Canadian Health measures Survey (CHMS)

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Statistics Canada
(on behalf of the CHMS team)

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DUC CAHSPR, Vancouver
CHMS introduction

The CHMS is an ongoing national health survey that adds physical measures to existing health data sources like CCHS/NPHS by:

- Addressing important data gaps and limitations in existing health information through direct physical measurement of the health of Canadians
- Conducting direct physical measures of Canadians’ health in a mobile examination centre (MEC), including:
  - Physical fitness, height, weight, etc.
  - Laboratory tests of blood and urine samples

Important health issues (metabolic syndrome, environmental toxins, physical inactivity) cannot be monitored without direct measures.
CHMS GOVERNANCE STRUCTURE

Canadian Population Health Statistics Program (HC/PHAC/SC)

Statistics Canada Policy Committee

Data users
- Researchers in academia
- Population health policy and program admin.
- Others

Funding organizations
- Health Canada
- Public Health Agency of Canada
- Others

Research Ethics Board

Federal and provincial privacy commissioners

Provincial and regional health authorities

Consultative groups
- Population Health Survey Steering Committee
- CHMS advisory committees (4)
  - Expert, Biobank, Scientific – Physical Measures, Scientific – Laboratory Measures
- U.S. National Health and Nutrition Examination Survey (NHANES)

Internal and external service providers

Statistics Canada senior management
Social, health and labour statistics

CHMS team
CHMS – One project, four components

- Household component – designed for use with physical measures...about 1¼ hours
  - Survey component – similar to CCHS

- Mobile Examination Centre (MEC) component – about 2 ¼ to 2½ hours

- Laboratory component – several reference labs, including one lab in the MEC

- Biobank component - storage for future health research of: whole blood, plasma, serum, urine and DNA.
The mobile examination centre
Physical measures taken at the MEC

Urine Collection

Anthropometry

Spirometry

Phlebotomy

Blood Pressure
More physical measures

Fitness Measures

Lab Measures

Indoor Air Sampler  (cycle 2 only)
and Activity Monitor

Oral Health  
(cycle 1 only)
Survey parameters

- National estimates:
  Cycle 1 (2007-2009) n= 5,604
  Cycle 2 (2010-2011) n=6,395

- Survey population:
  Cycle 1: 6 to 11, 12 to 19, 20 to 39, 40 to 59, 60 to 79 all with gender breakdown
  Cycle 2: 3 to 5 (no gender breakdown)
  6 to 11, 12 to 19, 20 to 39, 40 to 59, 60 to 79 all with gender breakdown

- Ongoing collection over 2 years

- Budget of $16 – 17 million per year

- Voluntary survey for selected participants
CHMS sampling strategy

In Cycle 1 and in Cycle 2:

- 257 eligible collection sites
- Collection sites stratified in 5 regions
- Covers 96% of the population
- Sample sizes to yield national estimates by sex/age groups at 10% prevalence with CV of 16.5%
  (except 3-5 year-olds in Cycle 2 – no gender breakdown)
# Response rates

<table>
<thead>
<tr>
<th>Cycle 1</th>
<th>Cycle 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Of eligible dwellings selected</td>
<td></td>
</tr>
<tr>
<td>% households agreed to participate</td>
<td>70%</td>
</tr>
<tr>
<td>% people agreed to respond to the household questionnaire</td>
<td>88%</td>
</tr>
<tr>
<td>% people reported to the clinic for physical measurements</td>
<td>85%</td>
</tr>
<tr>
<td><strong>Total combined response rate</strong></td>
<td>52%</td>
</tr>
<tr>
<td><strong>Sample size</strong></td>
<td>5,604</td>
</tr>
</tbody>
</table>
Analytical parameters

- CHMS is designed to produce national-level estimates representative of the Canadian population
- 46 questionnaire modules containing 722 questions
- Approximately 50 physical measures variables
- Over 120 lab tests
- Combining data across cycles
- Potential linkage to health records
Questionnaire content

- **Health status**
  General health, sleep, height and weight, weight change, health utility index, chronic conditions, hepatitis, HPV, pap smear, family medical history, phlegm, pregnancy, birth information, breastfeeding information

- **Nutrition and food**
  Grain, fruit and vegetable consumption, meat, fish and shellfish, dietary fat, salt, water and soft drinks, milk and dairy products

- **Medication use**
  Medications, other health products and herbal remedies

- **Health behaviours**
  Physical activities, sedentary activities, smoking, alcohol use, illicit drug use, sexual behaviour, maternal breast-feeding, strengths and difficulties

