1.73)	1.50	3.27	188 (86.5, 345)
	Male	157	1.13 (0.884, 1.44)	1.50	4.12	ref
	Female	201	0.583 (0.465, 0.732)	0.648	2.64	-49.6 (-62.2, -32.9)
	White	130	0.997 (0.756, 1.31)	1.06	3.84	ref
	Asian	22	1.21 (0.905, 1.61)	1.19	1.94	114 (38.8, 229)
	Black	17	0.480 (0.265, 0.871)	0.492	1.82	-14.4 (-55.1, 63.3)
	Hispanic or Latino	170	0.730 (0.550, 0.971)	0.758	3.20	5.87 (-30.7, 61.8)
	Other	19	0.440 (0.232, 0.835)	0.544	2.51	-40.7 (-77.4, 55.6)
	No high school degree	20	0.764 (0.424, 1.37)	0.777	2.80	ref
	High school diploma/GED	55	0.726 (0.493, 1.07)	0.740	4.67	5.81 (-34.3, 70.5)
	College, some college, or trade/ technical school	216	0.825 (0.663, 1.02)	0.934	3.16	19.8 (-25.7, 92.9)
	Graduate degree	67	0.986 (0.627, 1.55)	0.843	3.66	29.1 (-30.0, 138)
	Income ≤ $25,000	103	0.757 (0.544, 1.05)	0.801	3.14	ref
	Income $25,001-$75,000	160	0.705 (0.511, 0.973)	0.733	5.45	-10.3 (-39.6, 33.1)
	Income $75,001-$150,000	72	0.917 (0.666, 1.26)	1.11	3.10	3.03 (-32.0, 56.2)
	Income >$150,000	23	0.898 (0.575, 1.40)	0.846	2.83	-16.7 (-53.0, 47.6)
PFNA	Overall	358	0.211 (0.181, 0.246)	0.256	0.775	
	18-39 Years	102	0.145 (0.110, 0.191)	0.214	0.427	ref
	40-59 Years	142	0.247 (0.195, 0.313)	0.279	0.777	81.2 (24.6, 163)
	60 Years or over	114	0.295 (0.247, 0.354)	0.332	0.865	129 (62.7, 223)
	Male	157	0.222 (0.178, 0.276)	0.273	0.776	ref
	Female	201	0.202 (0.163, 0.251)	0.243	0.739	-12.5 (-32.6, 13.6)

Analyte	Demographic Characteristic	Sample Size	GM (95% CI)	50th percentile	95th percentile	Adjusted Percent Change (95% CI)
	White	130	0.252 (0.202, 0.314)	0.251	0.843	ref
	Asian	22	0.391 (0.315, 0.485)	0.390	0.712	85.8 (28.2, 169)
	Black	17	0.223 (0.120, 0.413)	0.232	0.690	31.2 (-27.3, 137)
	Hispanic or Latino	170	0.175 (0.137, 0.224)	0.248	0.602	1.29 (-26.2, 39.0)
	Other	19	0.145 (0.0786, 0.267)	0.174	0.443	-21.5 (-64.7, 74.8)
	No high school degree	20	0.145 (0.0828, 0.255)	0.170	0.555	ref
	High school diploma/GED	55	0.159 (0.112, 0.226)	0.227	0.775	22.6 (-28.5, 110)
	College, some college, or trade/ technical school	216	0.272 (0.237, 0.311)	0.284	0.884	76.5 (5.33, 196)
	Graduate degree	67	0.234 (0.173, 0.317)	0.219	0.661	40.9 (-22.7, 157)
	Income ≤ $25,000	103	0.147 (0.109, 0.198)	0.165	0.443	ref
	Income $25,001-$75,000	160	0.185 (0.135, 0.252)	0.232	0.778	21.7 (-18.5, 81.8)
	Income $75,001-$150,000	72	0.289 (0.242, 0.345)	0.305	0.578	60.0 (10.9, 131)
	Income >$150,000	23	0.261 (0.194, 0.350)	0.230	0.805	14.6 (-33.4, 97.1)
PFOA	Overall	358	0.987 (0.866, 1.12)	1.13	2.53	
	18-39 Years	102	0.692 (0.539, 0.889)	0.841	2.13	ref
	40-59 Years	142	1.08 (0.906, 1.29)	1.15	2.41	65.5 (22.8, 123)
	60 Years or over	114	1.47 (1.29, 1.67)	1.76	2.95	113 (58.7, 187)
	Male	157	1.20 (1.02, 1.40)	1.32	2.62	ref
	Female	201	0.828 (0.680, 1.01)	0.919	2.41	-31.2 (-45.1, -13.8)
	White	130	1.26 (1.04, 1.52)	1.57	2.70	ref
	Asian	22	1.50 (1.12, 2.00)	1.53	2.75	60.2 (5.24, 144)
	Black	17	0.768 (0.480, 1.23)	0.600	2.05	-10.8 (-44.1, 42.5)
	Hispanic or Latino	170	0.818 (0.666, 1.01)	0.971	2.30	-15.2 (-34.9, 10.4)
	Other	19	1.07 (0.688, 1.66)	0.868	3.28	6.51 (-38.2, 83.7)
	No high school degree	20	0.816 (0.495, 1.35)	1.07	2.23	ref
	High school diploma/GED	55	0.874 (0.676, 1.13)	1.02	2.32	6.44 (-30.5, 63.1)
	College, some college, or trade/ technical school	216	1.10 (0.949, 1.28)	1.28	2.61	28.1 (-17.9, 99.9)
	Graduate degree	67	1.07 (0.848, 1.34)	0.951	2.77	16.7 (-31.2, 98.0)
	Income ≤ $25,000	103	0.790 (0.601, 1.04)	1.02	2.25	ref
	Income $25,001-$75,000	160	0.934 (0.730, 1.19)	1.13	3.01	15.1 (-15.8, 57.3)
	Income $75,001-$150,000	72	1.19 (0.970, 1.46)	1.36	2.30	27.6 (-8.21, 77.5)
	Income >$150,000	23	1.06 (0.766, 1.46)	0.954	2.39	-6.32 (-41.6, 50.1)
PFOS	Overall	357	2.41 (2.05, 2.82)	2.88	7.14	

