

# Arsenic in Canadians

December 2021



Health  
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Canada

Canada

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## BACKGROUND



### What is arsenic?

Arsenic (CASRN 7440-38-2) is a naturally occurring element. It exists in inorganic and organic forms, and it enters the environment through both natural and industrial processes.



### Where is arsenic found?

Arsenic is present in the environment, including in soils and groundwater. It is used in manufacturing processes and can be found in textiles, paper, ceramics and explosives. It can also be found in foods, beverages and house dust.



### How are people exposed to arsenic?

People are exposed to arsenic mainly by eating foods containing arsenic, such as seafood and rice. Other potential sources of exposure include drinking water, soil and air. Exposure to arsenic may be higher in people who live near a source of arsenic.



### How is arsenic measured in people?

Inorganic and organic arsenic enter the bloodstream after being ingested or inhaled. Measurements of total and speciated arsenic in urine are reliable indicators of recent exposure. Arsenic species include the inorganic compounds arsenite (III) and arsenate (V). They also include the organic compounds monomethylarsonic acid (MMA), dimethylarsinic acid (DMA), arsenobetaine and arsenocholine.



### What are the potential health impacts of arsenic?

Chronic exposure to inorganic arsenic has been associated with decreased lung function, non-cancer skin effects and cardiovascular effects. The International Agency for Research on Cancer has classified arsenic and inorganic arsenic compounds as carcinogenic to humans. It has also classified DMA and MMA as possibly carcinogenic to humans. It has determined that other organic arsenic compounds (such as arsenobetaine) cannot be classified in terms of their carcinogenicity to humans.



### What is the Government of Canada doing to lower human exposures to arsenic?

Arsenic and inorganic arsenic compounds are identified as toxic under the *Canadian Environmental Protection Act, 1999*. Risk management strategies have been developed to control releases of arsenic from smelting, mining and manufacturing processes. Arsenic and its compounds are on the List of Ingredients that are Prohibited for Use in Cosmetic Products. The Food and Drug Regulations prohibit the sale of drugs containing arsenic for human use. Leachable arsenic content in a variety of consumer

products is regulated under the *Canada Consumer Product Safety Act*. The sale and use of pesticides containing arsenic are regulated through the *Pest Control Products Act*. The Government of Canada continues to monitor and assess arsenic.

## DATA SOURCES

**Table 1. Biomonitoring initiatives and their target populations**

Initiative	Target population
Canadian Health Measures Survey (CHMS)	General Canadian population living in the 10 provinces
First Nations Biomonitoring Initiative (FNBI)	First Nations people living on-reserve south of the 60° parallel
Maternal-Infant Research on Environmental Chemicals (MIREC) study	Pregnant women and their infants recruited from obstetric and prenatal clinics in 10 cities across Canada
U.S. National Health and Nutrition Examination Survey (NHANES)	General U.S. population

This fact sheet presents nationally representative data from the CHMS. These data are compared with data from the FNBI, the MIREC study and the U.S. NHANES.

