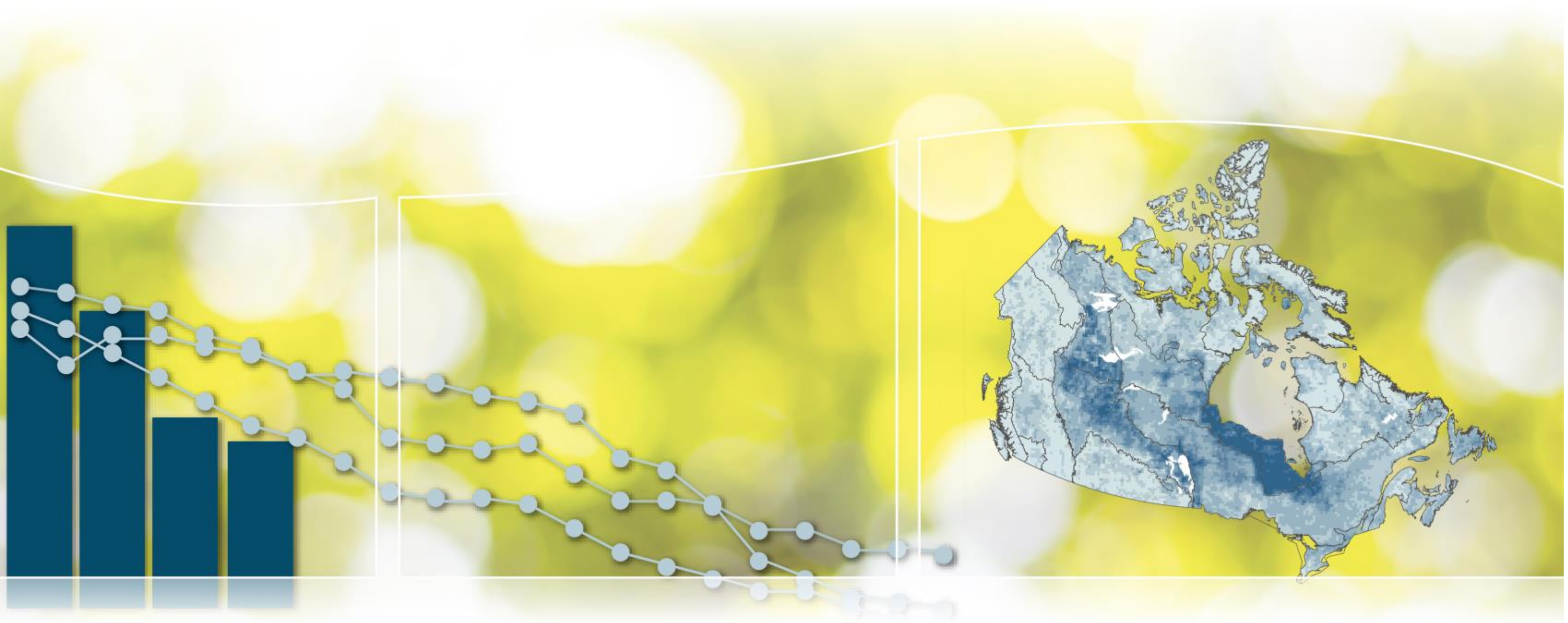
Environment and Climate Change Canada
Environnement et Changement climatique Canada

Canadian Environmental Sustainability Indicators

Human exposure to harmful substances



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Canadian Environmental Sustainability Indicators

Human exposure to harmful substances

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Human exposure to harmful substances

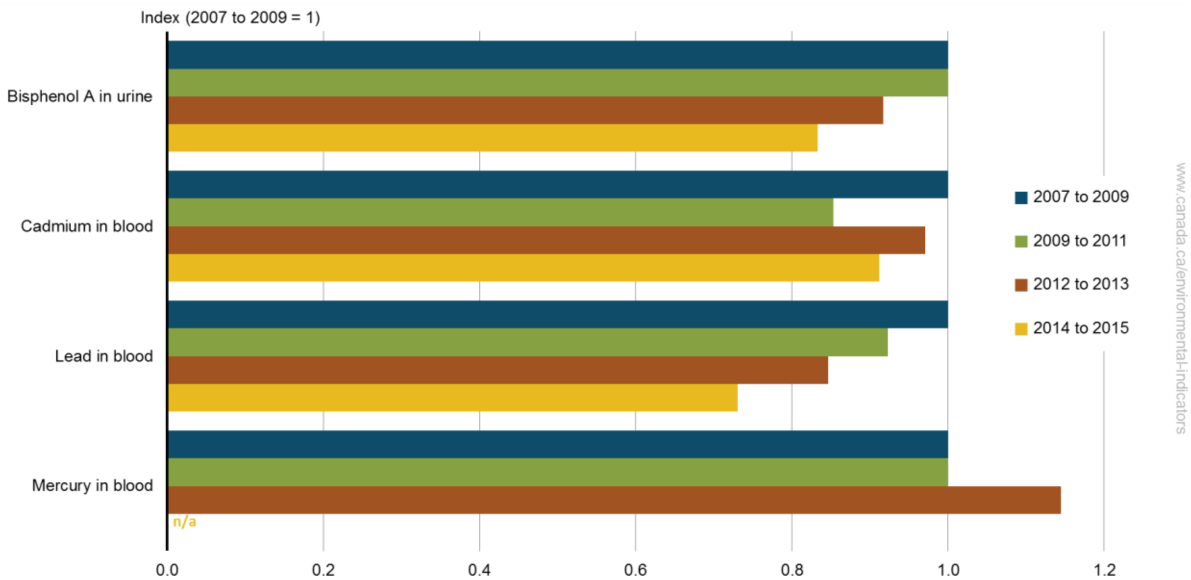
Chemicals are present in air, soil, water, products and food. Humans are exposed to chemicals in many ways, including inhalation, ingestion and skin contact. These indicators present the average concentrations of selected environmental chemicals in Canadians.

