

Sixth Report and Fact Sheets on Human Biomonitoring of Environmental Chemicals in Canada

Canadian Health Measures Survey

National Biomonitoring Section

Environmental Health Science and Research Bureau
Healthy Environments and Consumer Safety Branch
Health Canada

December 14, 2021

YOUR HEALTH AND SAFETY... OUR PRIORITY.



Purpose

To provide key information related to the publication of the *Sixth Biomonitoring Report* and *Biomonitoring Fact Sheets*, which present new results from the biomonitoring component of the Canadian Health Measures Survey Cycle 6 (2018-2019).

Canadian Health Measures Survey (CHMS) – Overview

- Conducted by Statistics Canada in partnership with Health Canada and the Public Health Agency of Canada since 2007.
- Cross-sectional survey conducted in 2 year cycles.
- Samples between 5,000 and 6,000 Canadians aged 3 to 79 years to produce national estimates.
- Representative of 96-97% of the population.



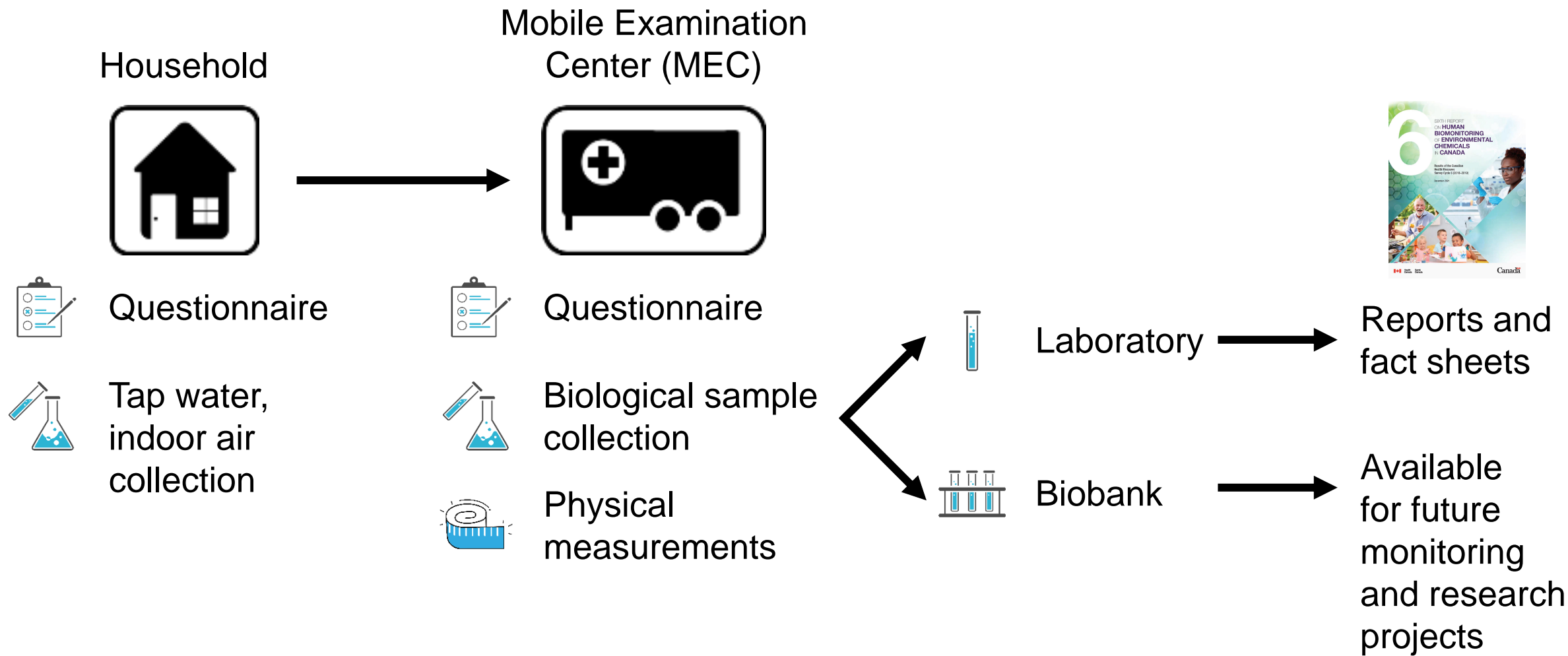
~ 100 sites



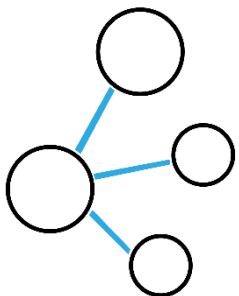
~ 35,000 people



CHMS – Collection, Analysis, and Reporting



CHMS – Chemicals

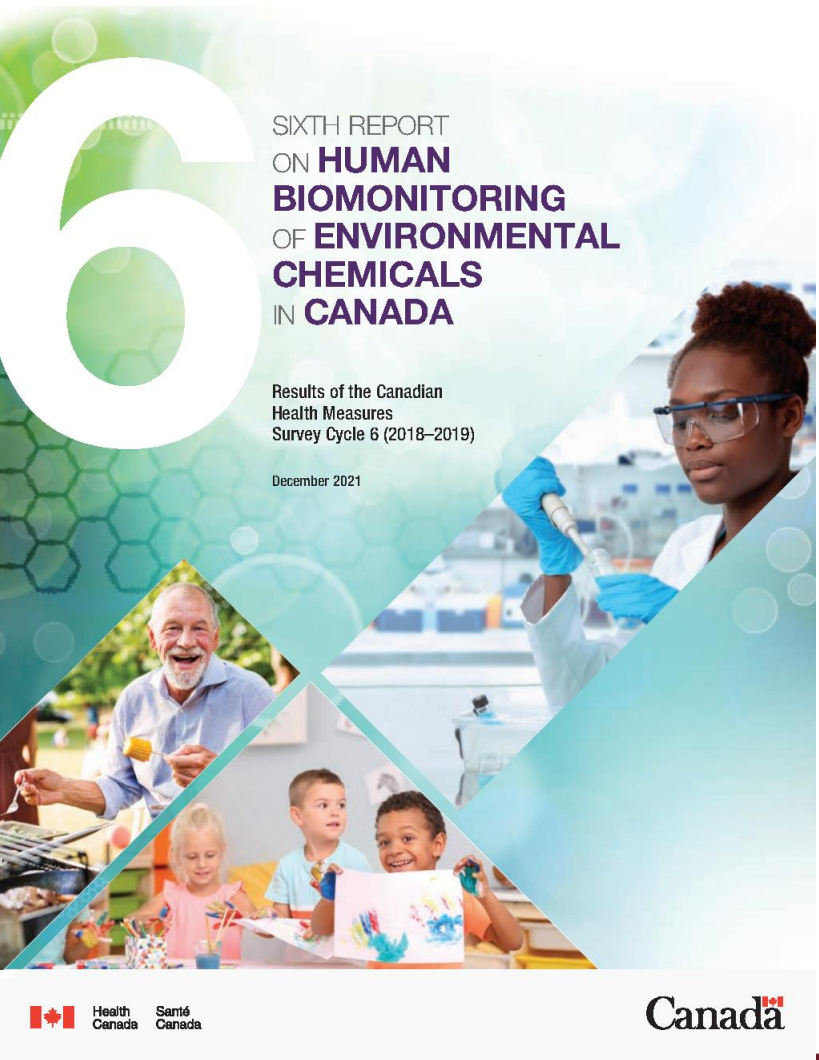


**> 250 chemicals
measured in
blood and/or urine
since 2007**

CYCLE 1 (2007-2009)	CYCLE 2 (2009-2011)	CYCLES 3 & 4 (2012-2015)	CYCLES 5 & 6 (2016-2019)
	Nicotine		
	Pesticides		
	Metals and trace elements		
	Self-care and consumer product chemicals		
Perfluoroalkyl substances (PFAS)			PFAS
Plasticizers			Plasticizers
		Acrylamide	
		Volatile organic compounds	
Dioxins & furans		Dioxins & furans*	
Flame retardants		Flame retardants*	
PCBs		Polychlorinated biphenyls (PCBs)*	
Organochlorines		Organochlorines*	
Chlorophenols			
	Polycyclic aromatic hydrocarbons		

*measured in pooled serum samples

National Biomonitoring Reports



Sixth Report on Human Biomonitoring of Environmental Chemicals in Canada

- **360 page technical document** describing objectives, survey design, methods and descriptive summaries of measured environmental chemicals.
- **79 environmental chemicals**
- **132 data tables** showing concentrations for the total Canadian population and sub-divided by age group and sex for CHMS cycles 1 through 6 (2007-2019)

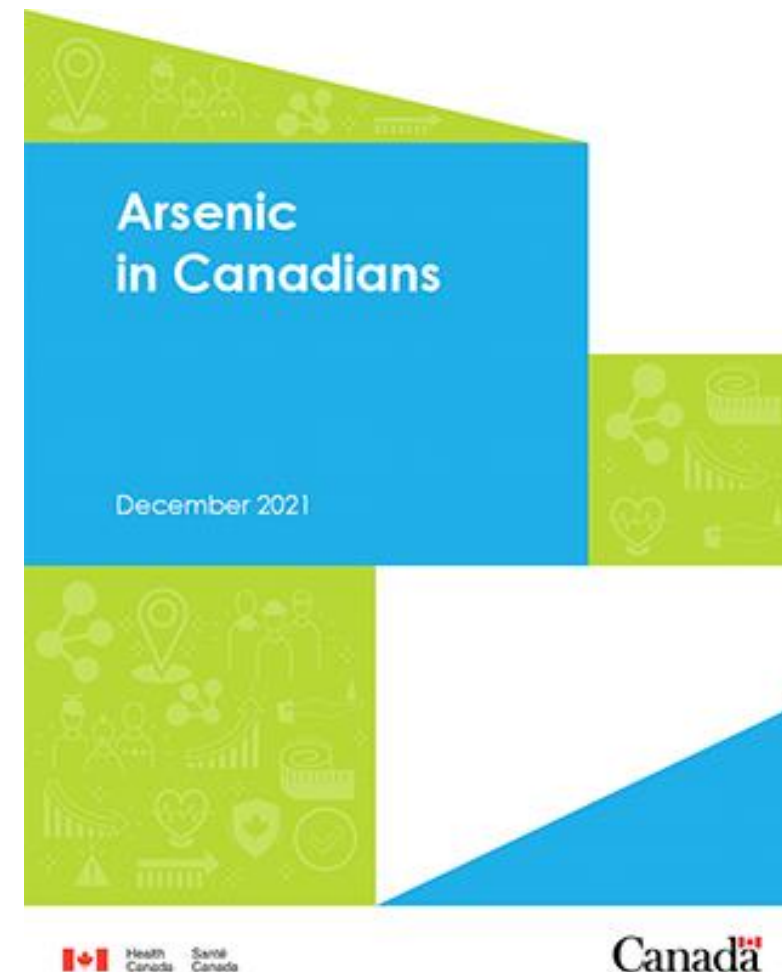