Analyte	Demographic Characteristic	Sample Size	GM (95% CI)	50th percentile	95th percentile	Adjusted Percent Change (95% CI)
	18-39 Years	102	1.52 (1.14, 2.04)	1.64	5.41	ref
	40-59 Years	141	2.68 (2.18, 3.29)	3.31	6.96	85.2 (23.7, 177)
	60 Years or over	114	4.07 (3.56, 4.67)	4.41	9.92	193 (92.3, 347)
	Male	156	2.82 (2.17, 3.67)	3.89	7.82	ref
	Female	201	2.09 (1.75, 2.48)	2.04	7.09	-29.3 (-44.5, -9.94)
	White	130	2.61 (1.90, 3.58)	3.40	8.37	ref
	Asian	22	4.41 (3.20, 6.08)	5.12	9.77	147 (53.3, 297)
	Black	17	1.92 (1.13, 3.26)	1.70	6.91	26.6 (-35.8, 150)
	Hispanic or Latino	169	2.17 (1.76, 2.68)	2.44	6.69	14.1 (-27.1, 78.6)
	Other	19	2.30 (1.47, 3.60)	3.02	4.93	20.0 (-44.0, 157)
	No high school degree	20	2.53 (1.67, 3.85)	3.15	5.45	ref
	High school diploma/GED	54	1.88 (1.23, 2.87)	2.23	6.95	-16.3 (-42.8, 22.7)
	College, some college, or trade/ technical school	216	2.60 (2.22, 3.04)	2.85	7.65	4.23 (-29.7, 54.5)
	Graduate degree	67	3.19 (2.34, 4.36)	2.89	7.80	12.3 (-28.4, 76.1)
	Income ≤ $25,000	102	1.74 (1.31, 2.32)	1.88	6.18	ref
	Income $25,001-$75,000	160	2.28 (1.65, 3.14)	2.95	7.97	22.7 (-16.8, 80.9)
	Income $75,001-$150,000	72	2.95 (2.37, 3.67)	3.75	6.96	45.9 (2.18, 108)
	Income >$150,000	23	2.86 (2.05, 3.99)	2.90	7.03	15.7 (-28.6, 87.5)