Key results

Four (4) surveys conducted from 2007 to 2015 indicate that average concentrations in Canadians of:

- lead and bisphenol A (BPA) generally decreased
- cadmium and mercury fluctuated

Figure 1. Changes in the average concentrations of selected substances in Canadians, between the periods 2007 to 2009 and 2014 to 2015



Data for Figure 1

Note: The chart presents changes in the average (geographic mean) concentrations of selected substances in Canadians relative to the values in the period 2007 to 2009. The concentrations of mercury, lead and cadmium in blood and bisphenol A in urine are from participants aged 3 to 79 years, except for the period 2007 to 2009 when there were no participants under the age of 6 years. n/a = not available, since more than 40% of samples were below the limit of detection.
Source: Health Canada (2017) Fourth Report on Human Biomonitoring of Environmental Chemicals in Canada: Results of the Canadian Health Measures Survey Cycle 4 (2014-2015).

There is a marginal decreasing trend[1] in the average concentration of BPA in urine between the periods 2007 to 2009 and 2014 to 2015.

There is no significant trend in the average concentration of cadmium in blood in Canadians between the periods 2007 to 2009 and 2014 to 2015.

There is a significant decreasing trend in the average concentration of lead in blood in Canadians with a 26% decrease between the periods 2007 to 2009 and 2014 to 2015, and an 80% decrease

[1] Trend results for BPA are provisional and should be interpreted with caution.

since 1978 to 1979.[2] This is mainly attributed to the progressive phase-out of lead in gasoline, paint and food-can solder.

There is no significant trend in the average concentration of mercury in blood in Canadians between the periods 2007 to 2009 and 2014 to 2015.

Mercury

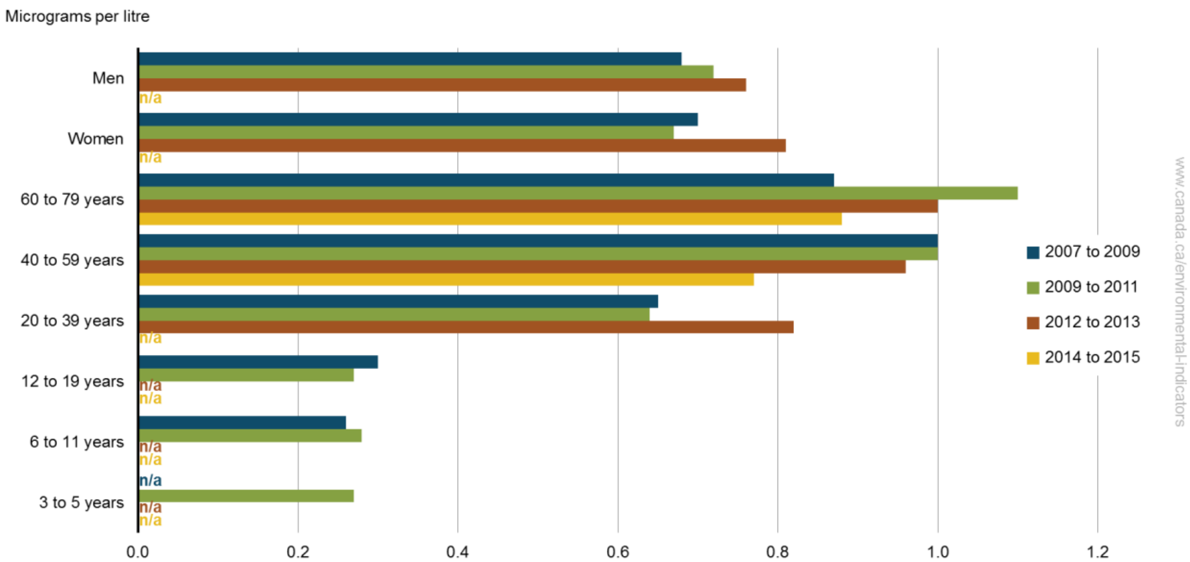
Mercury exposure is of global concern. Mercury is re-emitted to the air during forest fires, volcanic episodes and other geological activities. It is also used in, and released from, industrial processes and commercial products. Exposure to mercury can have adverse health effects.

Key results

During the 4 study periods, the average concentrations of mercury:

- showed no trend
- were higher in adults than in children
- were similar in women and men

Figure 2. Average concentration of mercury in blood in Canadians during the periods 2007 to 2009, 2009 to 2011, 2012 to 2013, and 2014 to 2015



Data for Figure 2

Note: n/a = not available. For the period 2007 to 2009, data were not available for children under the age of 6 years. For the periods 2012 to 2013 and 2014 to 2015, averages (geometric means) were not calculated for some age groups, since more than 40% of the samples were below the limit of detection. Mercury is shown as total mercury (organic and inorganic).
Source: Health Canada (2017) Fourth Report on Human Biomonitoring of Environmental Chemicals in Canada: Results of the Canadian Health Measures Survey Cycle 4 (2014-2015).

Adults aged 40 to 59 years and 60 to 79 years consistently presented higher average concentrations of mercury compared to other age groups because mercury accumulates in the body.

Mercury is widespread in the environment. It is a naturally occurring metal and is released by many industrial processes, such as chemical manufacturing operations, metal mining and coal combustion.

[2] Geometric mean was 47.9 micrograms per litre among people aged 6 to 79 years in 1978-79 (Bushnik et al. 2010).

It is carried over long distances in the atmosphere to settle everywhere in Canada. Mercury is toxic to humans and bioaccumulates in terrestrial and aquatic food chains.

Humans are exposed to methylmercury (neurotoxicant) primarily through consumption of contaminated fish and seafood. Fish that are long-lived and feed on other fish can accumulate high levels of methylmercury. To a much lesser extent, the general population is also exposed to inorganic mercury from sources such as dental amalgams and broken mercury-containing lamps.