■ **Table 8.1.1**

Lead—Geometric means and selected percentiles of whole blood concentrations (µg/dL) for the Canadian population aged 3–79 by age group, Canadian Health Measures Survey cycle 1 (2007–2009), cycle 2 (2009–2011), cycle 3 (2012–2013), cycle 4 (2014–2015), cycle 5 (2016–2017) and cycle 6 (2018–2019)

Cycle	n	Detection Frequency (95% CI)	GM ^a (95% CI)	10 th (95% CI)	50 th (95% CI)	90 th (95% CI)	95 th (95% CI)
Total, 3–79 years							
1 (2007–2009) ^a	—	—	—	—	—	—	—
2 (2009–2011)	6070	100	1.2 (1.1–1.2)	0.54 (0.50–0.59)	1.1 (1.1–1.2)	2.5 (2.3–2.7)	3.2 (2.9–3.4)
3 (2012–2013)	5538	99.8 (98.7–100)	1.1 (1.0–1.1)	0.49 (0.46–0.52)	1.0 (0.95–1.1)	2.4 (2.3–2.5)	3.2 (2.9–3.4)
4 (2014–2015)	5498	99.9 (99.7–100)	0.95 (0.90–1.0)	0.43 (0.40–0.46)	0.92 (0.88–0.95)	2.1 (1.8–2.3)	2.7 (2.4–3.0)
5 (2016–2017)	4517	99.7 (98.5–99.9)	0.89 (0.82–0.96)	0.37 (0.35–0.40)	0.88 (0.80–0.95)	2.0 (1.8–2.1)	2.4 (2.1–2.8)
6 (2018–2019)	4596	99.6 (98.6–99.9)	0.81 (0.77–0.85)	0.34 (0.32–0.37)	0.78 (0.72–0.84)	1.8 (1.6–2.0)	2.3 (2.0–2.5)
Males, 3–79 years							
1 (2007–2009) ^a	—	—	—	—	—	—	—
2 (2009–2011)	2940	100	1.3 (1.3–1.4)	0.62 (0.56–0.67)	1.2 (1.2–1.3)	2.8 (2.5–3.1)	3.4 (3.1–3.7)
3 (2012–2013)	2769	99.9 (99.1–100)	1.2 (1.2–1.3)	0.56 (0.55–0.58)	1.1 (1.0–1.2)	2.6 (2.4–2.9)	3.6 (3.1–4.0)
4 (2014–2015)	2754	100 (99.4–100)	1.0 (0.98–1.1)	0.47 (0.45–0.49)	1.0 (0.97–1.0)	2.2 (1.9–2.4)	2.9 (2.3–3.5)
5 (2016–2017)	2257	100 (99.5–99.9)	1.0 (0.89–1.1)	0.45 (0.40–0.51)	0.99 (0.90–1.1)	2.1 (1.8–2.4)	2.7 (2.0–3.3)
6 (2018–2019)	2330	99.8 (99.5–99.9)	0.87 (0.82–0.93)	0.38 (0.35–0.41)	0.86 (0.80–0.92)	2.0 (1.8–2.1)	2.3 (2.0–2.7)
Females, 3–79 years							
1 (2007–2009) ^a	—	—	—	—	—	—	—
2 (2009–2011)	3130	100	1.1 (1.0–1.1)	0.50 (0.46–0.54)	1.0 (0.96–1.1)	2.3 (2.1–2.5)	2.8 (2.6–3.0)
3 (2012–2013)	2769	99.6 (97.1–100)	0.96 (0.90–1.0)	0.42 (0.37–0.47)	0.93 (0.87–1.0)	2.2 (2.1–2.3)	2.6 (2.2–3.1)
4 (2014–2015)	2744	99.9 (99.8–100)	0.87 (0.81–0.94)	0.40 (0.36–0.43)	0.83 (0.78–0.89)	2.0 (1.6–2.3)	2.6 (2.3–2.8)
5 (2016–2017)	2260	99.4 (97.0–99.9)	0.79 (0.74–0.84)	0.33 (0.30–0.35)	0.77 (0.68–0.86)	1.8 (1.6–1.9)	2.2 (2.0–2.4)
6 (2018–2019)	2266	99.3 (97.1–99.8)	0.75 (0.70–0.80)	0.32 (0.29–0.35)	0.72 (0.66–0.78)	1.7 (1.5–1.8)	2.2 (1.9–2.6)