Table H3: CARE-2 serum PFAS concentrations (in ng/mL), unweighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	95th percentile	Total	LOD
Et-PFOSA-AcOH	19.3	*	<LOD	0.0461	358	0.0115
Me-PFOSA-AcOH	78.8	0.0384 (0.0340, 0.0434)	0.0365	0.323	358	0.0114
PFBS	10.9	*	<LOD	0.0500	357	0.0303
PFDA	65.9	0.0836 (0.0776, 0.0899)	0.0785	0.287	358	0.0560
PFDoA	0.3	*	<LOD	<LOD	358	0.110
PFHpA	43.3	*	<LOD	0.0994	358	0.0256
PFHxS	99.7	0.784 (0.703, 0.874)	0.839	3.79	358	0.0177
PFNA	92.2	0.205 (0.187, 0.225)	0.231	0.791	358	0.0424
PFOA	98.6	0.977 (0.898, 1.06)	1.11	2.70	358	0.0606
PFOS	98.6	2.40 (2.17, 2.65)	2.80	8.72	357	0.0615
PFOSA	19.8	*	<LOD	0.0562	358	0.0144
PFUnDA	58.4	*	0.0404	0.262	358	0.0285

Appendix I: Environmental phenol concentrations in CARE-LA and CARE-2

We measured environmental phenols in subsets of the CARE-LA and CARE-2 participants (Table I1). These subsets should not be considered representative of the regional populations. Please refer to Appendix C for details on subset selection and other methods, and the Acronyms and Abbreviations section (page 3) for full chemical names.

The laboratory analyzed 60 CARE-LA and 151 CARE-2 samples. Table I1 presents information on the CARE-LA and CARE-2 participants in these subsets and includes comparisons to the American Community Survey (ACS) conducted by the US Census Bureau.

Table I1: Demographic characteristics of the environmental phenols subsets from CARE-LA (N=60) and CARE-2 (N=151)

Demographic characteristic	CARE-LA Number	CARE-LA Percent (%)	CARE-LA Regional Population Percent (%)[1]	CARE-2 Number	CARE-2 Percent (%)	CARE-2 Regional Population Percent (%)[2]
18-39 Years	25	41.7	41.9	46	30.5	42.2
40-59 Years	22	36.7	33.4	54	35.8	33.4
60 Years or over	13	21.7	24.6	51	33.8	24.4
Male[3]	0	0	48.8	76	50.3	49.4
Female	60	100	51.2	75	49.7	50.6
Asian	15	25.0	14.6	8	5.3	6.4
Black	14	23.3	7.8	9	6.0	6.7
Hispanic or Latino	15	25.0	48.6	80	53.0	52.1
White	13	21.7	25.9	49	32.5	31.5
Other	3	5.0	3.1	5	3.3	3.3

[1]From ACS 2018 1-year estimates.

[2]From ACS 2019 5-year estimates.

[3]No participants in the CARE-LA or CARE-2 environmental phenols subsets indicated another gender identity. Information on sex assigned at birth was not collected from participants in CARE-LA. Sex assigned at birth and gender were both collected in CARE-2, and responses were concordant for this subset. Comparison with sex from ACS data was used to calculate regional population percentages.

The following tables present the unweighted geometric means (GMs) and percentiles for the 10 environmental phenols measured in the CARE-LA subset (Tables I2-I3) and the 8 environmental phenols measured in the CARE-2 subset (Tables I4-I5). GMs were not calculated for chemicals with a detection frequency less than 65% and are indicated with an asterisk (*). The limit of detection (LOD) is included for reference; some percentiles were below the LOD. The results are presented with and without adjustment for hydration using creatinine measurements.

Table I2: CARE-LA urinary environmental phenol concentrations (in µg/L), unweighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	90th percentile	Total	LOD
Benzophenone-3	95.0	31.6 (18.4, 54.2)	22.3	513	60	1.00
BPA	46.7	*	<LOD	1.96	60	0.100
BPF	23.3	*	<LOD	0.862	60	0.200
BPS	76.7	0.382 (0.269, 0.544)	0.342	2.42	60	0.100
Butyl paraben	16.7	*	<LOD	0.885	60	0.100
Ethyl paraben	35.0	*	<LOD	71.4	60	0.500

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	90th percentile	Total	LOD
Methyl paraben	95.0	15.7 (9.39, 26.2)	12.7	291	60	0.500
Propyl paraben	66.7	2.10 (1.11, 3.97)	2.57	81.3	60	0.200
Triclocarban	16.7	*	<LOD	0.211	60	0.100
Triclosan	81.7	1.67 (0.887, 3.15)	0.908	103	60	0.200

