

# Leveraging the Canadian Health Measures Survey for Environmental Health Research

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# Canadian Health Measures Survey

## CHMS Sampling Strategy

- Cross-sectional survey carried out in 2-year cycles
- Age groups: 1-2\*, 3-5, 6-11, 12-19, 20-39, 40-59, 60-79 years
- Collection sites stratified in 5 regions across the country
- Sample size (n = 5,000-6,000) to yield national estimates
- Covers 96% of population

Cycle 1 – 15 sites (2007-2009)

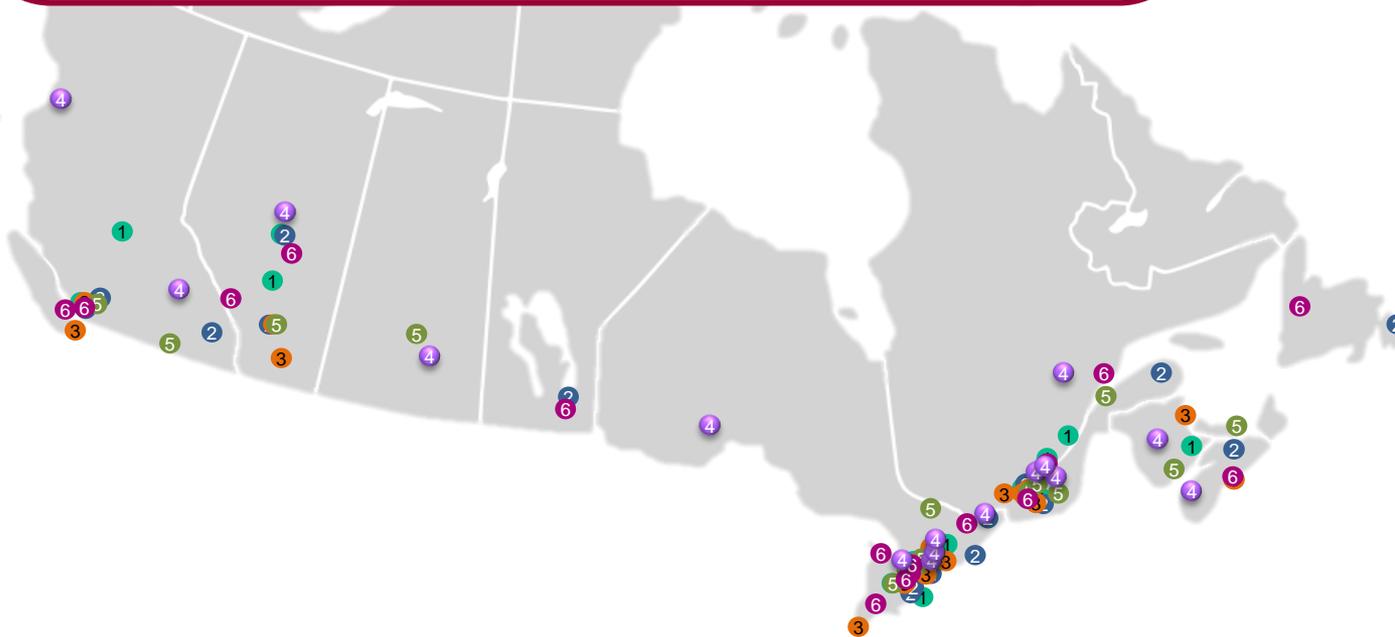
Cycle 2 – 18 sites (2009-2011)

Cycle 3 – 16 sites (2012-2013)