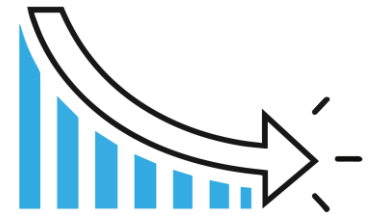
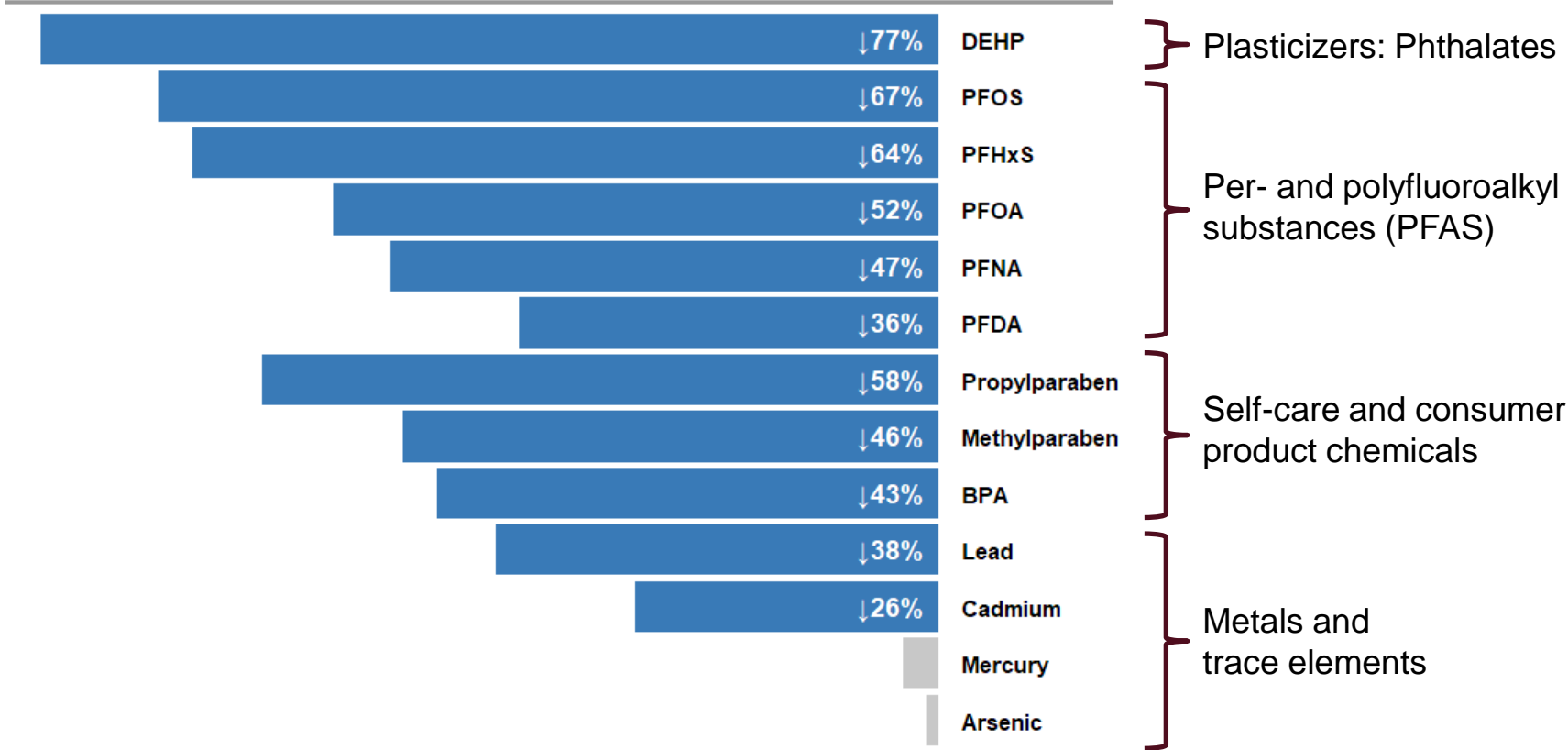
Biomonitoring Fact Sheets

- A new resource summarizing key findings from CHMS focusing on CMP priority chemicals
- Graphical representation of **trends over time** and **comparisons** between the general population and vulnerable sub-populations, including data from other biomonitoring initiatives in Canada and the U.S.
- Eight fact sheets are now published for:
 1. Arsenic
 2. Mercury
 3. Cadmium
 4. Lead
 5. BPA
 6. Parabens
 7. PFAS
 8. DEHP



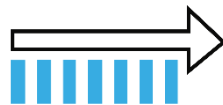
Time Trends for Chemicals in the Canadian Population

← Declining concentrations



Since 2007, average concentrations have **declined** for many chemicals in the Canadian population.