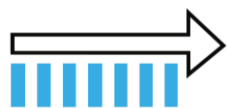
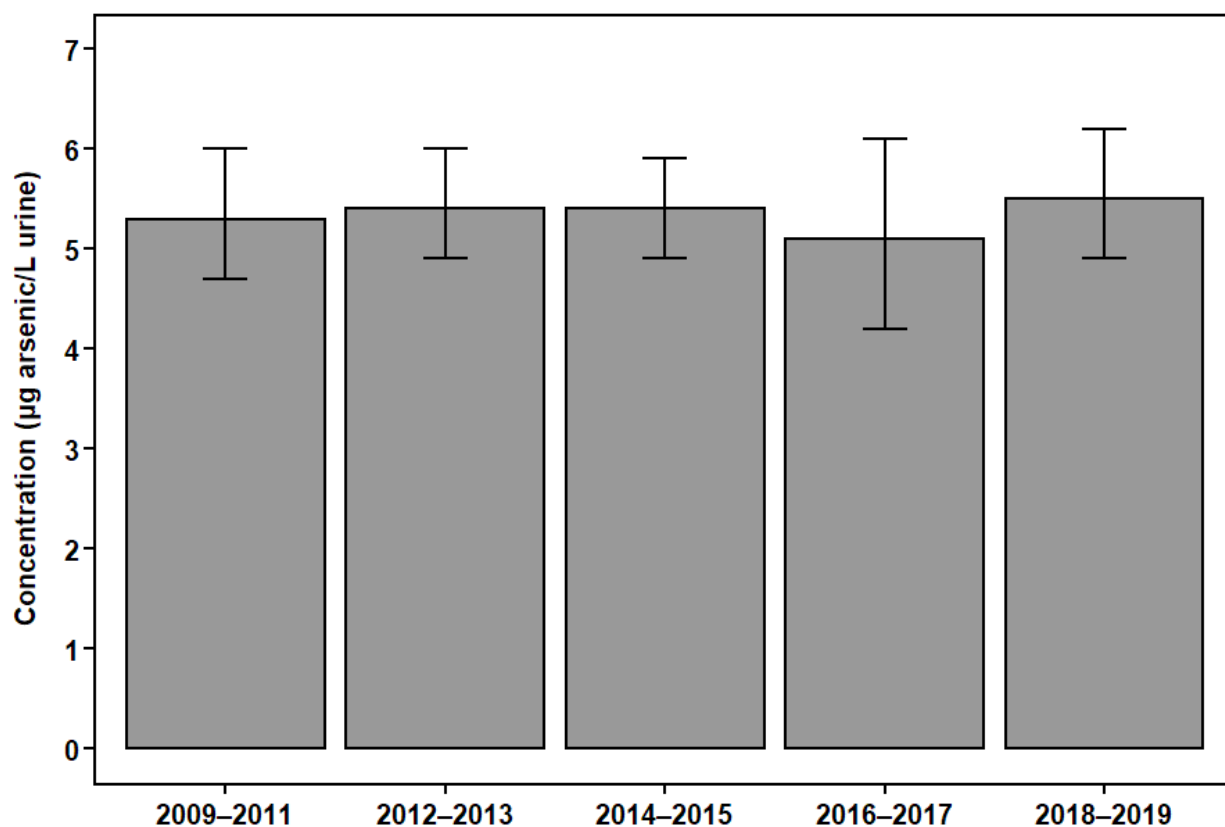
**Table 2. Biomonitoring initiatives and their collection periods, participant age ranges, matrices sampled and biomarkers measured**

Collection period	Age range (years)	Matrix	Biomarkers
<b>CHMS</b>			
2009–2011	3 to 79	Urine	Total arsenic, arsenite, arsenate, MMA, DMA
2012–2013	3 to 79	Urine	Arsenite, arsenate, MMA, DMA
2014–2015	3 to 79	Urine	Arsenite, arsenate, MMA, DMA
2016–2017	3 to 79	Urine	Arsenite, arsenate, MMA, DMA
2018–2019	3 to 79	Urine	Arsenite, arsenate, MMA, DMA
<b>FNBI</b>			
2011	20+	Urine	Total arsenic
<b>MIREC study</b>			
2008–2011	18+	Urine	Arsenite, arsenate, MMA, DMA
<b>U.S. NHANES</b>			
2009–2010	6+	Urine	Arsenite, arsenate, MMA, DMA
2011–2012	6+	Urine	Arsenite, arsenate, MMA, DMA
2013–2014	6+	Urine	Arsenite, arsenate, MMA, DMA
2015–2016	3+	Urine	Arsenite, arsenate, MMA, DMA

## RESULTS

### Canadian population

**Figure 1. Inorganic arsenic concentrations in the Canadian population aged 3 to 79.** This figure shows the geometric mean concentrations of inorganic arsenic in the Canadian population from the CHMS (2009–2019). Inorganic arsenic was calculated as the sum of 4 metabolites (arsenite, arsenate, MMA and DMA). Each metabolite was measured in urine ( $\mu\text{g}$  arsenic/L).