- **Environmental factors**
  Exposure to second-hand smoke, sun exposure, housing characteristics, hobbies, grooming product use

- **Socio-economic information**
Physical measures

- Anthropometry
  - Height, sitting height, weight
  - Waist and hip circumference
  - Five skinfolds

- Cardiovascular fitness
  - Blood pressure, resting heart rate
  - Modified Canadian Aerobic Fitness Test (step test)

- Musculoskeletal fitness
  - Hand grip strength
  - Sit-and-reach flexibility
  - Partial curl-ups

- Physical activity
  - Activity monitor

- Oral Health (cycle 1 only)

- Spirometry

- Biological specimens
Lab measures (selected examples)

**BLOOD**
- **Diabetes** (Fasting glucose, Fasting insulin, HbA1c)
- **Cardiovascular** (HDL, LDL, total cholesterol, triglycerides, Homocysteine)
- **Nutritional Status** (RBC folate, Vitamin B12, Vitamin D, Calcium)
- **Infectious Disease Markers** (Hepatitis A/B/C)
- **General** (CBC, Blood chemistry panel, Surplus blood, DNA sample)
- **Environmental exposure**
  - Metals (Metals like Lead, Cadmium, Mercury, Arsenic, Nickel, Copper, Zinc, Selenium, Uranium, Molybdenum, Manganese)
  - PCBs, pesticides

**URINE**
- **Phthalates and metabolites** (11)
- **Organophosphate pesticides and metabolites** (6)
- **Phenoxy Herbicide** (2,4-D)
- **Bisphenol A**
- **Cotinine, Microalbumin, Creatinine, Iodine**

**INDOOR AIR** (84 environmental contaminants, including benzene, methane and ethanol)
Biological specimen flow

- **Health Canada**: Chronic disease-related measures & nutrition
- **NML National Microbiology Laboratory**: Infectious disease biorepository
- **CTQ Centre de toxicologie du Québec**: Environmental biomarkers
- **CHMS Mobile Examination Centre**: Complete blood count (CBC) and sample preparation
CHMS DATA AT WORK....
Portrait of a typical 12-year-old boy and girl, 1981 and 2007 to 2009

**BOY**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>150.9 cm (4'11&quot;)</td>
<td>Height</td>
<td>155.8 cm (5')*</td>
</tr>
<tr>
<td>41.6 kg (92 pounds)</td>
<td>Weight</td>
<td>48.0 kg (106 pounds)*</td>
</tr>
<tr>
<td>18.1 kg/m²</td>
<td>Body mass index</td>
<td>19.2 kg/m²*</td>
</tr>
<tr>
<td>64.9 cm (25.6&quot;)</td>
<td>Waist circumference</td>
<td>66.2 cm (26.1&quot;)</td>
</tr>
<tr>
<td>78.0 cm (30.7&quot;)</td>
<td>Hip circumference</td>
<td>84.0 cm (33.1&quot;)*</td>
</tr>
<tr>
<td>0.83</td>
<td>Waist-to-hip ratio</td>
<td>0.82*</td>
</tr>
</tbody>
</table>

**FITNESS TESTS**

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>49 kg</td>
<td>Grip strength</td>
</tr>
<tr>
<td>25.5 cm</td>
<td>Sit-and-reach</td>
</tr>
</tbody>
</table>

**GIRL**

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>153.1 cm (5'0&quot;)</td>
<td>Height</td>
<td>155.9 cm (5')*</td>
</tr>
<tr>
<td>42.7 kg (94 pounds)</td>
<td>Weight</td>
<td>47.6 kg (105 pounds)*</td>
</tr>
<tr>
<td>18.4 kg/m²</td>
<td>Body mass index</td>
<td>19.5 kg/m²*</td>
</tr>
<tr>
<td>62.4 cm (24.6&quot;)</td>
<td>Waist circumference</td>
<td>68.0 cm (26.8&quot;)*</td>
</tr>
<tr>
<td>81.2 cm (32.0&quot;)</td>
<td>Hip circumference</td>
<td>86.0 cm (33.9&quot;)*</td>
</tr>
<tr>
<td>0.76</td>
<td>Waist-to-hip ratio</td>
<td>0.79*</td>
</tr>
</tbody>
</table>

**FITNESS TESTS**

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>43 kg</td>
<td>Grip strength</td>
</tr>
<tr>
<td>32.0 cm</td>
<td>Sit-and-reach</td>
</tr>
</tbody>
</table>
Vitamin intake

