BIOMONITORING OF ENVIRONMENTAL CHEMICALS IN THE CANADIAN HEALTH MEASURES SURVEY

California Biomonitoring Workshop
June 9, 2008

Douglas Haines
Safe Environments Programme
Health Canada

Policy Context For Health Canada

- **Regulatory**
  - Chemicals Management Plan
  - Canadian Environmental Protection Act
- **Public Health**
  - Surveillance / Indicators
  - Federal Contaminated Sites Program
  - Tobacco Control Strategy
  - First Nations and 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)
Canadian Health Measures Survey (CHMS)	Northern Contaminants Program	Biomonitoring Equivalents and PBPK models
Maternal-Infant Research on Environmental Chemicals (MIREC)	Impact of drinking water lead levels on the exposure of young children to lead	Measuring chronic exposure to lead across the lifespan (bone – blood – serum)
	Monitoring inorganic arsenic exposure in a population that uses water from private wells	Temporal variation in urinary phthalates and Bisphenol A in pregnant women
	First Nations – community specific biomonitoring studies	Identification of biomarkers of contaminant toxicity – Analysis of MIREC samples

Canadian Health Measures Survey (CHMS)

Statistics Canada survey in partnership with Health Canada

and the Public Health Agency of Canada

The CHMS aims to advance health information needs:

- by addressing important data gaps and limitations in existing health information that cannot be obtained through proxy or self-reports

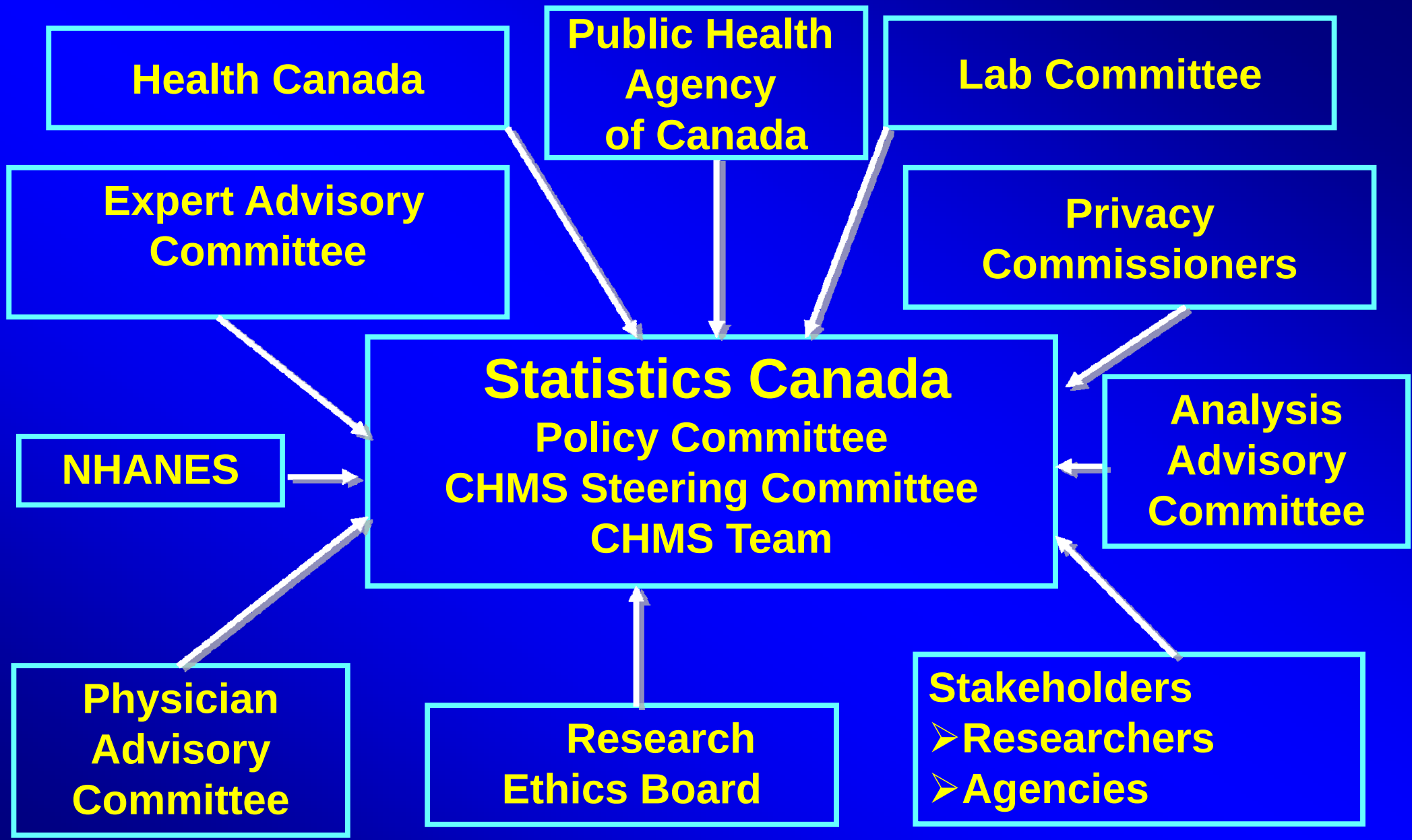
- through direct physical measures of Canadians' health
  - physical fitness, height, weight, etc.
  - blood and urine specimens