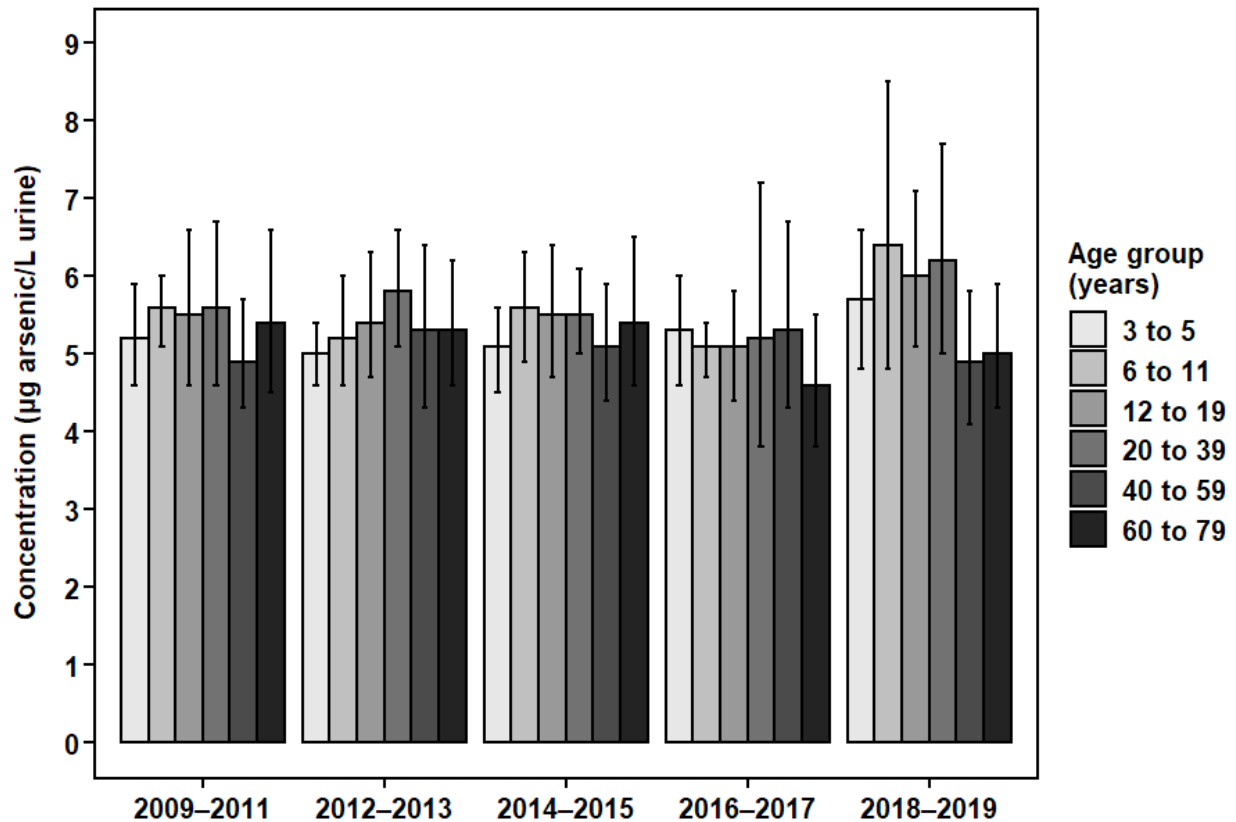


Concentrations of inorganic arsenic were relatively unchanged in the Canadian population from 2009–2019. There was no statistically significant change over time ( $P = 0.927$ ).

