

**BIOMONITORING
OF
ENVIRONMENTAL CHEMICALS
AT
HEALTH CANADA**

Exploring the Connection:
A State of the Science Conference on Pesticides and Cancer
Canadian Cancer Society
November 12-13, 2008

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Biomonitoring of Environmental Chemicals

The direct measurements of environmental chemicals, their metabolites or reaction products in people, usually in blood, urine, hair or milk.



Policy Context For Health Canada

- **Chemicals Management**
 - Initiative under the Chemicals Management Plan
- **Public Health**
 - Surveillance
 - Federal Contaminated Sites Program
 - Tobacco Control Strategy
 - First Nations and Inuit/Northern Health
- **International**
 - Stockholm Convention on Persistent Organic Pollutants
 - North American Agreement for Environmental Cooperation
 - Arctic Monitoring and Assessment Program (8 circumpolar nations)

Biomonitoring at Health Canada

National Surveys and Studies	Targeted Population Studies (selected)	Supporting Research (selected)
<p>Canadian Health Measures Survey (CHMS)</p> <p>Maternal-Infant Research on Environmental Chemicals (MIREC)</p>	<p>Northern Contaminants Program</p> <p>Canada-USA-Mexico Maternal Blood Contaminant Study</p> <p>Impact of drinking water lead levels on the exposure of young children to lead</p> <p>First Nations – community specific biomonitoring studies</p>	<p>Biomonitoring Equivalents and pharmacokinetic models</p> <p>Measuring chronic exposure to lead across the lifespan (bone – blood – serum)</p> <p>Temporal variation in urinary phthalates and Bisphenol A in pregnant women</p>

CHMS 2007-09 (Cycle 1) Biomonitoring Component



Partners: Statistics Canada
Health Canada
Public Health Agency of Canada

CHMS Survey Parameters

- National estimates, n = 5,000 over 2 years (2007-2009)
- Cross sectional survey design
- Atypical sample design (cost, logistics)
- Ages 6-79 yrs (6-11, 12-19, 20-39, 40-59, 60-79)
- 15 sites - 333 respondents per site

- Health questionnaire – home interview
- Direct measures - mobile clinic

- CHMS-Cycle 2 (2009-2011) in planning phase and will include children 3-5 years. Consultations on biomonitoring content undertaken in spring/summer 2008

Objectives of CHMS Biomonitoring Component

- Establish nationally-representative values for a range of environmental chemicals (first-ever for Canada)
- Provide a baseline for tracking trends and to allow for comparisons of data with sub-populations in Canada and with other countries
- Provide data to explore relationships between environmental chemicals, other physical measures, and self-reported information

Environmental Chemicals (CHMS Cycle 1)

Measure	Matrix	Sample Size	Age (years)				
			6-11	12-19	20-39	40-59	60-79
Metals (Pb, Cd, Hg, Mn, As, Cu, Mo, Ni, Se, U, Zn, Sb, V)	Blood & Urine	5200	✓	✓	✓	✓	✓
PCB (24 congeners, Arochlor 1260)	Plasma	1500			✓	✓	✓
Organochlorine pesticides (14)	Plasma	1500			✓	✓	✓
Polybrominated compounds (10 congeners)	Plasma	1500			✓	✓	✓
Perfluorinated compounds (PFOS, PFOA, PFHxS)	Plasma	1500			✓	✓	✓
Cotinine	Urine	5200	✓	✓	✓	✓	✓
Bisphenol A	Urine	2400	✓	✓	✓		
Organophosphate pesticides (6 Dialkyl phosphate metabolites)	Urine	2400	✓	✓	✓		
Phenoxy herbicides (2,4-D and 2,4-dichlorophenol)	Urine	2400	✓	✓	✓		
Pyrethroid pesticides (5 metabolites)	Urine	2400	✓	✓	✓		
Phthalates (11 metabolites)	Urine	3000	✓	✓	✓ *		

* 20-49 age group



MIREC

Maternal-Infant Research
on Environmental Chemicals

Étude mère-enfant
sur les composés chimiques
de l'environnement



Funding agencies

Health Canada
Ontario Ministry of the Environment
Canadian Institutes of Health Research

Project initiated by Health Canada,
in collaboration with Hôpital Ste-Justine



IRSC CIHR



CHU Sainte-Justine
Le centre hospitalier
universitaire mère-enfant

Pour l'amour des enfants



Principal Investigators

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MIREC – STUDY OBJECTIVES (selected)

To assess

- what pregnancy health risks, if any, are associated with exposure to heavy metals (lead, mercury, cadmium, arsenic and manganese)

To obtain

- national-level data on maternal and neonatal exposure to priority environmental chemicals which can be used as a baseline and guide decisions on further research
- Canadian data on smoking behaviour and exposure to tobacco smoke (active and passive) in pregnancy
- current levels of selected beneficial nutrients and immunoprotective endpoints in human milk and to establish time-trends for environmental chemicals which have been measured in previous human milk surveys