The human health effects depend on various factors, such as the form and amount of mercury encountered, the length of exposure, and the age of the person exposed. Oral exposure to organic mercury compounds can cause neurological damage and developmental neurotoxicity. Exposure of a fetus or young child to organic mercury can affect the development of the nervous system, including fine-motor function, attention, verbal learning and memory. Mercury is listed on the Toxic Substances List (Schedule 1) of the Canadian Environmental Protection Act, 1999.

Lead

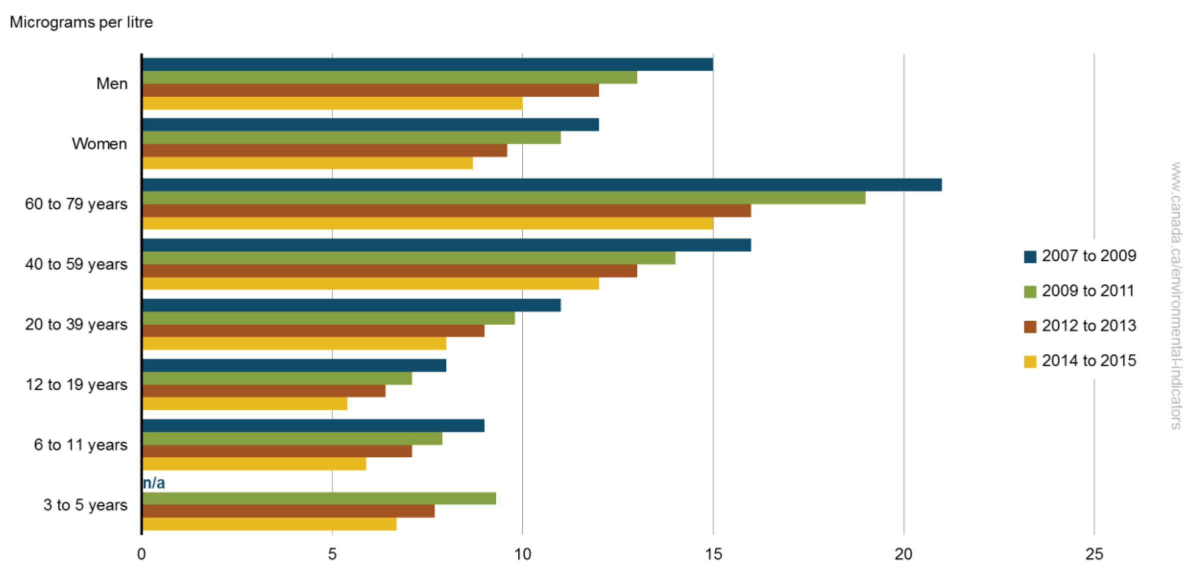
Lead can be deposited on land or water surfaces and then builds up in soils, sediments, humans and wildlife. Canadians are exposed to low levels of lead through food, drinking water, air, household dust, soil and various products. Exposure to lead, even in small amounts, can be hazardous to both humans and wildlife.

Key results

Over the 4 study periods, the average concentrations of lead:

- decreased over time
- were lower in children than in adults
- were highest in adults aged 60 to 79 years
- were higher in men than in women

Figure 3. Average concentration of lead in blood in Canadians during the periods 2007 to 2009, 2009 to 2011, 2012 to 2013, and 2014 to 2015



Data for Figure 3

Note: n/a = not available for children under the age of 6 years, as they were not included in the survey for the period 2007 to 2009. Average refers to geometric mean.
Source: Health Canada (2017) Fourth Report on Human Biomonitoring of Environmental Chemicals in Canada: Results of the Canadian Health Measures Survey Cycle 4 (2014-2015).

Adults aged 60 to 79 years consistently presented the highest concentrations of lead because it accumulates in teeth and bones over time. Children (especially 3 to 5 years) could be more vulnerable to exposure because of their age-appropriate hand-to-mouth behaviour, which increases their exposure to lead from dust and soil.

On average, men have greater concentrations of lead in their blood than women do. This may be due in part to men's higher volume of red blood cells, to which lead attaches to in the body.

Lead exposure in Canada has decreased substantially since the early 1970s. This decrease is largely attributed to the phase-out of leaded gasoline, restrictions on the use of lead in consumer paints and other coatings on children's products and elimination of lead solder in food cans.

Lead is a naturally occurring element found in rock and soil. It is currently used in the refining and manufacturing of products such as lead acid car batteries, lead shot and fishing weights, sheet lead, solder, some brass and bronze products, pipes, paints (other than paints for use by children) and some ceramic glazes. Exposure to trace amounts of lead occurs through soil, household dust, food, drinking water and air because of its natural abundance in the environment and its widespread use for much of the 20th century.

Lead is considered a cumulative general poison. Very high exposure may result in vomiting, diarrhea, convulsions, coma and death. Chronic exposure to relatively low levels may affect the central and peripheral nervous systems, blood pressure, and renal function and may result in reproductive problems and developmental neurotoxicity. Lead is listed on the Toxic Substances List (Schedule 1) of the Canadian Environmental Protection Act, 1999.