CHMS Survey Parameters

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

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

- Budget $35 million over 6 yrs
  - Biomonitoring component - $6.2 M
    - $0.5 M core content, $5.7 M “buy-in”
    - ≈ 90% costs for laboratory analysis


Health Canada
Public Health Agency of Canada
Lab Committee
Expert Advisory Committee
Privacy Commissioners
Statistics Canada
Policy Committee
CHMS Steering Committee
CHMS Team
NHANES
Analysis Advisory Committee
Physician Advisory Committee
Research Ethics Board
Stakeholders
Researchers
Agencies

Select a sampling frame

Select clusters

Set stand schedule; advanced stand preparation & public relations

Select households

Contact household

Select respondent

Informed consent

Book in-home interview → In-home interview & book clinic visit → Clinic measures

Questionnaire (in-home)

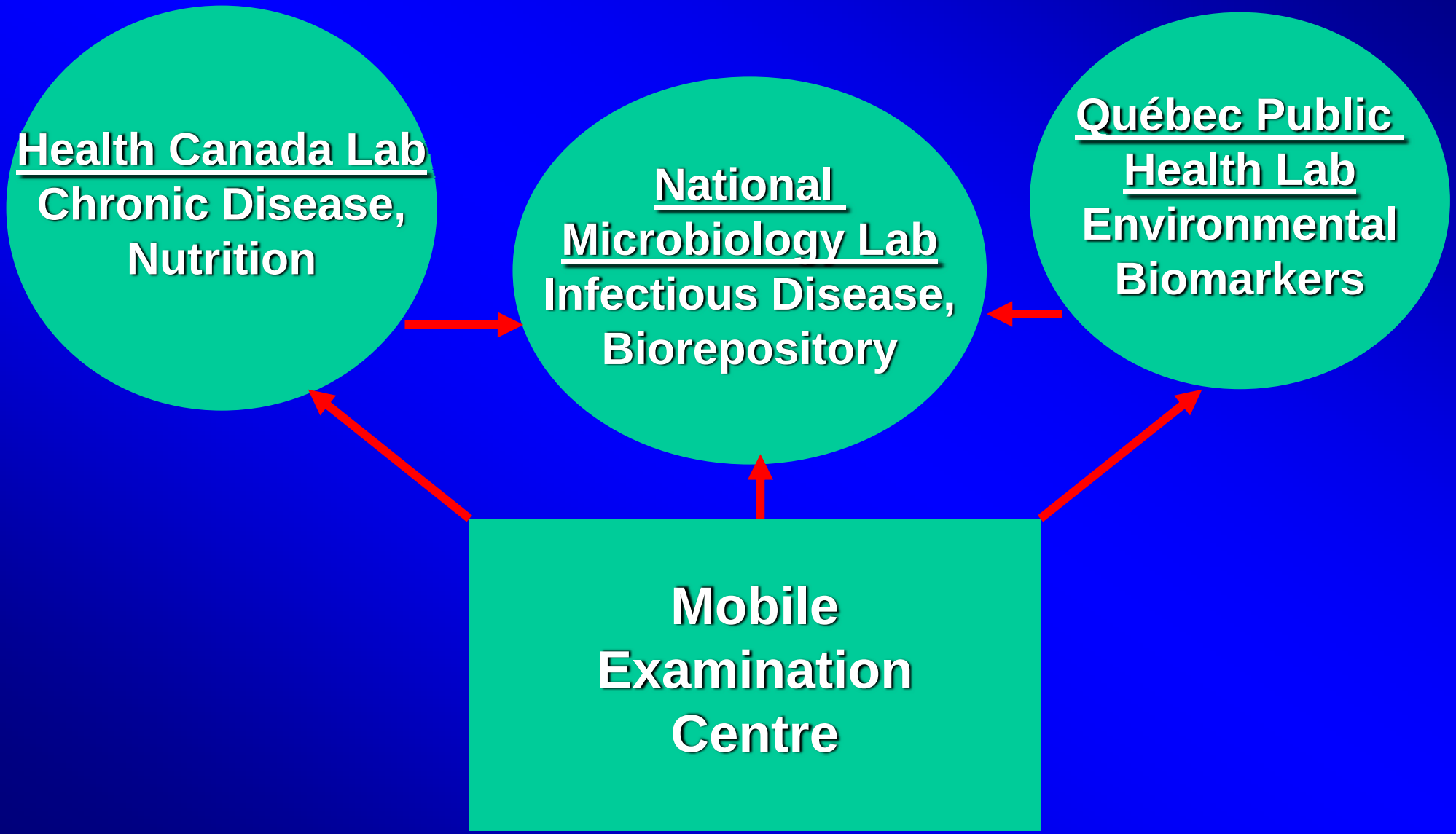
- Health Status
- Nutrition and Food
- Medication Use
- Health Behaviours
- Environmental Factors
- Socio-Economic Information