Table I3: CARE-LA urinary environmental phenol concentrations (in µg/g creatinine), unweighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	90th percentile	Total	LOD (µg/L)
Benzophenone-3	95.0	56.2 (33.3, 95.0)	48.9	1420	60	1.00
BPA	46.7	*	<LOD	2.90	60	0.100
BPF	23.3	*	<LOD	1.88	60	0.200
BPS	76.7	0.681 (0.479, 0.967)	0.780	3.95	60	0.100
Butyl paraben	16.7	*	<LOD	1.29	60	0.100
Ethyl paraben	35.0	*	<LOD	90.5	60	0.500
Methyl paraben	95.0	27.9 (17.7, 44.1)	26.9	323	60	0.500
Propyl paraben	66.7	3.73 (1.97, 7.04)	4.16	119	60	0.200
Triclocarban	16.7	*	<LOD	0.803	60	0.100
Triclosan	81.7	2.98 (1.60, 5.52)	1.27	201	60	0.200

Table I4: CARE-2 urinary environmental phenol concentrations (in µg/L), unweighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	95th percentile	Total	LOD
Benzophenone-3	96.0	18.5 (13.7, 25.1)	18.0	493	151	1.00
BPA	69.5	0.503 (0.419, 0.603)	0.466	3.19	151	0.200
BPS	64.9	*	0.233	2.25	151	0.100
Ethyl paraben	35.8	*	<LOD	69.7	151	0.500
Methyl paraben	94.0	15.3 (10.9, 21.5)	12.6	535	151	0.500
Propyl paraben	60.3	*	1.54	223	151	0.200
Triclocarban	11.3	*	<LOD	0.307	151	0.100
Triclosan	45.0	*	<LOD	389	151	1.00

Table I5: CARE-2 urinary environmental phenol concentrations (in µg/g creatinine), unweighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	95th percentile	Total	LOD (µg/L)
Benzophenone-3	96.0	24.2 (18.1, 32.3)	17.6	875	151	1.00
BPA	69.5	0.657 (0.556, 0.775)	0.689	3.22	151	0.200
BPS	64.9	*	0.335	1.72	151	0.100
Ethyl paraben	35.8	*	<LOD	61.7	151	0.500
Methyl paraben	94.0	19.9 (14.5, 27.4)	16.5	588	151	0.500
Propyl paraben	60.3	*	1.40	164	151	0.200
Triclocarban	11.3	*	<LOD	0.700	151	0.100
Triclosan	45.0	*	<LOD	646	151	1.00

Appendix J: 1-Nitropyrene metabolite concentrations in CARE-LA and CARE-2

We measured two metabolites of 1-NP, 6-hydroxy-1-nitropyrene (6-OHNP) and 8-hydroxy-1-nitropyrene (8-OHNP), in subsets of the CARE-LA and CARE-2 participants. These subsets should not be considered representative of the regional populations. Please refer to Appendix C for details on subset selection and other methods.

The laboratory analyzed 159 samples for 1-NP metabolites in both CARE-LA and CARE-2; however, due to laboratory analytic issues, the number of reportable values varied by metabolite (indicated in the Total columns in Tables J2 and J3 below). As a result, the CARE-LA subset includes data from 153 participants, and the CARE-2 subset includes data from 158 participants. Table J1 presents information on the CARE-LA and CARE-2 participants in these subsets and includes comparisons to the American Community Survey (ACS) conducted by the US Census Bureau.

Table J1: Demographic characteristics of the 1-nitropyrene metabolite subsets from CARE-LA (N=153) and CARE-2 (N=158)

Demographic characteristic	CARE-LA Number[1]	CARE-LA Percent (%)[1]	CARE-LA Regional Population Percent (%)[2]	CARE-2 Number[1]	CARE-2 Percent (%)[1]	CARE-2 Regional Population Percent (%)[3]
18-39 Years	47	30.7	41.9	43	27.2	42.2
40-59 Years	73	47.7	33.4	68	43.0	33.4
60 Years or over	33	21.6	24.6	47	29.7	24.4
Male[4]	68	44.4	48.8	70	44.3	49.4
Female	85	55.6	51.2	88	55.7	50.6
Asian	23	15.0	14.6	14	8.9	6.4
Black	17	11.1	7.8	7	4.4	6.7
Hispanic or Latino	50	32.7	48.6	63	39.9	52.1
White	52	34.0	25.9	68	43.0	31.5
Other	10	6.5	3.1	4	2.5	3.3