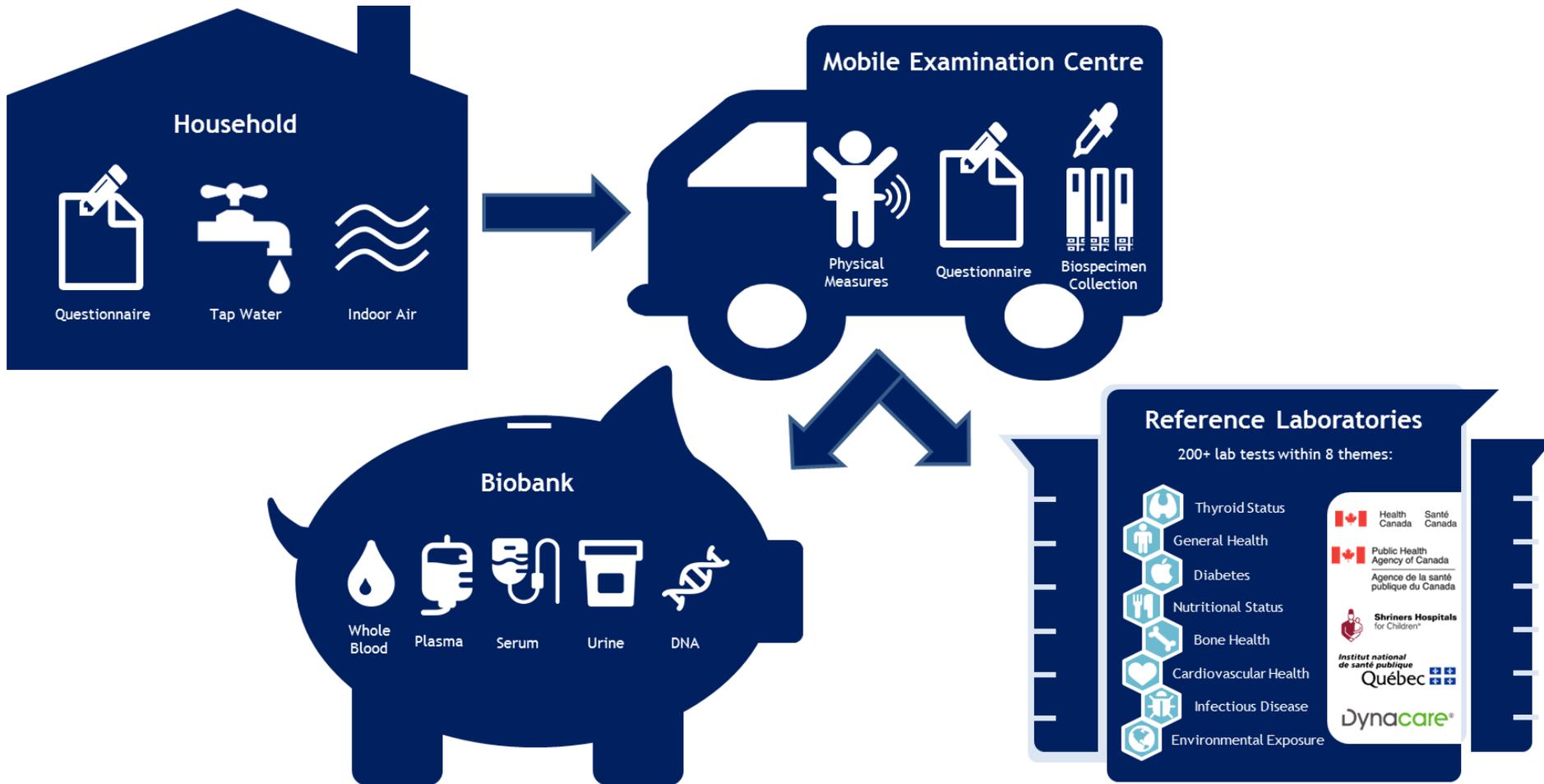
Cycle 4 – 16 sites (2014-2015)

Cycle 5 – 16 sites (2016-2017)