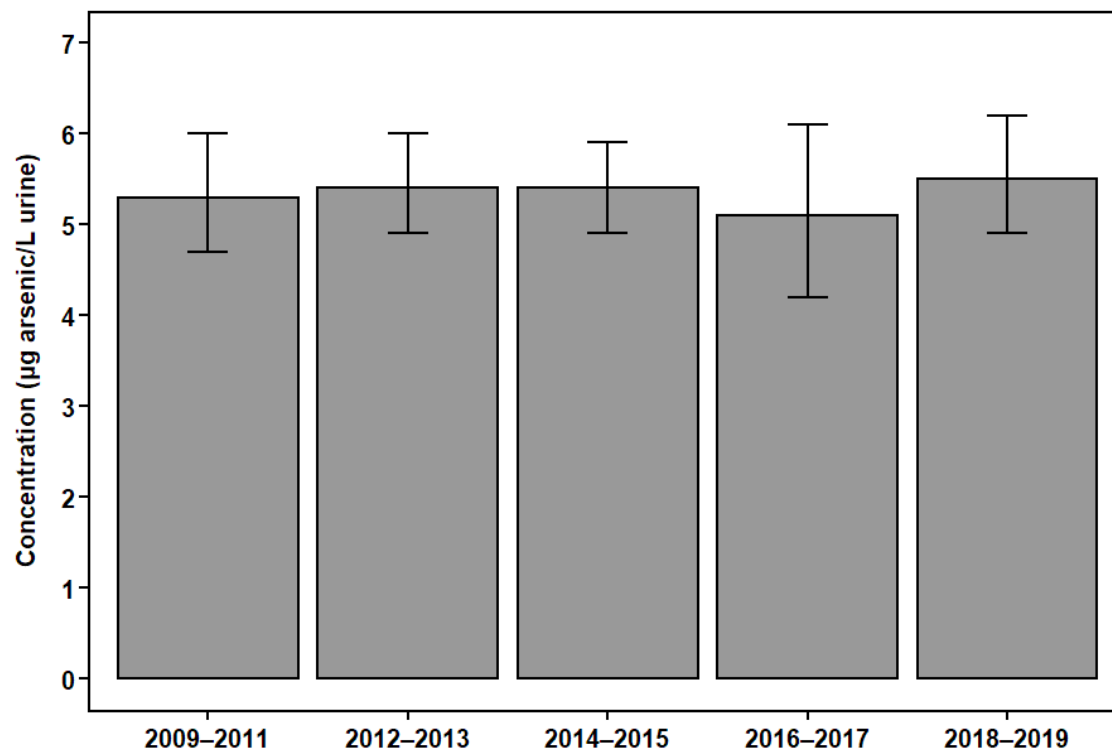
Metals and Trace Elements: Arsenic – Cycles 2 to 6 (2009–2019)



Concentrations of inorganic arsenic were relatively unchanged from 2009–2019.



Concentrations of inorganic arsenic for a subset of the general Canadian population at the higher end of exposures may exceed the threshold of concern.



- Arsenic exposure is mainly through eating foods containing arsenic, such as seafood and rice.
- Other potential sources of exposure include drinking water, soil and air.
- Based on results from CHMS, sources of exposure are being re-examined by RA/RM.

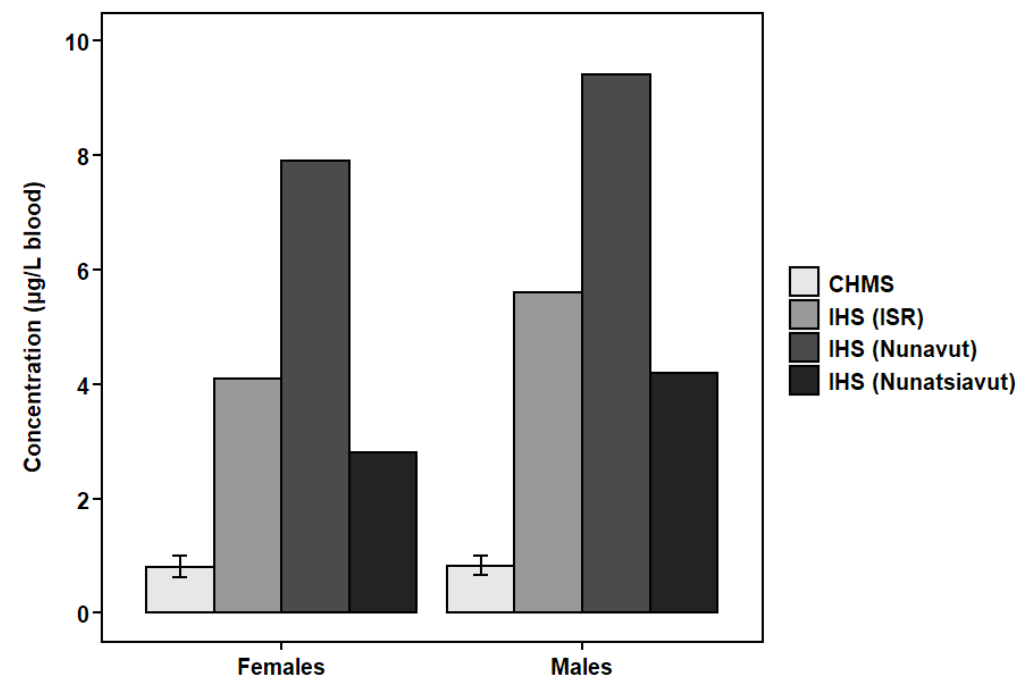
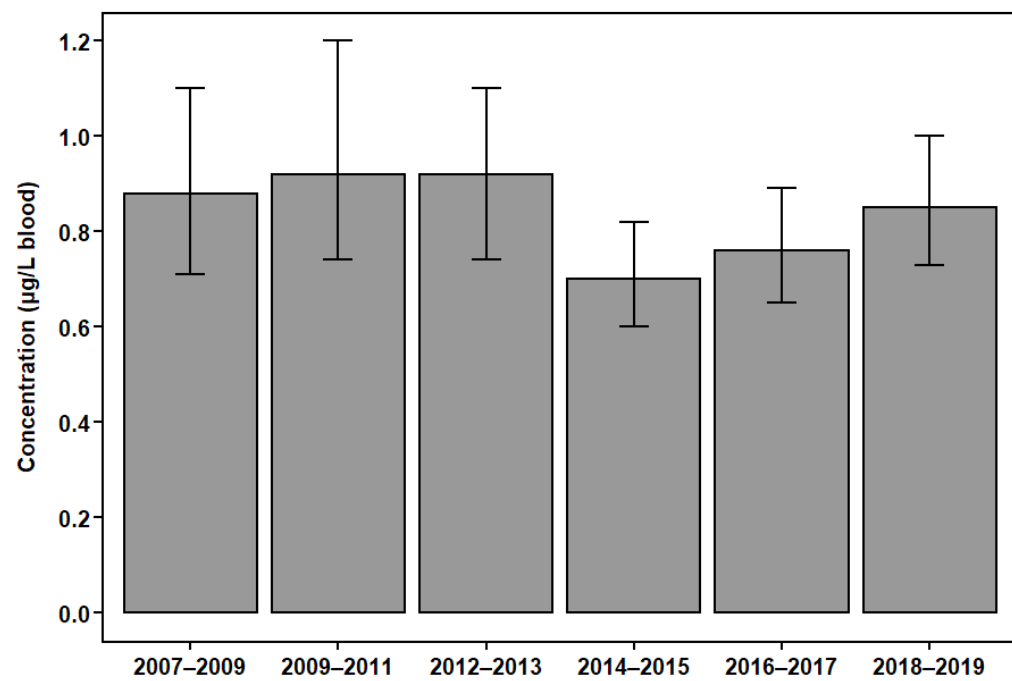
Metals and Trace Elements: Mercury – Cycles 1 to 6 (2007–2019)



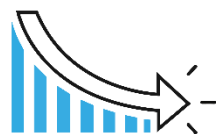
Concentrations were relatively unchanged from 2007–2019.