Cadmium

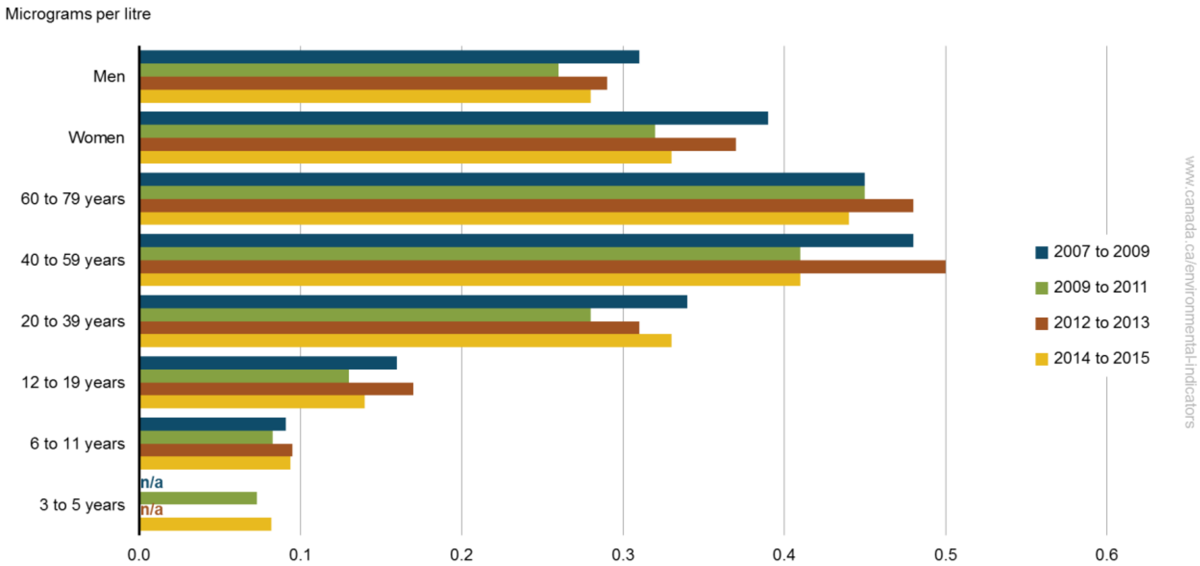
Cadmium is a naturally occurring metal. It is used in batteries and in electroplating to protect other metals from corrosion. Exposure to cadmium, which builds up in humans and wildlife, can be hazardous to both.

Key results

Over the 4 study periods, the average concentrations of cadmium:

- showed no trend over time
- were highest in adults aged 40 to 59 years and 60 to 79 years
- were higher in women than in men

Figure 4. Average concentration of cadmium in blood in Canadians during the periods 2007 to 2009, 2009 to 2011, 2012 to 2013, and 2014 to 2015



Data for Figure 4

Note: n/a = not available. For the period 2007 to 2009, data were not available for children under the age of 6 years. For the period 2012 to 2013, the average (geometric mean) was not calculated for children under the age of 6 years, since more than 40% of the samples were below the limit of detection.
Source: Health Canada (2017) Fourth Report on Human Biomonitoring of Environmental Chemicals in Canada: Results of the Canadian Health Measures Survey Cycle 4 (2014-2015).

Adults aged 40 to 59 years and 60 to 79 years consistently have the highest average concentrations of cadmium. Cadmium has a biological half-life (the time it takes to reduce the concentration by half) of about 10 to 12 years in the kidney and accumulates with age.

Women on average have greater concentrations of cadmium in their blood than men. This is due in part to the average rate of gastrointestinal absorption of dietary cadmium. The gastrointestinal absorption rate in women is estimated to be 10% or higher, while that in men is estimated to be 5%.

Cadmium is a naturally occurring metal used in batteries and in electroplating to protect other metals from corrosion. It may be emitted directly to air from human activities such as non-ferrous smelting and refining, and fuel consumption for electricity generation or heating. Inhalation of cigarette smoke is a major source of cadmium exposure in smokers. Non-smokers are primarily exposed to cadmium through food, although occupational exposure can also be a source. Other minor sources of exposure include drinking water, soil or dust, as well as inhalation and releases from consumer products.

Cadmium and its compounds have been classified by Environment and Climate Change Canada and Health Canada as a probable carcinogen in humans when inhaled. Inorganic cadmium compounds are listed on the Toxic Substances List (Schedule 1) of the Canadian Environmental Protection Act, 1999.

Bisphenol A

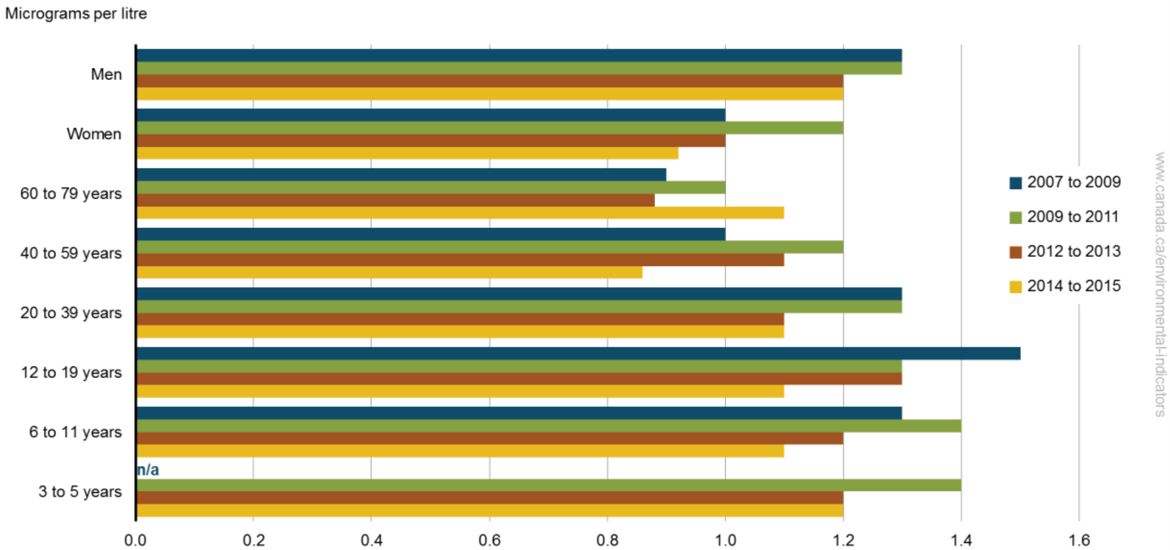
Bisphenol A (BPA) is a synthetic chemical used in plastics, epoxy resins and thermal paper, that poses environmental and health concerns; it is known as a potential hormone disruptor and it can adversely affect reproduction, growth, and development in wildlife.