[1]Because of missing data, numbers may not total 153 for CARE-LA or 158 for CARE-2, and percentages may not sum to 100%.
[2]From ACS 2018 1-year estimates.
[3]From ACS 2019 5-year estimates.
[4]No participants in the CARE-LA or CARE-2 1-nitropyrene metabolite subsets indicated another gender identity. Information on sex assigned at birth was not collected from participants in CARE-LA. Sex assigned at birth and gender were both collected in CARE-2, and responses were concordant for this subset. Comparison with sex from ACS data was used to calculate regional population percentages.

Tables J2 and J3 present the unweighted geometric means (GMs) and percentiles for the two 1-NP metabolites measured in the CARE-LA and CARE-2 subsets. To account for differences in hydration, concentrations were adjusted using the geometric mean specific gravity from NHANES 07-08 (1.017) as the reference value. The limit of detection (LOD) is included for reference.

Table J2: CARE-LA urinary 1-nitropyrene metabolite concentrations (in specific gravity adjusted pg/L), unweighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	95th percentile	Total	LOD
6-OHNP	90.8	110 (89, 130)	120	660	109	9.4
8-OHNP	87.2	88 (76, 100)	91	400	149	11.4

Table J3: CARE-2 urinary 1-nitropyrene metabolite concentrations (in specific gravity adjusted pg/L), unweighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	95th percentile	Total	LOD
6-OHNP	88.7	150 (120, 180)	150	960	142	13
8-OHNP	76.1	89 (76, 100)	78	410	155	22

Appendix K: CARE-3 Results

The CARE-3 study was a cross-sectional biomonitoring surveillance study that followed the same methodologies used in CARE-LA and CARE-2, but it was abbreviated due to the COVID-19 emergency. Please refer to Appendix C for detailed methods.

Outreach for CARE-3 started in early 2020, and fieldwork was stopped on March 13, 2020. At that time, a total of 530 residents had been invited, and 90 participants had completed all study steps. Because enrollment goals for CARE-3 were not met, the data collected from the 90 participants are not considered representative of the entire region. Table K1 presents information on CARE-3 participants and includes a comparison to the regional population. The statistics presented in this appendix are unweighted; no adjustments were made to the data to reduce under- or over-representativeness in the sample.

Table K1: CARE-3 study population and demographic characteristics (N = 90 participants)

Demographic characteristic	CARE-3 Number[1]	CARE-3 Percent (%)[1]	Regional Population Percent (%)[2]
18-39 Years	23	25.6	40.6
40-59 Years	36	40.0	32.8
60 Years or over	31	34.4	26.6
Male[3]	36	40.0	49.5
Female	50	55.6	50.5
Asian[4]	8	8.9	16.3
Black	5	5.6	3.2
Hispanic or Latino	21	23.3	34.1
White	49	54.4	42.3
Other	6	6.7	4.1

[1]Numbers may not total 90, and percentages may not sum to 100% because of missing data.
[2]From ACS 2019 1-year estimates.
[3]One participant indicated another gender identity. Sex assigned at birth and gender were both collected in CARE-3, and participants' responses were 98% concordant, including 2% missing responses for both. Comparison with sex from ACS data was used to calculate regional population percentages.
[4]Additional race and ethnicity information for CARE-3 participants is available in Table K9 at the end of this appendix.

Concentrations above the Levels of Concern (LOCs)

We identify participants who have results exceeding our Program's LOCs so that we can follow up with them and better understand the potential impacts of exposures on the population. Table K2 below presents the number of LOC exceedances in CARE-3, the majority of which were due to arsenic exposures. More information on how the LOCs were determined and the study's protocol for following up with participants is available in Appendix B.