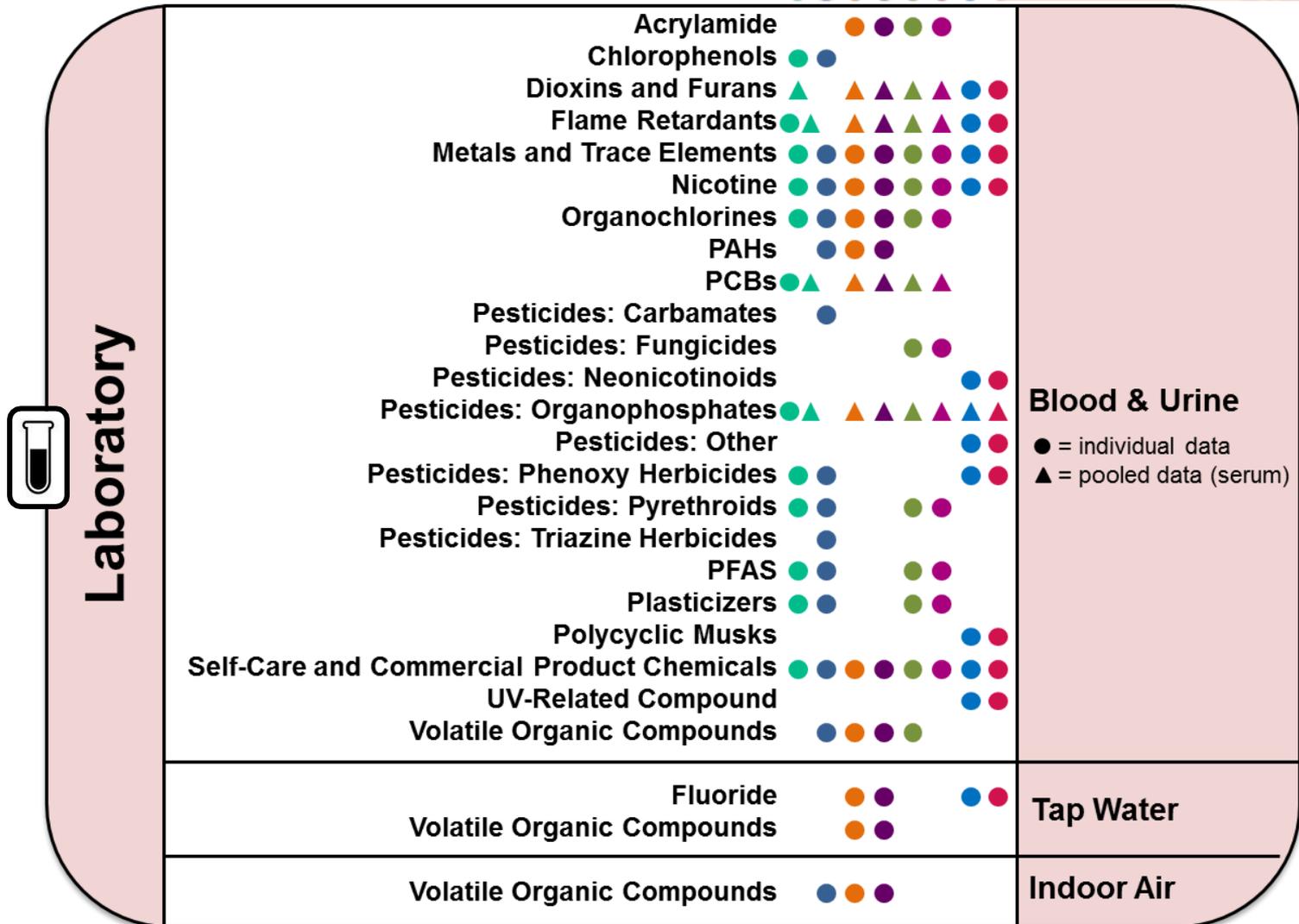
Cycle 6 – 16 sites (2018-2019)



# CHMS Components



# Environmental Health-Related Exposure Variables: Direct Measures



# Environmental Health-Related Exposure Variables: Self-Reported Data



<b>Questionnaire</b>	<p>Grooming and consumer product use ●</p> <p>Household use of chemical products ● ●</p> <p>Hobbies ● ● ● ●</p>	Air Quality
	<p>Housing characteristics ● ●</p> <p>Neighbourhood environment ● ● ●</p> <p>Sun exposure ● ● ● ●</p> <p>Time spent outdoors ● ● ● ● ● ●</p>	Built Environment
	<p>Exposure to second-hand smoke ● ● ● ● ● ● ●</p> <p>Exposure to second-hand vapour ● ● ● ● ● ● ●</p> <p>Smoking ● ● ● ● ● ● ●</p>	Environmental Tobacco Smoke
	<p>Tap water consumption ● ● ● ● ● ● ●</p>	Environmental Media
	<p>Noise exposure ● ● ● ●</p>	Other Environmental Hazards