Vitamin D levels by milk consumption (milk 1+ per day) by age group, Canada, 2007-2009

Mean plasma 25(OH)D (nmol/L)

Age group

6 to 11
12 to 19
20 to 39
40 to 59
60 to 79

* Significant difference between 1+ / d and < 1 / d (p < .05)
Proportion of 20 to 79 yr olds meeting physical activity guidelines by gender, Canada, 2007-2009

- At least 5 days of at least 30 minutes of MVPA in 10 minute bouts
  - Males: 5.5
  - Females: 4.0

- At least 150 minutes of MVPA a week in 10 minute bouts
  - Males: 17.1
  - Females: 13.7

- At least 10,000 steps a day on average
  - Males: 39.0
  - Females: 30.0

Hypertension – BP measures

Percentage with hypertension\(^1\) who are aware, treated by medication, controlled,\(^2\) household population aged 20 to 79 years with hypertension, Canada, March 2007 to February 2009

- Unaware
- Aware, but not treated (4%)\(^E\)
- Treated by medication, but not controlled (14%)
- Treated by medication and controlled (66%)

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\(^1\) measured SBP higher than or equal to 140 mm Hg or DBP higher than or equal to 90 mm Hg, or current use of antihypertensive medication
\(^2\) measured SBP lower than 140 mm Hg and DBP lower than 90 mm Hg
\(^E\) interpret with caution (coefficient of variation 16.6% to 33.3%)
Note: Because of rounding, the sum of the estimates exceeds 100%.

Wilkins K, Campbell NRC, Joffres MR et al. Blood pressure in Canadian adults. Health Reports 2010; vol 21(1)
Cycle 3

- In collection 2012-2013
- First results disseminated in fall 2014

New content will include:

- Hearing
- $\text{FE}_{\text{NO}}$
- Skin pigmentation
- VOCs and fluoride in tap water
- VOCs, total immunoglobulin E, fatty acids, Vitamin C, reproductive hormones, thyroid, dioxins, furans, new PCBs, HBCD, TBBPA, acrylamide and methyl mercury in blood
- New organophosphate insecticides, parabens in urine
Research Data Centres (RDCs)

- Access route for most researchers
- Allows microdata access in universities across Canada, under research agreement, in a secure setting
- CHMS microdata and supporting documentation, all Statistics Canada health survey microdata.
- Similar files at Health Canada & PHAC

http://www.statcan.gc.ca/rdc-cdr
User assistance

**Services:**

- User help line: 1-800-263-1136
- E-mail address: infostats@statcan.gc.ca
- Website: [www.statcan.gc.ca/chms](http://www.statcan.gc.ca/chms)
- Capacity building workshops
- Custom tabulations
- Human contact:

  **Brent Day**, Health Statistics Division

  Brent.Day@statcan.gc.ca
HEALTH DATA LINKAGE AT STATISTICS CANADA
Data linkage at Statistics Canada

Health Administrative Data

Population Health Surveys

Vital statistics

Canadian Cancer Registry
Census of Population
Immigration Database
Longitudinal Worker File
Linked health data – Why?

- Enhance the capacity of health data to address complex questions with “value added” information - fill data gaps
- Linked data allow for “population health” lens to the study of health care
- Population based studies on a representative sample of Canadians
- Opportunity for comparisons across provinces and territories
- Analytical advantages:
  - Multi-dimensionality
  - Sub-population analysis
  - Comprehensive information to better understand differences
  - Develop a profile of individuals experiencing health outcomes
Data Linkages – Some examples

- 1991 Canadian Census, Mortality and Cancer
  - Census (long form) cohort
  - 20 year follow-up for mortality and cancer
  - Longitudinal Worker File (1983-2010)

- 2006 Census and Hospital linkage (validation stage)
  - Census (long form) cohort,
  - 5 year follow-up using DAD

- CCHS, Hospital and Mortality linkage (underway)
  - 2000-2007 CCHS linked to DAD and CMDB
  - Varying follow-up times
Multi-dimensionality - Income and Education

Remaining life expectancy by educational attainment within each income adequacy quintile, 1991-2006 follow-up

Sub-populations – Immigrants

Age standardized mortality rates (ASMR) for circulatory disease for select countries by gender, Canada (1991-2001)

Per 100,000 person-years at risk

Males

Females

Sub-population - Aboriginal ancestry
Probability of survival to age 75 of Métis, Non-Status and Registered Status by gender, Canada, 1991-2006