## Canadian population, by age group

**Figure 2. Inorganic arsenic concentrations in the Canadian population, by age group.**

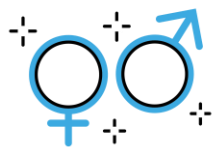
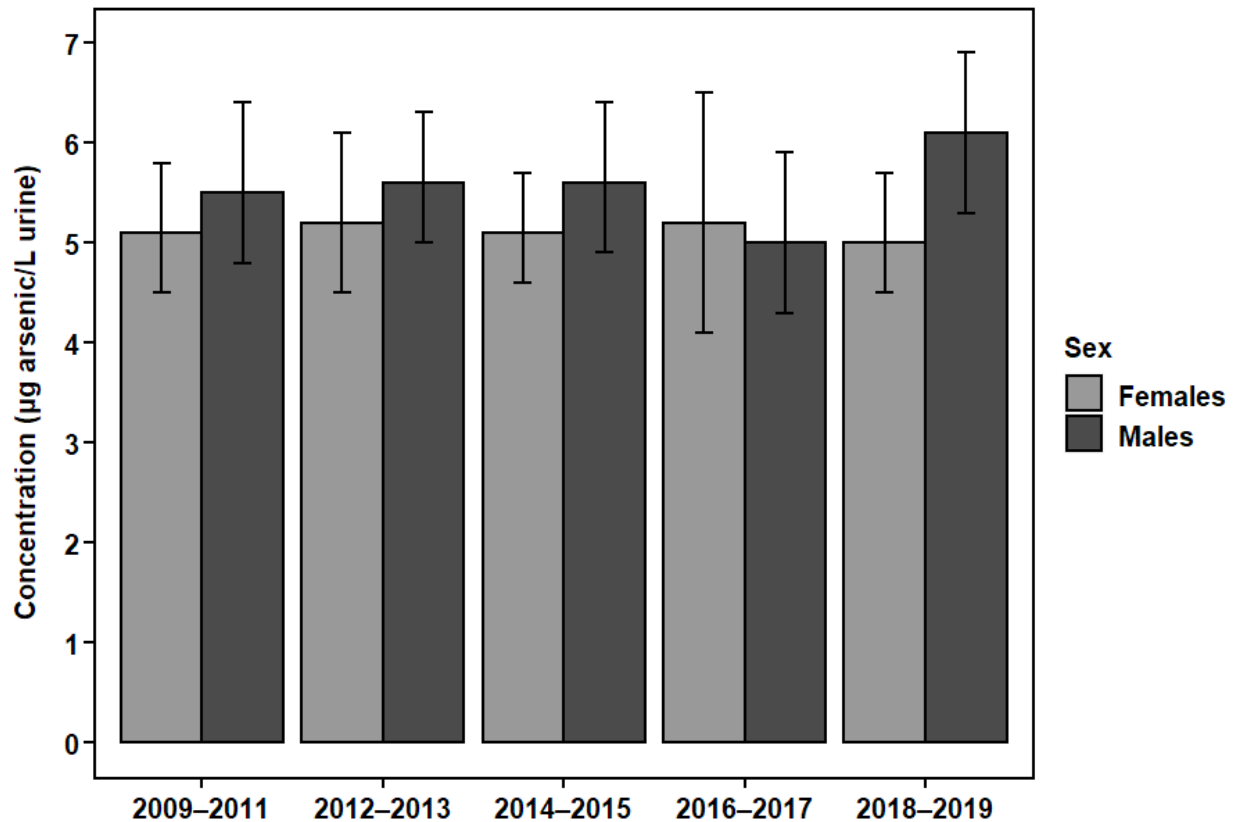
This figure shows the geometric mean concentrations of inorganic arsenic in the Canadian population by age group from the CHMS (2009–2019). Inorganic arsenic was calculated as the sum of 4 metabolites (arsenite, arsenate, MMA and DMA). Each metabolite was measured in urine ( $\mu\text{g}$  arsenic/L).



Concentrations of inorganic arsenic were similar across age groups in the Canadian population.

## Canadian population, by sex

**Figure 3. Inorganic arsenic concentrations in the Canadian population aged 3 to 79, by sex.** This figure shows the geometric mean concentrations of inorganic arsenic in the Canadian population by sex from the CHMS (2009–2019). Inorganic arsenic was calculated as the sum of 4 metabolites (arsenite, arsenate, MMA and DMA). Each metabolite was measured in urine ( $\mu\text{g}$  arsenic/L).