# Increase awareness and utilization of CHMS data



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Review article

## Leveraging the Canadian Health Measures Survey for environmental health research

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### ARTICLE INFO

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Built environment  
Chemical exposures

### ABSTRACT

Since 2007, the nationally representative, cross-sectional Canadian Health Measures Survey (CHMS) has collected detailed health and exposure data from more than 25,000 Canadians, including a wide range of chemical biomarkers analyzed in blood, urine, and environmental media. This article highlights the extent to which the CHMS dataset has been used in the peer-reviewed environmental health literature and opportunities for further expanding usage of the dataset. A literature search (2007–2018) was performed to identify peer-reviewed studies that have made substantive use of the CHMS dataset. Studies were analyzed according to the study type, data usage, populations studied, environmental health themes, citation/publication data, and institutional collaborations. A total of 51 environmental health related CHMS studies were identified, including studies related to indoor and outdoor air quality, the built environment, and chemical and environmental tobacco smoke exposures. Health indicator data are being increasingly exploited, as is the ability to combine cyclic datasets over time. Although these studies covered a range of environmental exposures, many CHMS variables remain underutilized. The CHMS dataset provides a valuable portrait of chemical exposures in Canadians of all ages, linked to a wide variety of health indicators. Many opportunities remain to exploit and expand both the use of the dataset and collaborations between Canadian agencies and domestic and international research institutions.

### 1. Introduction

In 2006, the Government of Canada established the Chemicals Management Plan (CMP), a national initiative aimed at reducing the risks posed by chemical substances to Canadians and their environment. One of the key activities under the CMP is the monitoring and surveillance of chemicals in humans and environmental media including wildlife (Canada, 2012). National human biomonitoring initiatives include the Canadian Health Measures Survey (CHMS) (Health Canada, 2017), the First Nations Biomonitoring Initiative (FNBI) (Assembly of First Nations, 2013), the Maternal-Infant Research on Environmental Chemicals (MIREC) study (Arbuckle et al., 2013), and the Northern Contaminants Program (Canada, 2018). Although MIREC does provide access to its biobank (for a fee), we here focus on the CHMS, as this large dataset has been available to Canadian researchers

since 2009 with new data released every two years.

The CHMS, which is carried out in partnership among Statistics Canada, Health Canada, and the Public Health Agency of Canada, was launched in 2007. Similar to the long-running National Health and Nutrition Examination Survey (NHANES) in the US, the CHMS collects detailed health, lifestyle, and exposure information for a representative sample of the population (Tremblay et al., 2007). Exposure data collected in the CHMS include a wide range of chemical biomarkers analyzed in blood and/or urine, as well as data on select chemicals in indoor air and tap water (Giroux, 2007). The aims of the biomonitoring component are to establish objective, biologically relevant, and nationally representative values for a wide range of biomarkers of environmental chemicals. These data may then be used in further analyses including identification of sub-populations with higher levels of exposure, associations with health outcomes, and the determinants of

Abbreviations: BEs, biomonitoring equivalent; BPA, bisphenol A; CHMS, Canadian Health Measures Survey; PCDD/Fs, dibenzo-p-dioxins and dibenzofurans; FNBI, First Nations Biomonitoring Initiative; HBCD, hexabromocyclohexane; NHANES, National Health and Nutrition Examination Survey; PFASs, perfluoroalkyl substances; POPs, persistent organic pollutants; PBDEs, polybrominated diphenyl ethers; PBDEs, polybrominated diphenyl ethers; PCBs, polychlorinated biphenyls; RV95s, reference values; VOCs, volatile organic compounds