Concentrations of mercury were higher in Inuit populations in the Inuvialuit Settlement Region (ISR), Nunavut and Nunatsiavut than in the general population in Canada.



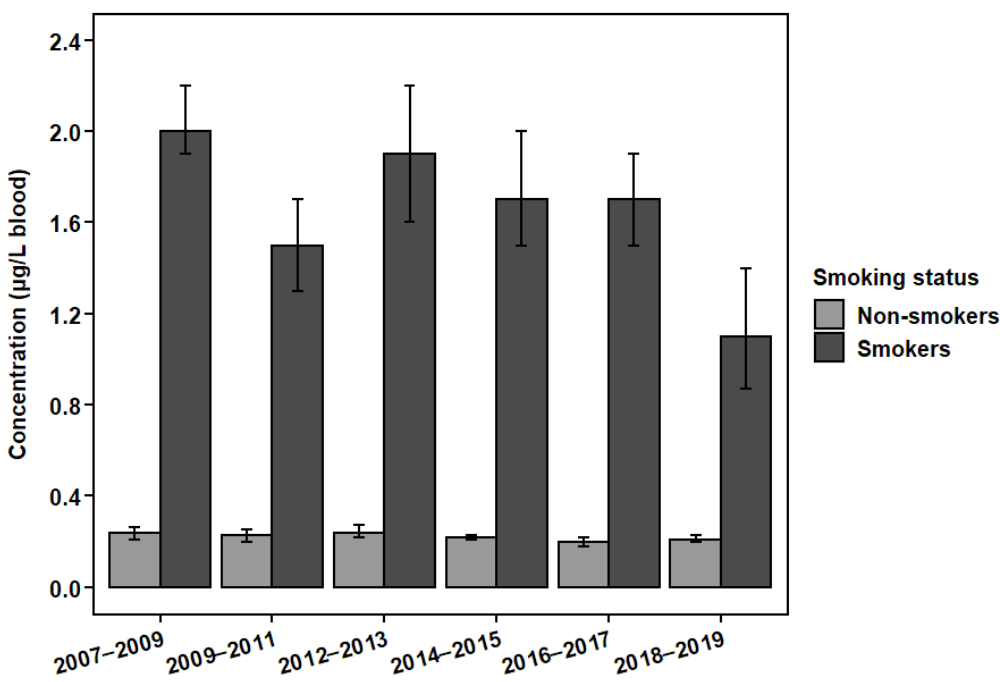
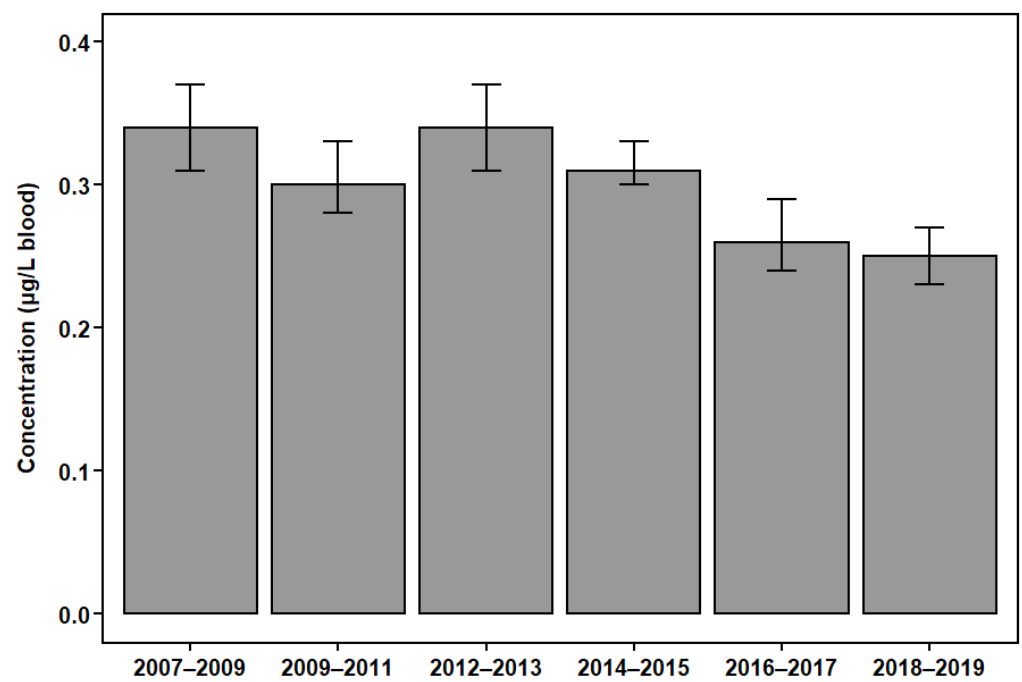
Metals and Trace Elements: Cadmium – Cycles 1 to 6 (2007–2019)



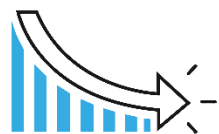
Concentrations declined by **26%** between 2007–2009 and 2018–2019.



Concentrations of cadmium were higher in smokers than in non-smokers in Canada.