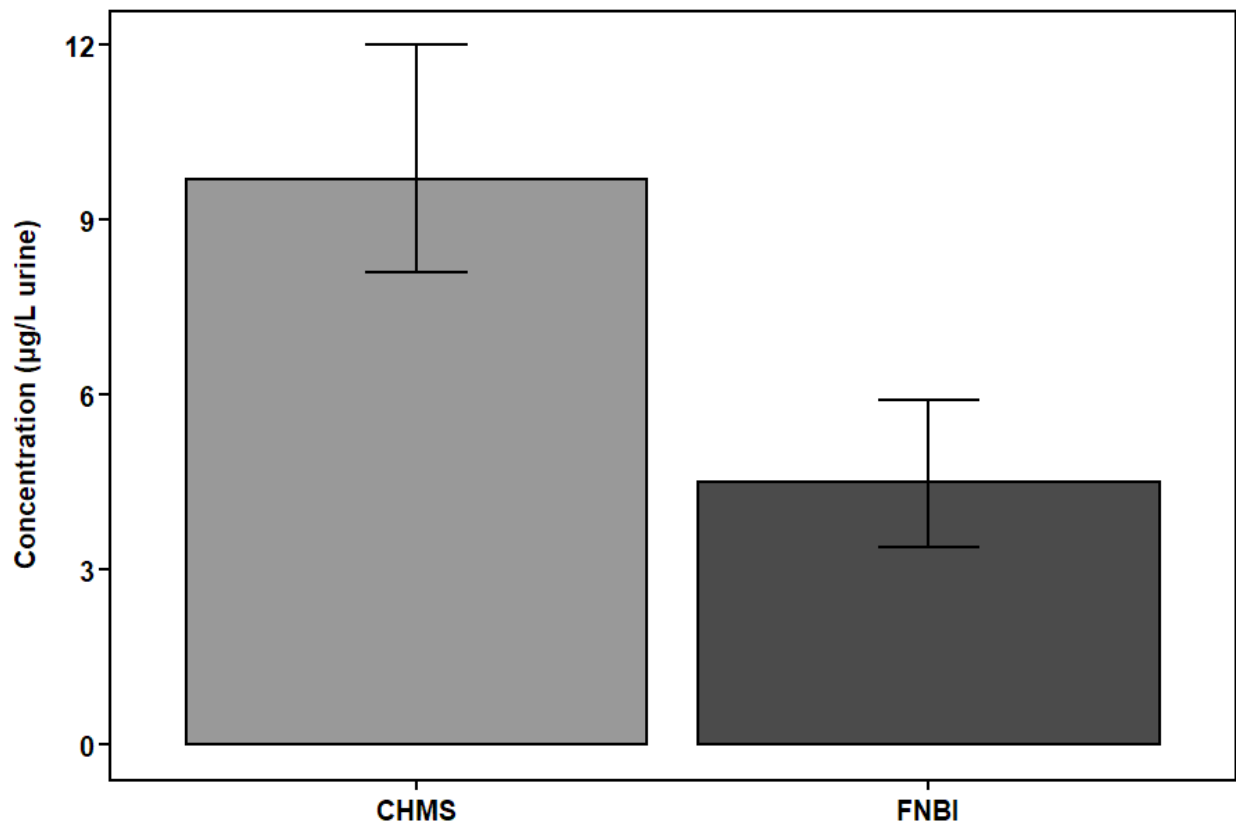


Concentrations of inorganic arsenic were similar between females and males in the Canadian population.