Physical Measures (clinic)

- Anthropometry
- Cardiorespiratory and musculoskeletal fitness
- Physical activity
- Oral health exam

- Blood measures
  - environmental exposures, nutritional status, diabetes, cardiovascular disease, infectious disease, blood chemistry, DNA sample (stored)
- Urine measures
  - environmental exposures, iodine, microalbumin, creatinine

Biological Specimen Flow



Reporting to Respondents

- At end of clinic visit, respondents receive results of their physical tests
- Selected laboratory results sent to respondents 12 weeks after clinic visit (with prior consent)
- Early reporting protocol in place for laboratory results beyond threshold values

CHMS 2007-09 (Cycle 1)
Biomonitoring Component

Objectives of CHMS Biomonitoring Component

- Establish nationally-representative values for a range of environmental chemicals (first-ever for Canada)
- Provide a baseline for emerging trends and allow 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

Selection of Environmental Chemicals (CHMS Cycle 1)

Expert workshop (2003) + programme priorities

Criteria

- Public health considerations
  - Known or suspected health risk or effects
  - Need for public health action
  - Public concern
- Evidence of population exposures
- Feasibility of field collection of biospecimens / respondent burden
- Availability and efficiency of laboratory analytical methods
- Consistency with other surveys
- Cost

Environmental Chemicals (CHMS Cycle 1)

Chemical Class	Rationale
Metals (e.g. Pb, Hg)	Known health risks; national baseline data required
Phthalates	Exposure data related to consumer products required
Polychlorinated Biphenyls	Stockholm Convention priority chemical
Organochlorine Pesticides	Stockholm Convention priority chemical
Polybrominated Diphenyl Ethers	Detected in North Americans; exposure data needed to inform risk management decisions
Organophosphate Pesticides	High volume use; exposure data needed for regulatory re-assessment
Phenoxy Herbicides	Concern about widespread residential use; data required for exposure and risk assessment
Pyrethroid Pesticides	Detected in general population; data needed for regulatory re-assessment
Perfluorinated Compounds	Persistent global contaminants; national baseline data required
Bisphenol A	High volume use; exposure data needed for risk assessment
Cotinine	Data needed to assess side-stream tobacco smoke exposure