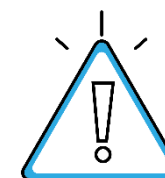
Metals and Trace Elements: Lead – Cycles 1 to 6 (2007–2019)



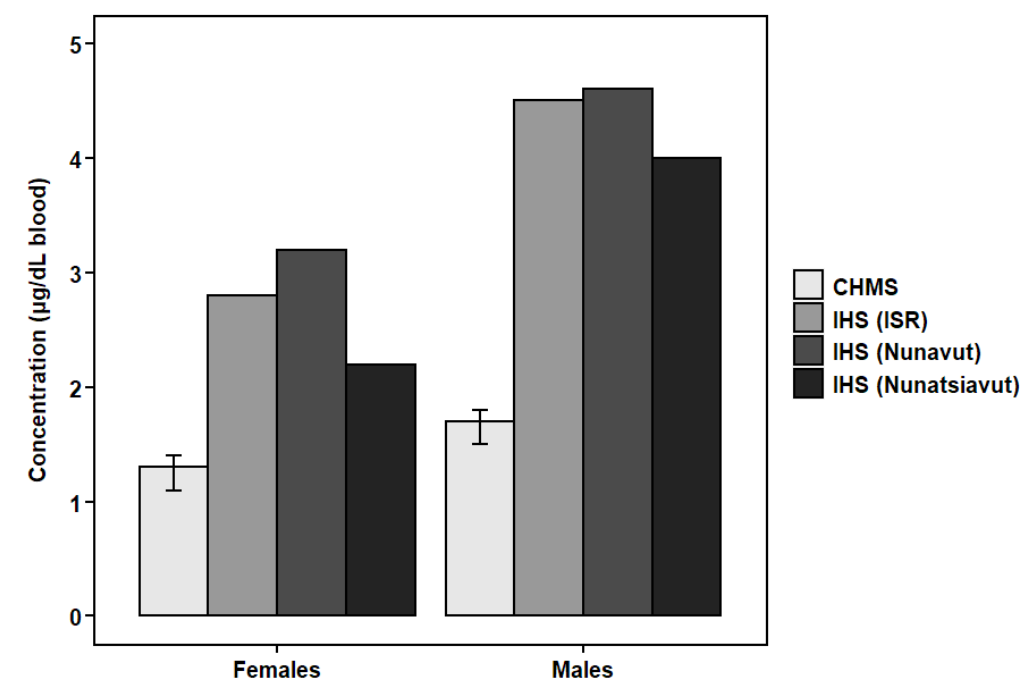
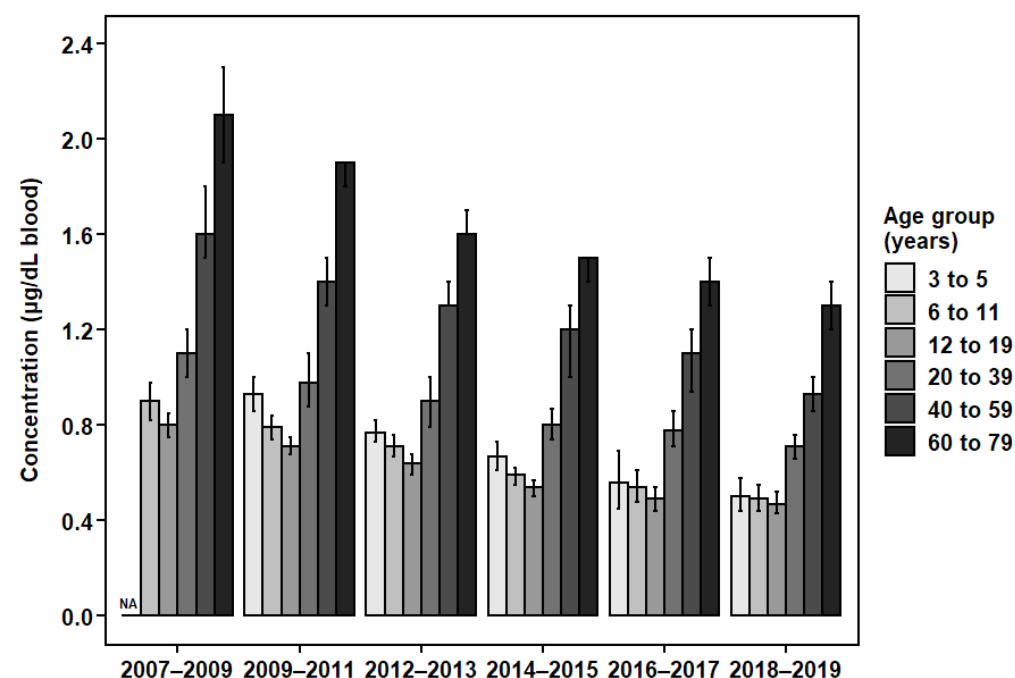
Concentrations declined by **38%** between 2007–2009 and 2018–2019.



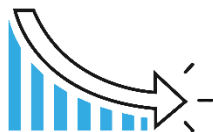
Concentrations of lead were higher in older adults than in children, adolescents and younger adults in the Canadian population.



Concentrations of lead were higher in Inuit populations in the Inuvialuit Settlement Region (ISR), Nunavut and Nunatsiavut than in the general population in Canada.



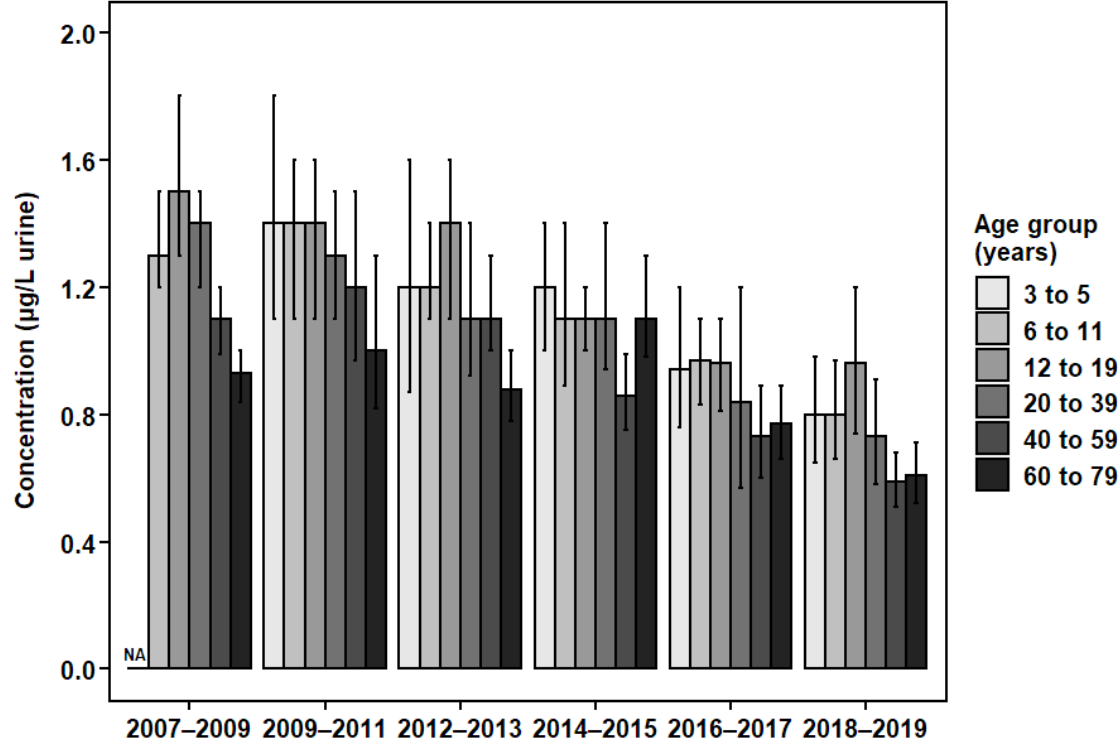
Self-care and Consumer Product Chemicals: BPA – Cycles 1 to 6 (2007–2019)



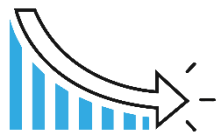
Concentrations declined by **43%** between 2007–2009 and 2018–2019.