MIREC - Study Design

- A new national-level pregnancy cohort
- Approximately 2,000 pregnant women
- Recruited during 1st trimester
- Clinical sites across Canada (Vancouver, Calgary, Winnipeg, Sudbury, Ottawa, Kingston, Hamilton, Toronto, Montreal, Halifax)
- Each site led by clinical research / obstetrician – the “site investigator”

MIREC - Data Collection Schedule

Data Collection Schedule	1 st trimester (6-12wks)	2 nd trimester (16-21 wks)	3 rd trimester (32-34 wks)	Delivery	2-8 wks post partum
Screen, Consent	•				
Questionnaire	•	•	•	•	•
Medical Record Check	•	•	•	•	
Maternal Urine	•	•	•	•	
Maternal Blood	•	•	•	•	
Cord Blood				•	
Meconium				•	
Maternal Hair					•
Breast Milk					•

Northern Contaminants Program (NCP) Biomonitoring Research

Objectives:

- To respond to potential concerns about human exposure to elevated levels of environmental contaminants in fish and wildlife species that are important to the traditional diets of northern Aboriginal peoples
- To provide important data points for trend analysis
- To provide comparisons of data with sub-populations in Arctic Canada and other Arctic states where similar biomonitoring programs are taking place

Background:

- NCP biomonitoring studies have been taking place since 1991 in three phases (1997; 2003; and 2009)
- Recent biomonitoring studies have been carried out in the following three different regions of the Canadian Arctic: Inuvik (NWT), Baffin (Nunavut), Nunavik (Northern Quebec)

NCP environmental contaminants measured (2004-2006)

Region	Environmental Contaminants	Matrix	Ethnicity	Sample Size	Participant Age ranges	Participants	
						Mothers	Pregnant Women
Inuvik	Organochlorine Compounds (oxychlordane, trans-nonachlor, p,p'-DDE, toxaphene-parlar 50, PCB)	Plasma	Dene-Métis	17	16-36	√	
			Inuvialuit	52	17-38		
			Non-aboriginals	6	23-40		
	Metals (Mercury, Lead, Cadmium, Selenium)	Blood	Dene-Métis	17	16-36		
			Inuvialuit	52	17-38		
			Non-aboriginals	6	23-40		
Baffin, Nunavut	Organochlorine Compounds (oxychlordane, trans-nonachlor, p,p'-DDE, toxaphene-parlar 50, PCB, Arochlor 1260)	Plasma	Inuit	99	15-39	√	
	Metals Mercury, Lead, Cadmium, Selenium)	Blood					
Nunavik	Organochlorine Compounds (Oxychlordane, trans nonachlor, p,p'-DDE, toxaphene-parlar 50, PCB)	Plasma	Inuit	29	18-37		√
	Metals (Mercury, Lead, Cadmium, Selenium)	Blood		31	18-37		

Commission for Environmental Cooperation

Tri-national Maternal Blood Contaminant Study (Canada – USA – Mexico)

Objective:

- to generate comparable data on human biomonitoring of environmental chemicals of mutual concern and build biomonitoring capacity in Mexico.

Canadian study sites:

- Calgary, Halifax, Hamilton, Ottawa, and Vancouver.

Contaminants measured:

- Dioxins, furans, PCBs, Organochlorine Pesticides
- Lead, mercury

Capacity building with Mexico:

- Increase the capacity of Mexican laboratories to produce comparable human biomonitoring data. This will strengthen the Parties' abilities to assess and manage chemicals of concern and will allow Mexico to meet its Stockholm POPs monitoring requirements.

Benefits / Limitations of Pesticides Biomonitoring in National Surveys

Benefits

Provide general population exposure data from all sources

Useful for tracking trends over time

Limitations

Not targeted on specific exposure scenarios or high exposure populations

Not designed to study cause-effect relationships (e.g. between pesticide exposure and cancer). Sample sizes in targeted studies often too small to study cause-effect.

Costs – survey operations and laboratory costs can be high

Conclusions

- CHMS and MIREC are the first comprehensive national biomonitoring studies in Canada
- Provide baselines for time and geographic trends and allow for comparisons with sub-populations in Canada and with other countries
- Significant resource for future research and monitoring
- Multiple uses and applications of data and results
- Limitations in studying potential pesticides-cancer relationships
- CHMS Cycle 2 in planning phase

For more information

- **Canadian Health Measures Survey**

www.statcan.ca/english/freepub/82-003-SIE/82-003-SIE2007000.htm

www.statcan.ca/english/survey/household/measures/research.htm

- **Maternal-Infant Research on Environmental Chemicals**

www.hc-sc.gc.ca/ewh-semt/contaminants/mirec/index-eng.php

- **Northern Contaminants Program**

www.ainc-inac.gc.ca/ncp/pub/helttoc_e.html