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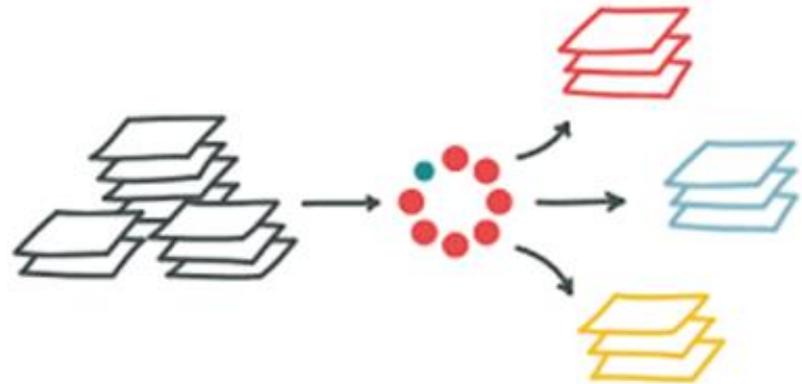
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Available online 01 August 2018

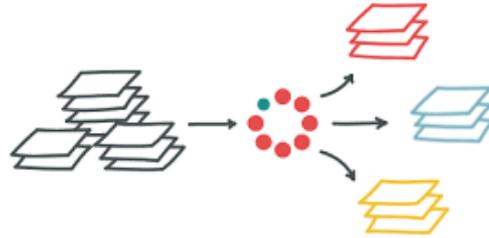
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# Literature search and review

- Bibliometric data from 2007-2018
- Identified all peer-reviewed, environmental health-related studies making substantive use of the CHMS dataset
- Total = 56 publications
- Categorize by:
  - Study population (age groups)
  - Cycles of data use
  - Study type and themes



# Study Analysis



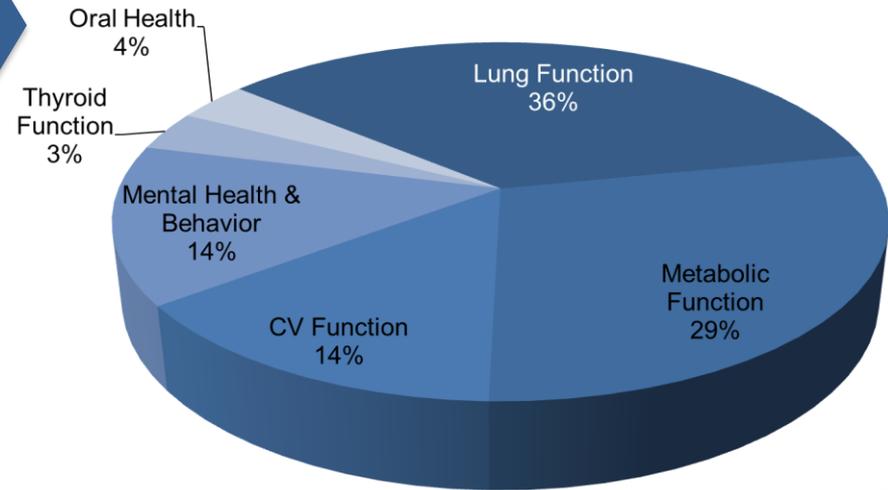
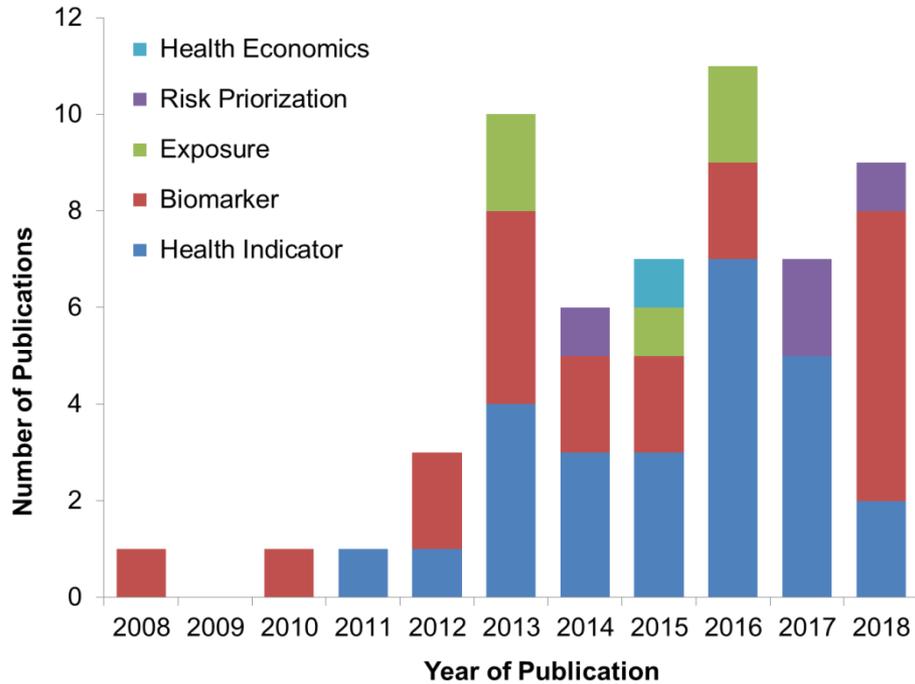
## Types