BPA in baby bottles and infant formula packaging was prohibited in Canada starting in 2010.



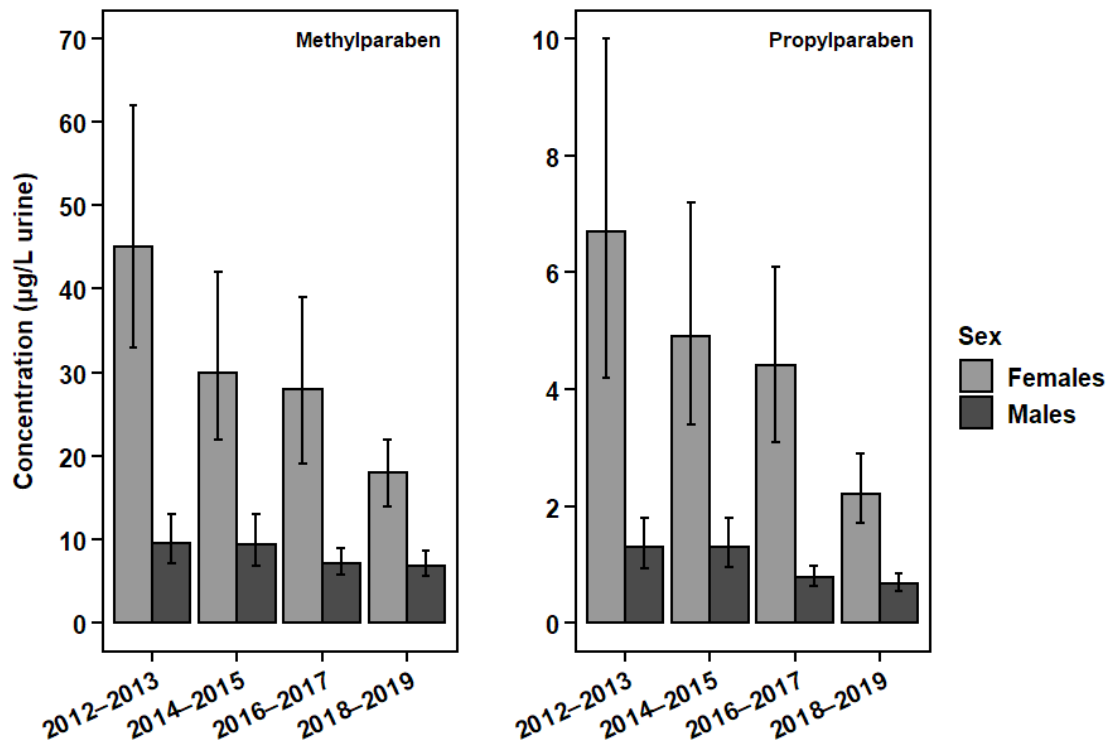
Self-care and Consumer Product Chemicals: Parabens – Cycles 3 to 6 (2012–2019)



Concentrations declined by **45–60%** between 2012–2013 and 2018–2019.

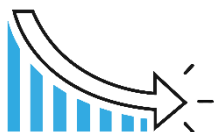


Concentrations of methylparaben and propylparaben were higher in females than in males in the Canadian population.



- Parabens are used in personal care products, including makeup, moisturizers, sunscreens, hair-care products, skin cleansers, shaving products and toothpastes.
- CHMS data were used in the estimation of exposure in *HC Draft screening assessment - Parabens group (2020)*

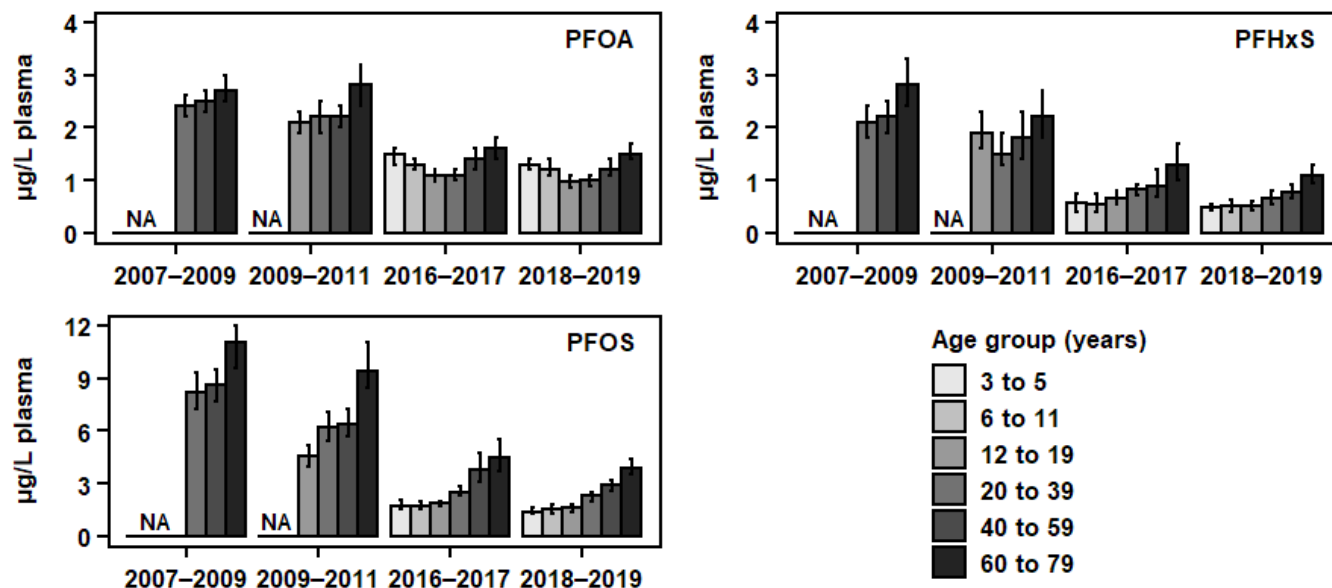
PFAS – Cycles 1, 2, 5 and 6 (2007–2011, 2016–2019)



Concentrations declined by **50–70%** between 2007–2009 and 2018–2019.

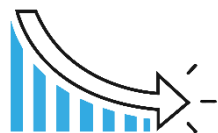


Concentrations of PFAS were generally higher in adults than in children in the Canadian population.



- First nationally-representative data for PFAS in children aged 3 to 11 years.
- Data have been used in the **notice of intent to address PFAS (2021)** and will be included in the **State of PFAS Report**.

