Canadian Health Measures Survey (CHMS): an introduction and overview

Brent Day
Health Statistics Division
Statistics Canada
CHMS OBJECTIVES

- **Explore** emerging public health issues and new measurement technologies
- **Establish** national baseline data on major health concerns
- **Determine** relationships among risk factors, protection practices and health status
- **Assess** the validity of self- and proxy-reported information
- **Assemble** a nationally representative sample for storage in a biobank
<table>
<thead>
<tr>
<th><strong>HEALTH SURVEYS PROGRAM</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Content</strong></td>
</tr>
<tr>
<td><strong>Sample size</strong></td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
</tr>
<tr>
<td><strong>Geography</strong></td>
</tr>
<tr>
<td><strong>Age groups</strong></td>
</tr>
</tbody>
</table>

CHMS:
- HH information related to physical measures
- Physical measures in MEC Laboratory tests
- Buy-ins

5,700 respondents per cycle

2 year cycle

Canada only

3 - 79
SURVEY PARAMETERS: CYCLE 3

- National estimates: $n = 5,700$
- Survey population aged 3 to 79
- Direct physical measurements completed in mobile clinic over 2 years
- Collection from Jan 2012 to Dec 2013
**SAMPLING STRATEGY: CYCLE 3**

**National sampling frame**
(360 eligible collection sites)

- Collection sites stratified in 5 regions
- Covers about 94% of population
- 11 age/sex groups from age 3 to 79
- Sample size (n = 5,700) to yield national estimates by sex/age group at 10% prevalence with coefficient of variation of 16.5%

**Collection sites selected**

**Households selected**

**Respondents selected**
The questionnaire content is to be used only in context with physical measures data and covers the following topics:

- Health status
- Nutrition and food
- Medication use
- Health behaviours
- Environmental factors
- Socio-economic information
THE MOBILE CLINIC
THE MOBILE CLINIC
PHYSICAL MEASURES: CYCLE 3

- **Anthropometry**
  - Standing height, sitting height, weight
  - Waist and hip circumference

- **Cardiorespiratory fitness**
  - Resting blood pressure and heart rate
  - Spirometry
  - Fractional exhaled nitric oxide (FENO)

- **Muscular strength**
  - Hand grip strength

- **Hearing assessment**

- **Skin pigmentation**

- **Physical activity**
  - Accelerometer

- **Indoor air sampler**

- **Tap water samples**
  (taken from some randomly selected households)
BLOOD AND URINE TESTS: CYCLE 3

Blood

- **General:** Complete blood count (CBC), blood chemistry panel
- **Allergies**
- **Cardiovascular health:** C-reactive protein (high sensitivity), HDL, LDL, total cholesterol and triglycerides and fatty acids
- **Diabetes:** Fasting, non-fasting and random glucose, fasting insulin and HbA1c
- **Environmental exposure:** Metals (cadmium, lead and mercury (total and methyl)), acrylamide and volatile organic compounds (VOCs)
- **Infectious diseases:** Hepatitis B and C
- **Nutritional status:** Ferritin, red blood cell folate, vitamin B12, vitamin C and vitamin D
- **Reproductive hormones**
- **Thyroid status**

Urine

- **Environmental exposure:** Metals (arsenic (speciated), fluoride and inorganic mercury), benzene metabolites, bisphenol A, organophosphate insecticides, polyaromatic hydrocarbons (PAHs), parabens, tobacco and triclosan
- **Kidney function:** Creatinine and microalbumin
- **Nutritional status:** Iodine
### MICRODATA FILES (CYCLE 1)

#### Full sample 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 |

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Statistics Canada • Statistique Canada
## 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>

Household questionnaire, clinic and laboratory measures done on all respondents:

- Full sample file: 6,395 obs. Ages 3 to 79
- Subsample files:
  - Fasting measures: 2,793, Ages 6 to 79
  - Indoor air - hhld: 3,857, N/A
  - Indoor air - person: 5,191, Ages 3 to 79
  - Activity monitor: 4,948, Ages 3 to 79
  - Environmental blood: 1,524, Ages 12 to 79
  - Environmental urine: 2,563, Ages 3 to 79

Medication file:

- Medication File: 6,395 obs. Ages 3 to 79
## Plans for Microdata Files (Cycle 3)