Key results

Over the 4 study periods, the average concentrations of BPA:

- decreased slightly over time
- were higher in children than in adults
- were higher in men than in women

Figure 5. Average concentration of bisphenol A in urine in Canadians during the periods 2007 to 2009, 2009 to 2011, 2012 to 2013, and 2014 to 2015



Data for Figure 5

Note: n/a = not available for children under the age of 6 years, as they were not included in the survey for the period 2007 to 2009. Average refers to geometric mean.
Source: Health Canada (2017) Fourth Report on Human Biomonitoring of Environmental Chemicals in Canada: Results of the Canadian Health Measures Survey Cycle 4 (2014-2015).

The average concentration of BPA was lowest in adults aged 60 to 79 years and highest in the 12- to 19-year age group. Overall, men have a higher concentration of BPA than women. Further research is ongoing to better understand how BPA is absorbed, distributed, metabolized and excreted by the body.

BPA is found in food packaging and repeat-use plastic containers; it migrates from the packaging into food and drinks. Exposure can also occur from air, drinking water, soil, dust and use of consumer products. The Government of Canada has concluded that current dietary exposure to BPA through food packaging is not expected to pose a health risk to the general population, including newborns and infants.

Bisphenol A is known as a hormone disruptor and can adversely affect the liver, the kidneys and reproduction, including fertility and development. Although dietary exposure to BPA through food packaging is not expected to pose a health risk to Canadians, a precautionary approach has been taken to limit exposure of infants and newborns to BPA from food packaging. As part of these efforts, BPA has been prohibited in baby bottles sold in Canada since 2010. It is listed on the Toxic Substances List (Schedule 1) of the Canadian Environmental Protection Act, 1999.

About the indicators

What the indicators measure

These indicators present the concentrations of 4 substances (mercury, lead, cadmium and bisphenol A) in Canadians for the periods 2007 to 2009, 2009 to 2011, 2012 to 2013, and 2014 to 2015. These substances were chosen from the Canadian Health Measure Survey because they complement other Canadian Environmental Sustainability Indicators. For each substance, the concentration in blood or urine is provided by age group and by sex when data are available.

Why these indicators are important

Chemical substances are everywhere, including in the air, soil, water, products and food, and can enter the body through ingestion, inhalation and skin contact. Mercury and its compounds, lead, inorganic cadmium compounds and bisphenol A are on the Toxic Substances List under Schedule 1 of the Canadian Environmental Protection Act, 1999. This means that these substances are "entering or may enter the environment in a quantity or concentration or under conditions that (a) have or may have an immediate or long-term harmful effect on the environment or its biological diversity; (b) constitute or may constitute a danger to the environment on which life depends; or (c) constitute or may constitute a danger in Canada to human life or health."

The Government of Canada uses a variety of methods, tools and models to assess human exposure to environmental chemicals and their potential health effects. Human exposure to chemicals can be estimated indirectly by measuring chemicals in the environment, food or products, or directly by biomonitoring. The Canadian Health Measures Survey measures environmental chemicals and their metabolites in blood and urine of participants. These indicators provide a snapshot of the survey results.

Through biomonitoring, the government can identify priorities, develop or revise risk management strategies, and track progress on policies put in place to reduce or control these substances.

Related indicators

The Air pollutant emissions indicators track emissions of 6 key air pollutants from human activities: sulphur oxides, nitrogen oxides, volatile organic compounds, ammonia, carbon monoxide and fine particulate matter. For each substance, data are provided at the national, regional (provincial and territorial) and facility level and by source.

The Emissions of harmful substances to air indicators track human-related emissions to air of 3 toxic substances, namely mercury, lead and cadmium, and their compounds. For each substance, data are provided at the national and regional (provincial and territorial) level and by source. Facility and global emissions to air are also provided for mercury.

The Releases of harmful substances to water indicators track human-related releases to water of 3 toxic substances, namely mercury, lead and cadmium, and their compounds. For each substance, data are provided at the national, regional (provincial and territorial) and facility level and by source.

Safe and healthy communities

The indicators support the measurement of progress towards the following 2016–2019 Federal Sustainable Development Strategy long-term goal: All Canadians live in clean, sustainable communities that contribute to their health and well-being.

Data sources and methods

Data sources

These indicators are based on data from Health Canada's Reports on Human Biomonitoring of Environmental Chemicals in Canada. The reports provide results from the Canadian Health Measures Survey (the survey). The survey started in 2007, and data are collected in 2-year cycles.

More information

Statistics Canada, in partnership with Health Canada and the Public Health Agency of Canada, launched the survey to collect national-level data on important indicators of Canadians' health status, including those pertaining to environmental chemical exposure. The survey is representative of approximately 96% of the Canadian population aged 6 to 79 years (cycle 1) and 3 to 79 years (cycle 2, cycle 3 and cycle 4).

Table 1. Characteristics of the Canadian Health Measures Survey cycles

Cycle	Temporal coverage	Spatial coverage	Sample size	Age of Canadians in the sample
Cycle 1	March 2007 to February 2009	15 sites across Canada	5 600	6 to 79 years
Cycle 2	August 2009 to November 2011	18 sites across Canada	6 400	3 to 79 years
Cycle 3	January 2012 to December 2013	16 sites across Canada	5 800	3 to 79 years
Cycle 4	January 2014 to December 2015	16 sites across Canada	5 700	3 to 79 years

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

The collection sites (Table 2) were selected from within the 5 standard regional boundaries used by Statistics Canada (Atlantic, Quebec, Ontario, the Prairies and British Columbia). The collection sites varied between each survey cycle. The survey design does not target specific exposure scenarios, meaning that participants are not selected or excluded on the basis of their potential for low or high exposures to environmental chemicals.