Table K2: Number of CARE-3 participants with metals concentrations above the 2020 levels of concern, and corresponding study population percentages

Analyte	Level of concern	CARE-3 Number	CARE-3 Percent (%)
Arsenic (urine)	≥ 20 µg/L inorganic arsenic	1	1.1
	≥ 50 µg/L total arsenic	7	7.8
Cadmium (blood)	≥ 5 µg/L	0	0
Cadmium (urine)	> 3 µg/g creatinine	0	0
Lead (blood)	≥ 4.5 µg/dL[1]	1	1.1
Mercury (blood)	≥ 5.8 µg/L if pregnant or may become pregnant[2]	0	0
	≥ 10 µg/L for all other adults	1	1.5
	≥ 5.8 µg/L applied to all participants[3]	2	2.2
Mercury (urine)	≥ 10 µg/L	0	0

[1]Since CARE-3 was conducted, the CDC blood lead reference level was lowered to ≥ 3.5 µg/dL. Three CARE-3 participants (3.4%) had blood lead levels exceeding this lower reference level.
[2]Persons who "may become pregnant" are defined here as those assigned female at birth and 18-49 years of age. In CARE-3, there were 25 people in this category.
[3]Program follow-up was provided to all participants with blood mercury levels that exceeded 5.8 µg/L, regardless of sex or gender.

Detection frequencies and average concentrations

The blood metals measured for CARE-3 (cadmium, lead, manganese, and mercury) were detected in all or almost all participants (95-100%). Five of the nine urinary metals measured (arsenic, cadmium, cobalt, molybdenum, and thallium) were detected in all or almost all participants (91-100%). One or more PFAS was detected in 87 participants; on average, seven PFASs were detected in each participant's sample. Three of the 10 phenols measured (BPA, BP-3, and MP) were detected in most participants (80-90%).

The following tables present the unweighted geometric means (GMs) and percentiles for the 10 metals, 12 PFASs, and 10 environmental phenols measured in CARE-3. GMs were not calculated for chemicals with a detection frequency less than 65% and are indicated with an asterisk (*). The limit of detection (LOD) is included for reference; some percentiles were below the LOD. Please refer to Appendix C for detailed methods and the "Acronyms and abbreviations" section (page 3) for full chemical names.

Table K3: CARE-3 blood metal concentrations (in µg/L for cadmium, manganese, and mercury and µg/dL for lead), unweighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	90th percentile	Total	LOD
Cadmium	95.5	0.279 (0.235, 0.332)	0.289	0.629	88	0.0750
Lead	100	0.690 (0.606, 0.785)	0.706	1.42	88	0.0250
Manganese	100	9.13 (8.46, 9.87)	9.54	14.1	88	0.250
Mercury	98.9	1.03 (0.809, 1.30)	1.16	4.04	88	0.0750

Table K4: CARE-3 urinary metal concentrations (in µg/L), unweighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	90th percentile	Total	LOD
Antimony	20.0	*	<LOD	0.0558	90	0.0300
Arsenic	100	6.13 (4.57, 8.21)	4.44	40.0	90	0.100
Cadmium	91.1	0.131 (0.104, 0.163)	0.137	0.435	90	0.0300
Cobalt	92.2	0.171 (0.133, 0.220)	0.182	0.846	90	0.0300
Manganese	18.9	*	<LOD	0.132	90	0.100
Mercury	88.9	0.156 (0.121, 0.201)	0.156	0.643	90	0.0300
Molybdenum	100	24.5 (19.8, 30.3)	26.2	85.2	90	0.300
Thallium	98.9	0.108 (0.0909, 0.129)	0.119	0.273	90	0.0100
Uranium	40.0	*	<LOD	0.0326	90	0.0100

Table K5: CARE-3 urinary metal concentrations (in µg/g creatinine), unweighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	90th percentile	Total	LOD (µg/L)
Antimony	20.0	*	<LOD	0.191	90	0.0300
Arsenic	100	11.3 (8.87, 14.3)	9.65	62.5	90	0.100
Cadmium	91.1	0.240 (0.201, 0.287)	0.231	0.714	90	0.0300
Cobalt	92.2	0.315 (0.261, 0.379)	0.270	1.03	90	0.0300
Manganese	18.9	*	<LOD	0.694	90	0.100
Mercury	88.9	0.287 (0.239, 0.344)	0.294	0.805	90	0.0300
Molybdenum	100	45.1 (39.3, 51.8)	45.2	99.0	90	0.300
Thallium	98.9	0.199 (0.173, 0.229)	0.184	0.459	90	0.0100

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	90th percentile	Total	LOD (µg/L)
Uranium	40.0	*	<LOD	0.0673	90	0.0100