<table>
<thead>
<tr>
<th>Release date</th>
<th>Topic</th>
<th>Full sample files</th>
<th>Subsample files</th>
</tr>
</thead>
<tbody>
<tr>
<td>October 15, 2014</td>
<td>Most household/clinic data Climate file, postal code file</td>
<td>2</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>December 17, 2014</td>
<td>Medication, activity monitor and non-environmental lab data</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>March 18, 2015</td>
<td>Fluoride and volatile organic compounds</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>May 20, 2015</td>
<td>Environmental lab data</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>July 15, 2015</td>
<td>Indoor air data</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>October 21, 2015</td>
<td>Pooled serum data file (50 environmental variables)</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>
The National Microbiology Laboratory in Winnipeg is the biorepository (i.e., biobank) for long-term storage of biosamples. Information on purposes of storage, access and right of withdrawal is provided to respondents prior to collection. Blood and urine samples from all consenting respondents are stored for future studies. DNA samples from consenting respondents 14 years and older are stored for future studies. Invaluable but finite (non-renewable) source of information.
CHMS BIOBANK: CURRENT STATUS

- Access requirements developed and posted on Statistics Canada’s website (www.statcan.gc.ca/chms)

- Two projects fully approved:
  - to help establish pediatric and adult “normal values” in Canadian populations to allow for appropriate clinical interpretation of laboratory results (K. Adeli, The Hospital for Sick Children, Toronto)
  - to support the hypothesis that individuals within the population respond differently to folate intake depending on genetic predisposition (H. Morrison, PHAC)

- Five projects passed the feasibility stage of approval

CHMS BIOBANK: CONSIDERATIONS

- Multi-step access and approval process
- Must do analysis at a Statistics Canada Research Data Centre
- Exclusive access to data file for a year before file becomes available to other researchers in RDCs
- Cost:
  - 2 ml serum, plasma, whole blood: $7.40 per sample
  - DNA plates: $12.00 per sample
  - 5 ml urine: $8.20 per sample
- Statistics Canada’s confidentiality and physical security requirements must be satisfied
CHMS BIOBANK: STEPS FOR ACCESS

- Thoroughly review *Access Requirements and Protocols for the Canadian Health Measures Survey Biobank*
- Complete detailed *Application Form to Use Biospecimens*
- Provide additional clarification and information to CHMS Biobank Coordinator at several possible stages
  - Initial feasibility stage
  - Biobank Advisory Committee review stage
  - Statistics Canada’s senior management review stage
CHMS DOCUMENTATION

- **User guide**
  - Survey content, procedures
  - Data quality, weighting

- **Data dictionaries**
  - Information for all variables on the master file
    - Name, length, data type (character / numeric)
    - Location on the file, applicable values
    - Coverage statements
    - Univariate counts (weighted and unweighted; at RDC only)

- **Instructions for combining cycle 1 and cycle 2 CHMS data**

- **Analytical products released in the Daily**
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
DATA HIGHLIGHTS FROM CYCLE 2

- 22% of Canadian adults suffer from high blood pressure; however, 17% of these individuals are unaware of their condition.

- 39% of Canadians aged 6 to 79 have an unhealthy level of total cholesterol.

- 96% of Canadians aged 3 to 79 have sufficient vitamin B12 and iron levels.

- Over the last 20 years, there has been a reduction in Canadians’ exposure to indoor air pollutants (i.e. benzene, toluene, ethylbenzene, and xylenes).
### 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 (5'1&quot;)*</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**

| 49 kg | Grip strength | 44 kg* |
| 25.5 cm | Sit-and-reach | 21.4 cm* |

#### GIRL

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>153.1 cm (5'0&quot;)</td>
<td>Height</td>
<td>155.9 cm (5'1&quot;)*</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**

| 43 kg | Grip strength | 40 kg* |
| 32.0 cm | Sit-and-reach | 28.2 cm* |
Vitamin intake

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

Mean plasma 25(OH)D (nmol/L) by age group and milk consumption

* Significant difference between 1+ / d and < 1 / d (p < .05)
Physical Activity measures

Proportion of 20 to 79 year olds meeting physical activity guidelines by gender, Canada, 2007-2009

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>At least 5 days of at least 30 minutes of MVPA in 10 minute bouts</td>
<td>5.5</td>
<td>4.0</td>
</tr>
<tr>
<td>At least 150 minutes of MVPA a week in 10 minute bouts</td>
<td>17.1</td>
<td>13.7</td>
</tr>
<tr>
<td>At least 10,000 steps a day on average</td>
<td>39.0</td>
<td>30.0</td>
</tr>
</tbody>
</table>

ADDITIONAL INFORMATION

For more information on the CHMS:

Fill out a request for information:
• Specific products needed
• Contact information
• Questions

For general information:
• toll-free number: 1-888-253-1087
• e-mail: chms-ecms@statcan.gc.ca
• Web site: www.statcan.gc.ca/chms