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

Proposed Data Analysis

- **Nationally representative data**
  - Normative data for environmental chemicals measured in the CHMS
- **Trends and comparisons**
  - Temporal / geographic trends using past studies
  - International comparisons
- **Relationship between measures**
  - Between exposure sources and blood/urine concentrations
  - Between biomonitoring measures and health outcomes
- **Quality assurance**

CHMS Cycle 2
Consultation Timeline and Process (2008)

May | June | July | August

Initiate Consultations - questionnaire

Health Canada, Other Departments

Fed/Prov/Territorial Committee on Health and the Environment

Chemicals Management Plan Stakeholder Advisory Council

Academics, industry groups, NGOs

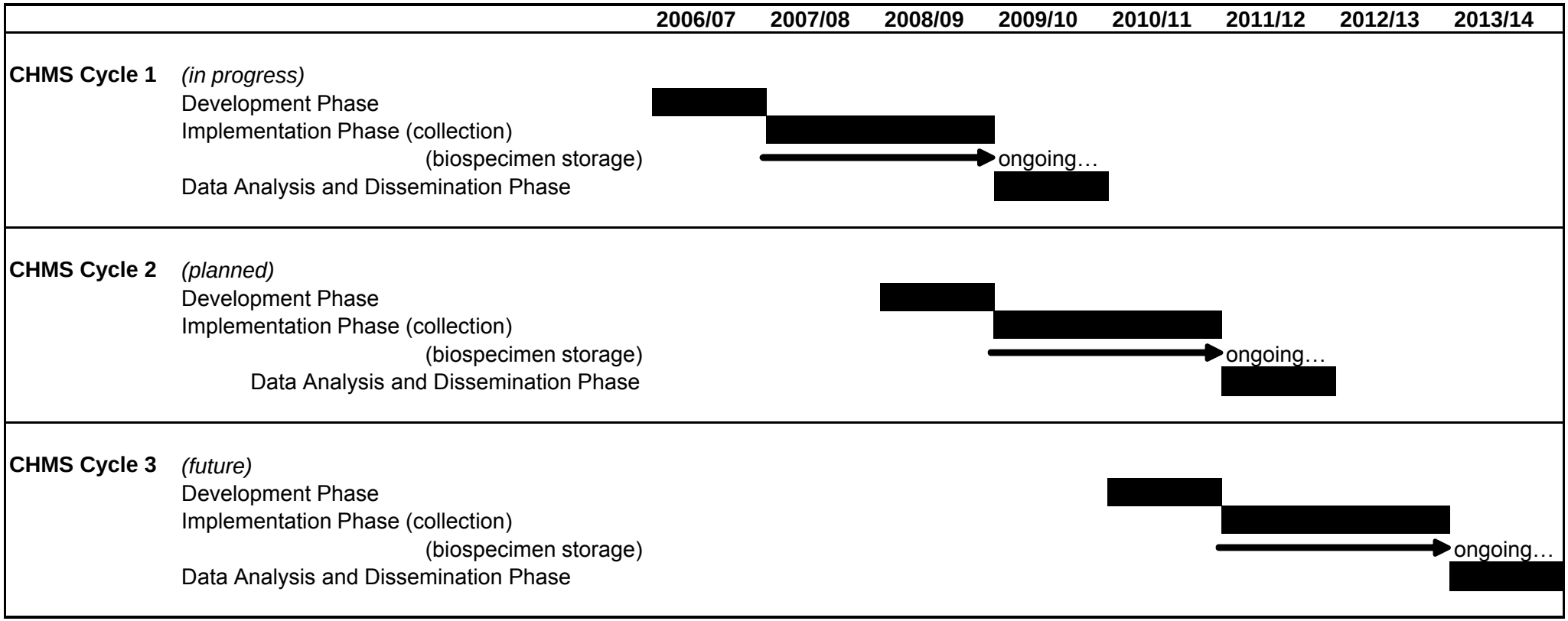
Review and assess results of questionnaire using selection criteria

Finalize candidate substances for CHMS Cycle 2

Final priority list to Statistics Canada

CHMS Cycle 2 to include children under 6 years of age (2 or 3 to 5 yrs)

Canadian Health Measures Survey Plan



Conclusions

- First comprehensive national biomonitoring study in Canada
- Provides a baseline for temporal / 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
- 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_e.html

- **Northern Contaminants Program**

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