- Health Indicator: link exposure data to specific health indicators
- Biomarker: examine prevalence of and/or risk factors for specific biomarkers of exposure
- Exposure: focus on characterizing exposure based on environmental data
- Risk Prioritization: related to chemical risk prioritization (i.e. ranking lower vs. higher risk chemicals for management or study)
- Health Economics

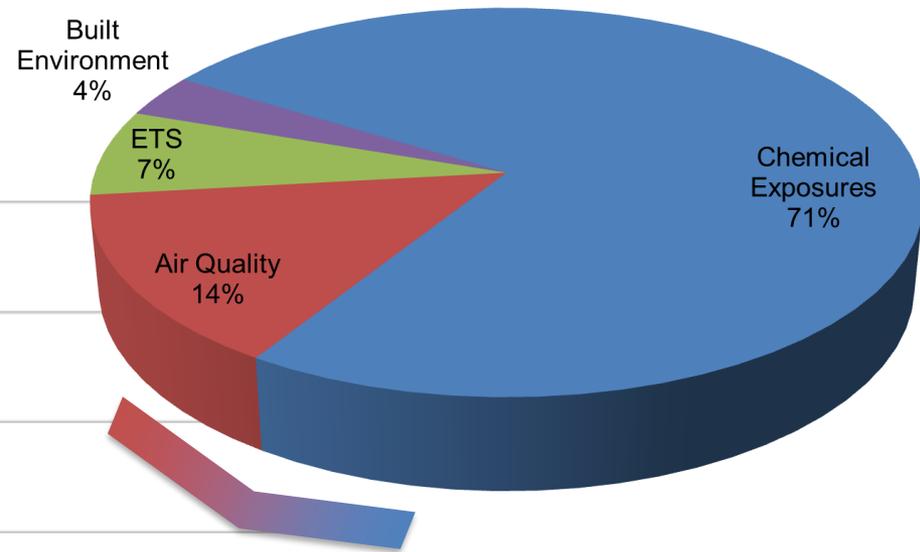
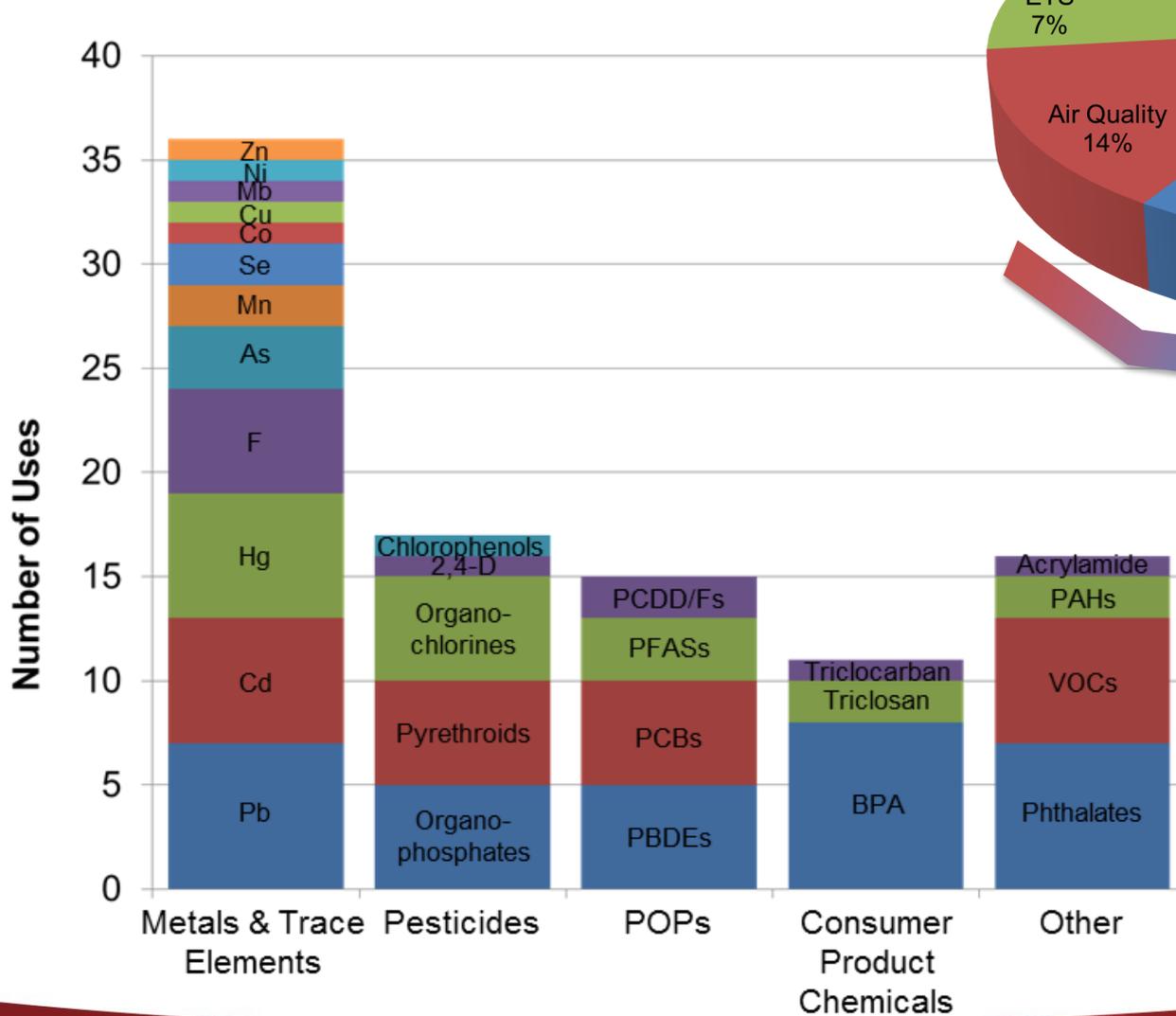
## Environmental Health Themes