## Comparison of the general population and First Nations on-reserve population in Canada

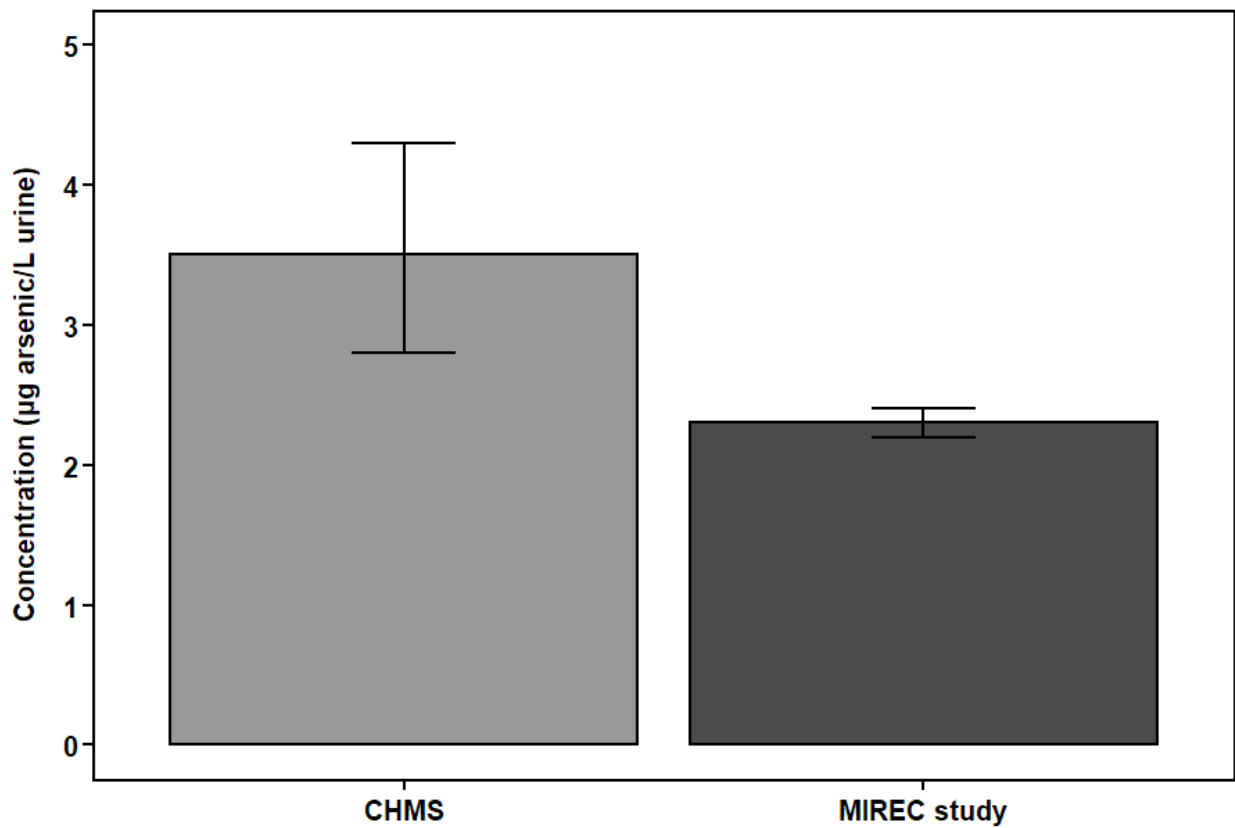
**Figure 4. Total arsenic concentrations in the general population and First Nations on-reserve population in Canada.** This figure shows the geometric mean concentrations of total arsenic in urine ( $\mu\text{g/L}$ ) in the general population aged 20 to 79 from the CHMS (2009–2011) and in the First Nations on-reserve population aged 20 and older from the FNBI (2011).



Concentrations of total arsenic were higher in the general population than in the First Nations on-reserve population in Canada.

## Comparison of women of child-bearing age and pregnant women in Canada

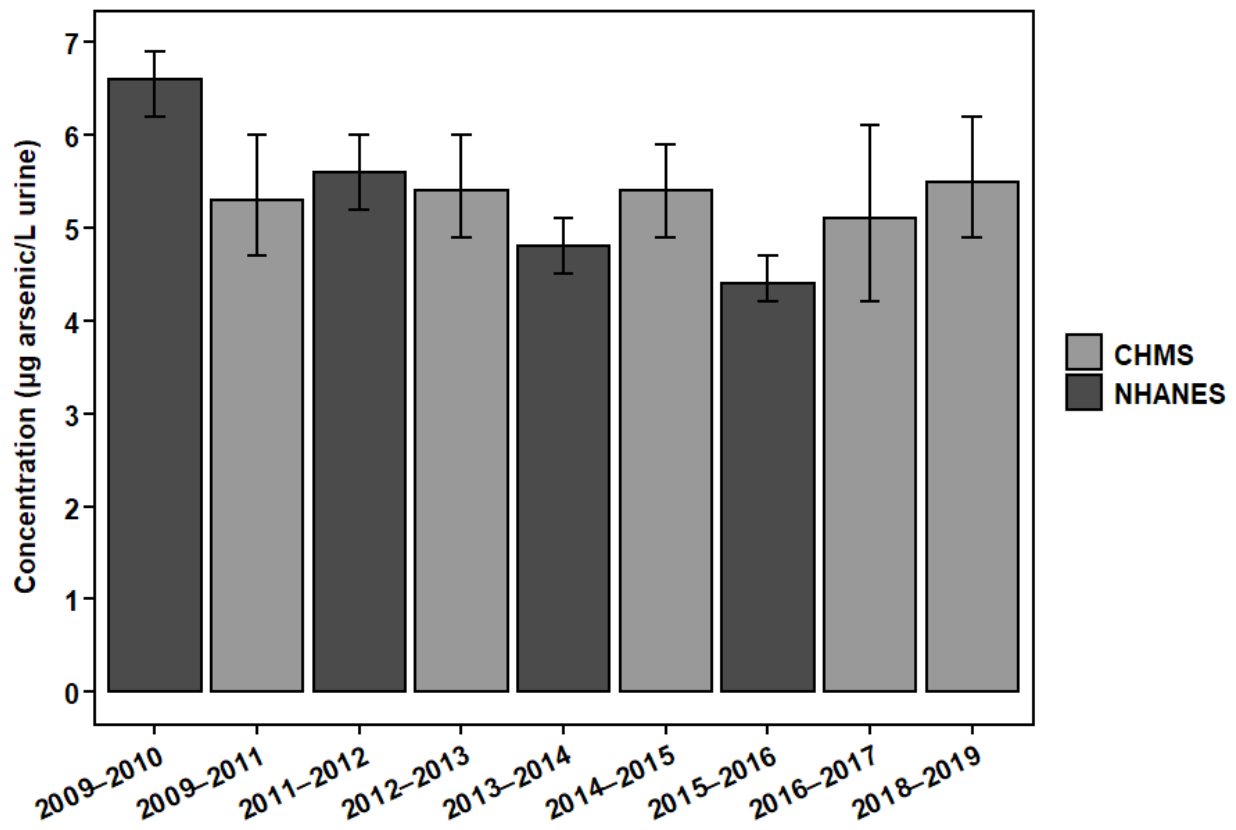
**Figure 5. DMA concentrations in women of child-bearing age and women in the first trimester of pregnancy in Canada.** This figure shows the geometric mean concentrations of DMA in urine ( $\mu\text{g arsenic/L}$ ) for women of child-bearing age (18 to 49) in the general population from the CHMS (2009–2011) and for women in the first trimester of pregnancy from the MIREC study (2008–2011).