Table 2. Sites of collection of the Canadian Health Measures Survey, Canada, 2007 to 2015

Cycle	Atlantic	Quebec	Ontario	Prairies	British Columbia
Cycle 1 (2007 to 2009)	Moncton, New Brunswick	Montérégie Montreal Québec City South Mauricie	Clarington Don Valley Kitchener-Waterloo North York Northumberland County St. Catherine's, Niagara	Edmonton, Alberta Red Deer, Alberta	Vancouver Williams Lake and Quesnel
Cycle 2 (2009 to 2011)	Colchester and Pictou Counties, Nova Scotia St. John's, Newfoundland and Labrador	Gaspésie Laval North Shore Montreal South Montérégie	Central and East Ottawa East Toronto Kingston Oakville South of Brantford Southwest Toronto	Calgary, Alberta Edmonton, Alberta Winnipeg, Manitoba	Central and East Kootney Coquitlam Richmond
Cycle 3 (2012 to 2013)	Kent County, Nova Scotia Halifax, Nova Scotia	South-central Laurentians Southwest Montérégie East Montreal West Montreal	Brampton Brantford-Brant County Orillia Oshawa-Whitby North Toronto Windsor	Southwest Calgary, Alberta Lethbridge, Alberta	Victoria-Saanich Vancouver
Cycle 4 (2014 to 2015)	Shelburne-Argyle, Nova Scotia South Fredericton, New Brunswick.	Saguenay Sainte-Hyacinthe West Laval West Montreal	Kitchener-Waterloo Leeds-Grenville North Toronto Thunder Bay West Hamilton West Toronto	Central and East Edmonton, Alberta East Regina, Saskatchewan	Kelowna Terrace-Kitimat

Source: Health Canada (2010) Report on Human Biomonitoring of Environmental Chemicals in Canada: Results of the Canadian Health Measures Survey Cycle 1 (2007-2009). Health Canada (2013) Second Report on Human Biomonitoring of Environmental Chemicals: Results of the Canadian Health Measures Survey Cycle 2 (2009-2011). Health Canada (2015) Third Report on Human Biomonitoring of Environmental Chemicals in Canada: Results of the Canadian Health Measures Survey Cycle 3 (2012-2013). Health Canada (2017) Fourth Report on Human Biomonitoring of Environmental Chemicals in Canada: Results of the Canadian Health Measures Survey Cycle 4 (2014-2015).

Methods

Selected environmental chemicals were measured in the blood and urine of survey participants. For the national summary, the geometric mean was calculated for each substance for all results. The geometric mean was also calculated for results within different age groupings. Trend analysis was done to support statements regarding change over time.

More information

The geometric mean (or average) was used because it is less influenced by extreme values and provides a better estimate of central tendency compared to the arithmetic mean.

For the laboratory methods used, there is a limit of detection. This is the lowest concentration of the substance that can be detected with 99% confidence. Results that fell below the limit of detection were assigned a value equal to half the limit of detection. If more than 40% of results were below limits of detection, the geometric mean was not calculated.

There are some variations between cycles in analytical methods and limits of detection.

Table 3. Limit of detection of the Canadian Health Measures Survey by chemical substances

Substance	Limit of detection cycle 1	Limit of detection cycle 2	Limit of detection cycle 3	Limit of detection cycle 4
Bisphenol A (µg/L)	0.2	0.2	0.23	0.23
Cadmium (µg/L)	0.04	0.04	0.08	0.08
Lead (µg/L)	0.2	1.0	1.6	1.6
Mercury (µg/L)	0.1	0.1	0.42	0.42

Note: µg/L = micrograms per litre.
Source: Health Canada (2017) Fourth Report on Human Biomonitoring of Environmental Chemicals in Canada: Results of the Canadian Health Measures Survey Cycle 4 (2014-2015).

Owing to the high cost of laboratory analyses, some environmental chemicals were not measured for all survey participants. The sample size can differ by chemical and be less than the total sample size for the survey. Mercury is shown as total mercury (organic and inorganic). Geometric mean is calculated at the 95% confidence interval.

The following tables provide a summary of data characteristics for the selected substances by survey.

Table 4. Characteristics of selected substances from Cycle 1 (2007 to 2009) of the Canadian Health Measures Survey

Chemical	Sample size	Percentage of results that fall below the limit of detection	Geometric mean (micrograms per litre)	95% confidence interval (micrograms per litre)
Mercury	5 319	11.64	0.69	0.55-0.86
Lead	5 319	0.02	13	12-14
Cadmium	5 319	2.91	0.34	0.31-0.37
Bisphenol A	5 476	9.26	1.2	1.1-1.2

Source: Health Canada (2010) Report on Human Biomonitoring of Environmental Chemicals in Canada: Results of the Canadian Health Measures Survey Cycle 1 (2007-2009).

Table 5. Characteristics of selected substances from Cycle 2 (2009 to 2011) of the Canadian Health Measures Survey

Chemical	Sample size	Percentage of results that fall below the limit of detection	Geometric mean (micrograms per litre)	95% confidence interval (micrograms per litre)
Mercury	6 070	15.55	0.69	0.56-0.87
Lead	6 070	0	12	11-12
Cadmium	6 070	5.16	0.29	0.26-0.32
Bisphenol A	2 560	5.04	1.2	1.1-1.3

Note: Bisphenol A was measured for only a subset of the sample in Cycle 2.
Source: Health Canada (2013) Second Report on Human Biomonitoring of Environmental Chemicals: Results of the Canadian Health Measures Survey Cycle 2 (2009-2011).