Table K6: CARE-3 serum PFAS concentrations (in ng/mL), unweighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	90th percentile	Total	LOD
Et-PFOSA-AcOH	16.9	*	<LOD	0.0250	89	0.0115
Me-PFOSA-AcOH	65.9	0.0363 (0.0266, 0.0494)	0.0332	0.238	88	0.0114
PFBS	2.5	*	<LOD	<LOD	79	0.0303
PFDA	67.4	0.0942 (0.0802, 0.111)	0.0926	0.234	89	0.0560
PFDoA	5.0	*	<LOD	<LOD	80	0.110
PFHpA	39.0	*	<LOD	0.0690	82	0.0256
PFHxS	97.8	0.670 (0.517, 0.868)	0.796	2.69	89	0.0177
PFNA	92.1	0.295 (0.245, 0.356)	0.335	0.762	89	0.0424
PFOA	95.5	0.901 (0.733, 1.11)	1.03	2.21	89	0.0606
PFOS	95.5	1.75 (1.34, 2.28)	2.30	5.22	89	0.0615
PFOSA	20.2	*	<LOD	0.0328	89	0.0144
PFUnDA	80.9	0.0804 (0.0660, 0.0980)	0.0839	0.286	89	0.0285

Table K7: CARE-3 urinary environmental phenol concentrations (in µg/L), unweighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	90th percentile	Total	LOD
Benzophenone-3	90.0	14.4 (9.16, 22.6)	13.1	190	90	0.500
BPA	82.2	0.287 (0.233, 0.352)	0.281	0.895	90	0.100
BPF	41.1	*	<LOD	2.03	90	0.200
BPS	64.4	*	0.288	2.85	90	0.100
Butyl paraben	11.1	*	<LOD	0.114	90	0.100
Ethyl paraben	25.6	*	<LOD	8.92	90	0.200
Methyl paraben	80.0	8.33 (5.15, 13.5)	9.57	152	90	0.500
Propyl paraben	50.0	*	<LOD	42.5	90	0.200
Triclocarban	5.6	*	<LOD	<LOD	90	0.100
Triclosan	18.9	*	<LOD	1.82	90	1.00

Table K8: CARE-3 urinary environmental phenol concentrations (in µg/g creatinine), unweighted

Analyte	Detection Frequency (%)	GM (95% CI)	50th percentile	90th percentile	Total	LOD (µg/L)
Benzophenone-3	90.0	26.5 (17.7, 39.7)	22.6	256	90	0.500
BPA	82.2	0.527 (0.431, 0.644)	0.491	1.63	90	0.100
BPF	41.1	*	<LOD	5.21	90	0.200
BPS	64.4	*	0.555	2.72	90	0.100
Butyl paraben	11.1	*	<LOD	0.698	90	0.100
Ethyl paraben	25.6	*	<LOD	7.14	90	0.200
Methyl paraben	80.0	15.3 (10.0, 23.4)	14.2	290	90	0.500
Propyl paraben	50.0	*	<LOD	68.6	90	0.200
Triclocarban	5.6	*	<LOD	<LOD	90	0.100
Triclosan	18.9	*	<LOD	7.45	90	1.00

Table K9: Additional racial and/or ethnic designations for CARE-3 (N = 90[1])

Participants who identified as a single race/ethnicity, not in combination with any other ethnic or racial designation	**Number**	**Percent (%)**
American Indian or Alaskan Native	0	0
Asian	8	9
Black or African American	5	6
Hispanic or Latino[2]	19	21
Native Hawaiian or Other Pacific Islander	0	0
White	49	54
Participants who identified as multiple ethnic or racial designations	**Number**	**Percent (%)**
Hispanic or Latino and one race[2]	1	1
Hispanic or Latino multiracial[2]	1	1
Non-Hispanic multiracial	6	7
Participants who identified as any of these ethnic or racial designations, either alone or in combination	**Number**	**Percent (%)**
American Indian or Alaskan Native	1	1
Asian	12	13
Black or African American	7	8
Hispanic or Latino	21	23
Native Hawaiian or Other Pacific Islander	2	2
White	55	61

[1]One individual in CARE-3 provided no race or ethnicity designations; therefore, numbers and percentages do not always equal the total sample population.
[2]CARE Study participants were asked their race and ethnicity in a single question, without a separate question about Hispanic or Latino ethnicity. Therefore, it is possible for a participant to have indicated "Hispanic or Latino" alone and no racial category.