Concentrations of DMA were higher in women of child-bearing age in the general population than in women in the first trimester of pregnancy in cities across Canada.

## Comparison of the Canadian and U.S. populations

**Figure 6. Inorganic arsenic concentrations in the Canadian and U.S. populations.** This figure shows the geometric mean concentrations of inorganic arsenic in the Canadian population from the CHMS (2009–2019) and in the U.S. population from the NHANES (2009–2016). Inorganic arsenic was calculated as the sum of 4 metabolites (arsenite, arsenate, MMA and DMA). Each metabolite was measured in urine ( $\mu\text{g}$  arsenic/L). Note that there are slight differences between the surveys in sampling (such as the age ranges of participants) and analysis (such as the limits of detection).



Concentrations of inorganic arsenic were similar between the Canadian and U.S. populations.

## ADDITIONAL INFORMATION

Assembly of First Nations. 2013. First Nations Biomonitoring Initiative: National Results (2011). Ottawa, ON, Canada.

Centers for Disease Control and Prevention. 2021. National Report on Human Exposure to Environmental Chemicals. Atlanta, GA, USA.

Ettinger AS, Arbuckle TE, Fisher M, Liang CL, Davis K, Cirtiu C-M, Bélanger P, LeBlanc A, Fraser WD, MIREC Study Group. 2017. Arsenic levels among pregnant women and newborns in Canada: Results from the Maternal-Infant Research on Environmental Chemicals (MIREC) cohort. *Environmental Research*, 153: 8–16.

Health Canada. 2013. Second Report on Human Biomonitoring of Environmental Chemicals in Canada: Results of the Canadian Health Measures Survey Cycle 2 (2009–2011). Ottawa, ON, Canada.

Health Canada. 2015. Third Report on Human Biomonitoring of Environmental Chemicals in Canada: Results of the Canadian Health Measures Survey Cycle 3 (2012–2013). Ottawa, ON, Canada.

Health Canada. 2017. Fourth Report on Human Biomonitoring of Environmental Chemicals in Canada: Results of the Canadian Health Measures Survey Cycle 4 (2014–2015). Ottawa, ON, Canada.

Health Canada. 2019. Fifth Report on Human Biomonitoring of Environmental Chemicals in Canada: Results of the Canadian Health Measures Survey Cycle 5 (2016–2017). Ottawa, ON, Canada.

Health Canada. 2021. Sixth Report on Human Biomonitoring of Environmental Chemicals in Canada: Results of the Canadian Health Measures Survey Cycle 6 (2018–2019). Ottawa, ON, Canada.