Table 6. Characteristics of selected substances from Cycle 3 (2012 to 2013) of the Canadian Health Measures Survey

Chemical	Sample size	Percentage of results that fall below the limit of detection	Geometric mean (micrograms per litre)	95% confidence interval (micrograms per litre)
Mercury	5 538	37.02	0.79	0.64-0.97
Lead	5 538	0.09	11	10-11
Cadmium	5 538	11.48	0.33	0.30-0.36
Bisphenol A	5 670	7.80	1.1	1.0-1.2

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

Table 7. Characteristics of selected substances from Cycle 4 (2014 to 2015) of the Canadian Health Measures Survey

Chemical	Sample size	Percentage of results that fall below the limit of detection	Geometric mean (micrograms per litre)	95% confidence interval (micrograms per litre)
Mercury	5 498	44.82	n/a	n/a
Lead	5 498	0.13	9.5	9.0-10
Cadmium	5 497	10.88	0.31	0.29-0.32
Bisphenol A	2 560	7.30	1.0	0.95-1.1

Note: n/a = not available. Bisphenol A was measured for only a subset of the sample in Cycle 4.
Source: Health Canada (2017) Fourth Report on Human Biomonitoring of Environmental Chemicals in Canada: Results of the Canadian Health Measures Survey Cycle 4 (2014-2015).

Further information on survey methodology can be obtained directly from the surveys.

Trend analysis

All analysis was conducted using the statistical analysis software tools SAS (EG 5.1 2012) and SUDAAN (RTI, 2008) incorporating the survey sample weights (taking into account the unequal probability of selection into the survey as well as non-response). All data considered in this analysis were log normally distributed; therefore, the results are based on the natural log transformation of the data. Comparison of cycles was tested using a weighted linear regression model with Satterthwaite p-values less than 0.05 to determine significance. If the overall Satterthwaite p-value for cycle differences was significant ($p<0.05$) then pairwise comparisons were considered, namely comparing cycle 1 to cycle 4 levels. If the percent non-detected was greater than 40% in any one cycle then no weighted linear regression analysis to compare cycles was carried out. Trend analysis was also assessed with weighted linear regression of levels by cycle. If the percent non-detected was greater than 40% across all 4 cycles combined then no trend analysis was carried out on the data.

Recent changes

Only national averages were previously provided. For this edition of the indicators, data are broken out by age group (3 to 5 years, 6 to 11 years, 12 to 19 years, 20 to 39 years, 40 to 59 years and 60 to 79 years) and by sex when data are available.

Trend analysis was done and statements regarding change over time were included.

Neither 2,2',4,4'-tetrabromodiphenyl ether (PBDE-47) nor perfluorooctane sulfonate (PFOS) were included in this version of the indicators. Concentration data were not available for 3 out of 4 cycles for PBDE-47 and 2 out of 4 for PFOS.

Cycle 1 participants were aged 6 to 79 years, while cycle 2, 3 and 4 participants were aged 3 to 79 years. The previous edition of the indicators focused on data for participants aged 6 years and older to allow for direct comparison between cycles. However, starting in cycle 4, the data for the 6- to 79-year-old subpopulation are no longer provided, and these indicators are now based on the data for participants aged 3 to 79 years. The averages for the total population are still included for all cycles and it is noted that, for the period 2007 to 2009, data were not available for children under the age of 6 years.

Caveats and limitations

The Canadian Health Measures Survey (the survey) is designed to provide national-level estimates and does not permit further breakdown of data by collection site. In addition, the survey design does not target specific exposure scenarios and consequently does not select or exclude participants based on their potential for low or high exposures to environmental chemicals.

People living on reserves or in other Indigenous settlements in the provinces, residents of institutions, full-time members of the Canadian Forces, people living in certain remote areas, and people living in areas with a low population density were excluded.

Concentrations of total mercury, lead, and cadmium in blood and total BPA in urine differ between cycles, owing in part to changes in analytical methods and the limit of detection. Further analysis is required to determine whether these differences are statistically significant.

Chemicals may be present and detectable in a person without causing an adverse health effect. Detection of a chemical indicates that exposure has occurred. However, biomonitoring alone cannot predict the health effects, if any, that may result from exposure. Factors such as age, health status, dosage, duration, frequency and timing of exposure and toxicity of the chemical must be considered in order to predict whether adverse health effects may occur.

Biomonitoring cannot tell us the source or route of exposure. The amount of chemical measured in a person's blood or urine is representative of the total amount present in the body at a given time from all sources (air, water, soil, food and consumer products) and all routes of exposure (ingestion, inhalation, skin contact).

Resources

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Annex

Annex A. Data tables for the figures presented in this document

Table A.1A. Data for Figure 1. Changes in the average concentrations of selected substances in Canadians, between the periods 2007 to 2009 and 2014 to 2015

Year	Mercury in blood (changes from the 2007 to 2009 survey, indexed to 1)	Lead in blood (changes from the 2007 to 2009 survey, indexed to 1)	Cadmium in blood (changes from the 2007 to 2009 survey, indexed to 1)	Bisphenol A in urine (changes from the 2007 to 2009 survey, indexed to 1)
2007 to 2009	1	1	1	1
2009 to 2011	1	0.92	0.85	1
2012 to 2013	1.14	0.85	0.97	0.92
2014 to 2015	n/a	0.73	0.91	0.83

Note: The table presents changes in the average (geographic mean) concentrations of selected substances in Canadians relative to the values in the period 2007 to 2009. The concentrations of mercury, lead and cadmium in blood and bisphenol A in urine are from participants aged 3 to 79 years, except for the period 2007 to 2009 when there were no participants under the age of 6 years. n/a = not available, since more than 40% of samples were below the limit of detection.
Source: Health Canada (2017) Fourth Report on Human Biomonitoring of Environmental Chemicals in Canada: Results of the Canadian Health Measures Survey Cycle 4 (2014-2015).