- Chemical Exposure: dataset from biomonitoring component in urine and blood
- Air Quality: indoor air dataset and linked outdoor air
- Environmental Tobacco Smoke: dataset for nicotine, nicotine metabolites and other tobacco biomarkers as well as self-reported information
- Built Environment: external data linked with accelerometry data

# Results: Types



# Results: Themes



## Next steps and opportunities for research

- Expanding usage of the CHMS dataset
  - Focus on underutilized substance data including acrylamide, metals and trace elements (Co, Cu, Mn, Mo, Ni, Zn), parabens, and polycyclic aromatic hydrocarbons
  - Systematic approach to assess and contextualize health associations with chemical biomarkers
  - Utilization of biobank
  - Examine effect of the built environment on human health using data from cycle 5 (neighborhood design)
- Linkage to other datasets
  - Other environmental datasets or research/modeling tools
- Putting chemical exposures into context
  - Analyse population-level CHMS biomonitoring data in a health risk context using biomonitoring screening values (**Poster Session 1 #43**)

# Future Data from the Biomonitoring Component of CHMS

## Cycle 3 & 4 – pooled data (serum)

- Data analyses are underway with release anticipated in 2020
- Pooled serum was used to maximize the sample volume and allow for high-resolution analysis
- 52 chemicals (e.g. PCBs, organochlorines, dioxins, furans, and PBDEs)

## Cycle 5 (2016-2017)

- Data collection completed with release anticipated in 2019
- 96 chemicals (35% new including alternate plasticizers and new phthalates)