Understand differences in the context of other factors

Hazard ratios for dying from CVD for First Nations compared to non-Aboriginal cohort members, 1991-2001 follow-up

<table>
<thead>
<tr>
<th>Adjusted for:</th>
<th>Hazard ratio</th>
<th>95% CI</th>
<th>Hazard ratio</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1.24</td>
<td>1.16</td>
<td>1.34</td>
<td></td>
</tr>
<tr>
<td>Age + education</td>
<td>1.15</td>
<td>1.07</td>
<td>1.24</td>
<td></td>
</tr>
<tr>
<td>Age + education + income</td>
<td>1.08</td>
<td>1.00</td>
<td>1.16</td>
<td></td>
</tr>
</tbody>
</table>

### Profile of healthcare users

Profile of males and females at « high » risk (50+%) of an ACSC hospitalization

#### Males
- 67 years
- Lowest to lower middle income
- Married‡ or formerly married±
- Severe disability
- Former smoker
- High use of specialist services (4+)
- At least one inpatient hospitalization in previous year

#### Females
- 64 years
- Lowest income
- Comorbidities (2+)
- Former and Daily smokers
- Underweight
- Inactive
- At least one inpatient hospitalization in previous year
For more on record linkage at STC:

http://www.statcan.gc.ca/health-sante/link-coup-eng.htm

Claudia Sanmartin, Chief
Health Analysis Division, Statistics Canada
claudia.sanmartin@statcan.gc.ca

Thank-you!
EXTRA
Consent process

1. **Physical measures**: To participate in the physical measures tests
2. **Lab report**: To receive a copy of the test results
3. **Reportable disease/contaminants panel**: To allow Statistics Canada to test blood and urine for diseases and contaminants that are reportable in this province and to be contacted, along with the appropriate provincial authorities, if the results are positive
4. **Biostorage**: To allow the storage of blood and urine for use in future health studies
5. **DNA storage (age 20+; 14+ for cycle 3)**: To allow the storage of DNA for use in future health studies
6. **Youth assent / written parental consent**: For children under 14 to take part in the survey and for storage
7. **Re-consent**: Of children at age 14 to continue to store and use their biosamples for statistical health research
8/9. **Linking and sharing**: Oral consent at end of clinic collection to use the information collected for these purposes
# Microdata files (Cycle 1)

### Master file

- **Household questionnaire, clinic and laboratory measures done on all respondents**
- **5604 obs.**
- **Ages 6 to 79**

### Subsample files

<table>
<thead>
<tr>
<th>Content</th>
<th># obs.</th>
<th>Age covered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting measures</td>
<td>2,634</td>
<td>6 to 79</td>
</tr>
<tr>
<td>Inorganic mercury</td>
<td>1,123</td>
<td>6 to 79</td>
</tr>
<tr>
<td>PBDE / PCB</td>
<td>1,696</td>
<td>20 to 79</td>
</tr>
<tr>
<td>PFCs</td>
<td>2,880</td>
<td>20 to 79</td>
</tr>
<tr>
<td>Activity monitor</td>
<td>4,441</td>
<td>6 to 79</td>
</tr>
<tr>
<td>Phthalates</td>
<td>3,237</td>
<td>6 to 49.</td>
</tr>
<tr>
<td>Nicotine</td>
<td>2,483</td>
<td>12 to 79</td>
</tr>
</tbody>
</table>

### Medication file

- **Medication File**
- **5604 obs.**
- **Ages 6 to 79**
## Microdata files (Cycle 2)

<table>
<thead>
<tr>
<th>Content</th>
<th># obs.</th>
<th>Age covered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting measures</td>
<td>2,793</td>
<td>6 to 79</td>
</tr>
<tr>
<td>Indoor air – hhld</td>
<td>3,857</td>
<td>N/A</td>
</tr>
<tr>
<td>Indoor air - person</td>
<td>5,191</td>
<td>3 to 79</td>
</tr>
<tr>
<td>Activity monitor</td>
<td>4,948</td>
<td>3 to 79</td>
</tr>
<tr>
<td>Environmental blood</td>
<td>1,524</td>
<td>12 to 79</td>
</tr>
<tr>
<td>Environmental urine</td>
<td>2,563</td>
<td>3 to 79</td>
</tr>
</tbody>
</table>

**Master file**
Household questionnaire, clinic and laboratory measures done on all respondents
6,395 obs.
Ages 3 to 79

**Subsample files**

<table>
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