Table A.1B. Average concentrations of selected substances in blood or urine in Canadians during the periods 2007 to 2009, 2009 to 2011, 2012 to 2013, and 2014 to 2015

Year	Mercury in blood (micrograms per litre)	Lead in blood (micrograms per litre)	Cadmium in blood (micrograms per litre)	Bisphenol A in urine (micrograms per litre)
2007 to 2009	0.69	13	0.34	1.2
2009 to 2011	0.69	12	0.29	1.2
2012 to 2013	0.79	11	0.33	1.1
2014 to 2015	n/a	9.5	0.31	1.0

Note: The table presents the average (geographic mean) concentrations of selected substances in Canadians . The concentrations of mercury, lead and cadmium in blood and bisphenol A in urine are from participants aged 3 to 79 years, except for the period 2007 to 2009 when there were no participants under the age of 6 years. n/a = not available, since more than 40% of samples were below the limit of detection.
Source: Health Canada (2017) Fourth Report on Human Biomonitoring of Environmental Chemicals in Canada: Results of the Canadian Health Measures Survey Cycle 4 (2014-2015).

Table A.2. Data for Figure 2. Average concentration of mercury in blood in Canadians during the periods 2007 to 2009, 2009 to 2011, 2012 to 2013, and 2014 to 2015

Year	3 to 5 years (micrograms per litre)	6 to 11 years (micrograms per litre)	12 to 19 years (micrograms per litre)	20 to 39 years (micrograms per litre)	40 to 59 years (micrograms per litre)	60 to 79 years (micrograms per litre)	Women (micrograms per litre)	Men (micrograms per litre)
2007 to 2009	n/a	0.26	0.30	0.65	1.0	0.87	0.70	0.68
2009 to 2011	0.27	0.28	0.27	0.64	1.0	1.1	0.67	0.72
2012 to 2013	n/a	n/a	n/a	0.82	0.96	1.0	0.81	0.76
2014 to 2015	n/a	n/a	n/a	n/a	0.77	0.88	n/a	n/a

Note: n/a = not available. For the period 2007 to 2009, data were not available for children under the age of 6 years. For the periods 2012 to 2013 and 2014 to 2015, averages (geometric means) were not calculated for some age groups, since more than 40% of the samples were below the limit of detection. Mercury is shown as total mercury (organic and inorganic).
Source: Health Canada (2017) Fourth Report on Human Biomonitoring of Environmental Chemicals in Canada: Results of the Canadian Health Measures Survey Cycle 4 (2014-2015).

Table A.3. Data for Figure 3. Average concentration of lead in blood in Canadians during the periods 2007 to 2009, 2009 to 2011, 2012 to 2013, and 2014 to 2015

Year	3 to 5 years (micrograms per litre)	6 to 11 years (micrograms per litre)	12 to 19 years (micrograms per litre)	20 to 39 years (micrograms per litre)	40 to 59 years (micrograms per litre)	60 to 79 years (micrograms per litre)	Women (micrograms per litre)	Men (micrograms per litre)
2007 to 2009	n/a	9	8	11	16	21	12	15
2009 to 2011	9.3	7.9	7.1	9.8	14	19	11	13
2012 to 2013	7.7	7.1	6.4	9	13	16	9.6	12
2014 to 2015	6.7	5.9	5.4	8	12	15	8.7	10

Note: n/a = not available for children under the age of 6 years, as they were not included in the survey for the period 2007 to 2009. Average refers to geometric mean.
Source: Health Canada (2017) Fourth Report on Human Biomonitoring of Environmental Chemicals in Canada: Results of the Canadian Health Measures Survey Cycle 4 (2014-2015).

Table A.4. Data for Figure 4. Average concentration of cadmium in blood in Canadians during the periods 2007 to 2009, 2009 to 2011, 2012 to 2013, and 2014 to 2015

Year	3 to 5 years (micrograms per litre)	6 to 11 years (micrograms per litre)	12 to 19 years (micrograms per litre)	20 to 39 years (micrograms per litre)	40 to 59 years (micrograms per litre)	60 to 79 years (micrograms per litre)	Women (micrograms per litre)	Men (micrograms per litre)
2007 to 2009	n/a	0.091	0.16	0.34	0.48	0.45	0.39	0.31
2009 to 2011	0.073	0.083	0.13	0.28	0.41	0.45	0.32	0.26
2012 to 2013	n/a	0.095	0.17	0.31	0.50	0.48	0.37	0.29
2014 to 2015	0.082	0.094	0.14	0.33	0.41	0.44	0.33	0.28

Note: n/a = not available. For the period 2007 to 2009, data were not available for children under the age of 6 years. For the period 2012 to 2013, the average (geometric mean) was not calculated for children under the age of 6 years, since more than 40% of the samples were below the limit of detection.
Source: Health Canada (2017) Fourth Report on Human Biomonitoring of Environmental Chemicals in Canada: Results of the Canadian Health Measures Survey Cycle 4 (2014-2015).

Table A.5. Data for Figure 5. Average concentration of bisphenol A in urine in Canadians during the periods 2007 to 2009, 2009 to 2011, 2012 to 2013, and 2014 to 2015

Year	3 to 5 years (micrograms per litre)	6 to 11 years (micrograms per litre)	12 to 19 years (micrograms per litre)	20 to 39 years (micrograms per litre)	40 to 59 years (micrograms per litre)	60 to 79 years (micrograms per litre)	Women (micrograms per litre)	Men (micrograms per litre)
2007 to 2009	n/a	1.3	1.5	1.3	1.0	0.90	1.0	1.3
2009 to 2011	1.4	1.4	1.3	1.3	1.2	1.0	1.2	1.3
2012 to 2013	1.2	1.2	1.3	1.1	1.1	0.88	1.0	1.2
2014 to 2015	1.2	1.1	1.1	1.1	0.86	1.1	0.92	1.2

Note: n/a = not available for children under the age of 6 years, as they were not included in the survey for the period 2007 to 2009. Average refers to geometric mean.
Source: Health Canada (2017) Fourth Report on Human Biomonitoring of Environmental Chemicals in Canada: Results of the Canadian Health Measures Survey Cycle 4 (2014-2015).

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