Plasticizers | Phthalates: DEHP – Cycles 1, 2, 5 and 6 (2007–2011, 2016–2019)



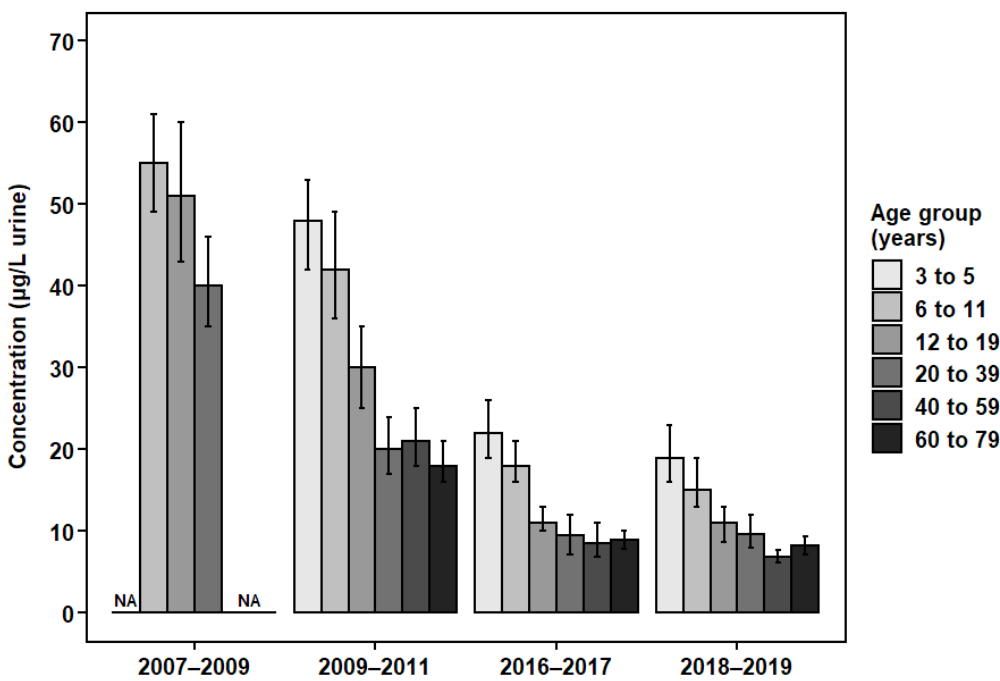
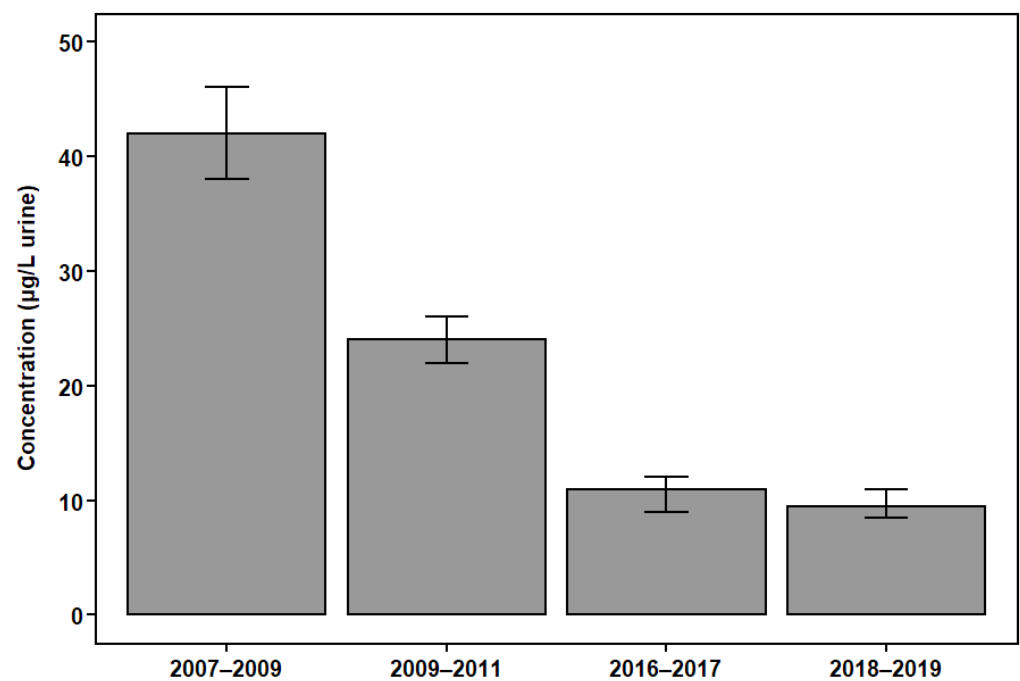
Concentrations declined by **77%** between 2007–2009 and 2018–2019.



Concentrations of DEHP were higher in children than in adults in the Canadian population.



2011 *Phthalates Regulations* limited the concentration of DEHP allowed in soft vinyl toys and childcare articles

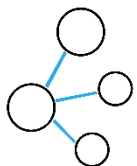


Ongoing Biomonitoring Through the CHMS



Cycle 6 Data and Analyses (2018–2019)

- Results will be added to the open data portal (2022)
- New and updated trend analysis for 30 chemicals (2022)
- New data for persistent organic pollutants in pooled samples (2023)
- In-depth data analysis to identify demographic, environmental, and lifestyle factors affecting exposure (e.g., PFAS in children)



Retrospective Analyses – CHMS Biobank Projects

- Emerging priority chemicals such as BPA replacements, pesticides, and flame retardants are being measured in stored samples from the CHMS biobank (2022)



Cycle 7 (2022–2023)

- Start of data collection delayed to June 2022 due to Covid-19
- New vulnerable sub-population (1–2 year old children)
- Sampling of tap water for metals and trace elements
- Pilot longitudinal cohort by re-contacting past CHMS participants



Future Reporting for the National Biomonitoring Program



Content and Results Dashboard

- Beginning with results from CHMS biobank projects in 2022, we will seek to make new information and data available through an interactive, web-based dashboard
- Our pilot dashboard is currently online and data from cycle 6 will be added in the near future: <https://biomonitoring.shinyapps.io/content/>
- Please note that this pilot version is only available in English and does not yet meet all accessibility requirements

Acknowledgements

- All CHMS participants
- Health Canada's National Biomonitoring Program
- Statistics Canada's CHMS Team
- Laboratories responsible for chemical measurements: CTQ (INSPQ) and ROEB Lab (HC)
- Health Canada's program experts for technical reviews of the report and fact sheets
- Funding for this initiative from the Government of Canada's Chemicals Management Plan (CMP)



For More Information

Health Canada:

canada.ca/biomonitoring

Statistics Canada:

statcan.ca/chms

statcan.gc.ca/dai-quo/

Research Data Centres:

crdcn.org

Centre de toxicologie, Institut national de santé publique du Québec:

<https://www.inspq.qc.ca/ctq/accueil>