## Cycle 6 (2018-2019)

- Similar chemicals as cycle 5
- Data collection in progress

## Cycles 7 & 8 (2020-2023)

- Preparation for cycles 7 & 8 is currently underway including method development for new chemicals
- Data collection scheduled to start in January 2020

# CHMS Biomonitoring Data Access and Availability

**Health Canada** Your health and safety, our priority. Your world at your service, every minute.

## SUMMARIES AND RESULTS FOR ENVIRONMENTAL PHENOLS

### 9.1 BISPHENOL A

Table 9.1.1: Summary means and standard deviations of some concentrations (µg/L) for the Canadian Health Measures Survey (CHMS) cycles 1 (2007-2008), 2 (2009-2010), 3 (2011-2012), 4 (2013-2014) and 5 (2015-2016).

Year	n	Mean	SD	95th Percentile	99th Percentile	99.9th Percentile
2007-2008	486	0.16	0.12	0.37	0.61	0.97
2009-2010	486	0.16	0.12	0.37	0.61	0.97
2011-2012	486	0.16	0.12	0.37	0.61	0.97
2013-2014	486	0.16	0.12	0.37	0.61	0.97
2015-2016	486	0.16	0.12	0.37	0.61	0.97

**Reports: PDF & HTML**

**Canada.ca**

## Canadian Health Measures Survey (CHMS) Human Biomonitoring Data for Environmental Chemicals

Have your say: Rate this dataset (0 Comments)

Additional Information: Contact Email: [open@open.can.ca](mailto:open@open.can.ca)

## Open Data Portal: CSV

**Resources**

Resource Name	Resource Type	Format	Language	Links
CHMS Biomonitoring Data: 2007-2013	Dataset	XLS	English	<a href="#">Access</a>
CHMS Biomonitoring Data: 2007-2013	Dataset	XLS	French	<a href="#">Access</a>
Report on Human Biomonitoring of Environmental Chemicals in Canada	Website	HTML	English	<a href="#">Access</a>
Report on Human Biomonitoring of Environmental Chemicals in Canada	Website	HTML	French	<a href="#">Access</a>

**OPEN.CANADA.CA**

**CANADA.CA/BIOMONITORING**

**OPEN.CANADA.CA**

## BIOMONITORING CONTENT SUMMARY FOR THE CANADIAN HEALTH MEASURES SURVEY: CYCLES 1-4 (2007-2015)

## Biomonitoring Content Summary

Chemical	2007-2008	2009-2010	2011-2012	2013-2014	2015-2016
1,1,1-Trichloroethane (TCE)	100	100	100	100	100
1,1,2,2-Tetrachloroethane (PCE)	100	100	100	100	100
1,1,2-Trichloroethane (1,1,2-TCE)	100	100	100	100	100
1,1-Dichloroethane (DCE)	100	100	100	100	100
1,1-Dichloroethylene (DCE)	100	100	100	100	100
1,1-Dichloroethane (DCE)	100	100	100	100	100
1,1-Dichloroethane (DCE)	100	100	100	100	100
1,1-Dichloroethane (DCE)	100	100	100	100	100
1,1-Dichloroethane (DCE)	100	100	100	100	100
1,1-Dichloroethane (DCE)	100	100	100	100	100

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## CHMS Biobank

Whole Blood, Plasma, Serum, Urine, DNA

**STATCAN.GC.CA/BIOBANK**

**CRDCN** Canadian Research Data Centre Network

## Research Data Centre: microdata

CHMS (Canadian Health Measures Survey)

Available Cycles: January 2014 to December 2015 Cycle

**CRDCN.ORG**

## Disclosure Statement

- I have no affiliation (financial or otherwise) with a pharmaceutical, medical device or communications organization.

# Additional Information

## ➤ Canada's National Biomonitoring Program

[canada.ca/biomonitoring](http://canada.ca/biomonitoring)

[open.canada.ca](http://open.canada.ca)



**Booth 12**



## ➤ Statistics Canada CHMS information

[statcan.gc.ca/chms](http://statcan.gc.ca/chms)

## ➤ National Collaborating Centre for Environmental Health

[ncceh.ca](http://ncceh.ca)



National Collaborating Centre  
for Environmental Health

Centre de collaboration nationale  
en santé environnementale