The Canadian Longitudinal Study on Aging

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on behalf of

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and the CLSA Research Team across Canada

* Most of the slides were created by the CLSA and its participants
Overview

• Background
• Study Design
• Study Content and Data Collection
• Current Status
• Sample demographics
Increase in life expectancy, 1600 - 2000
Oepen and Vaupel, Science 2002; C Finch adaptation

Phase 1
early urban

Phase 2
sanitation-nutrition
modern medicine

Phase 3?
regeneration
Social Policy Innovation

Phase 1
Phase 2
Phase 3?

Life expectancy in years

England
Norway
New Zealand
Iceland
Netherlands
Sweden
Japan

1550 1600 1650 1700 1750 1800 1850 1900 1950 2000 2050
Life expectancy, Brazil

<table>
<thead>
<tr>
<th>Date</th>
<th>LE (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1900</td>
<td>32</td>
</tr>
<tr>
<td>1950</td>
<td>50.3</td>
</tr>
<tr>
<td>1975</td>
<td>61.8</td>
</tr>
<tr>
<td>2000</td>
<td>70.7</td>
</tr>
<tr>
<td>2015</td>
<td>74.4</td>
</tr>
</tbody>
</table>

Source: gapminder.org
## Total fertility rate, Brazil

<table>
<thead>
<tr>
<th>Date</th>
<th>TFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1900</td>
<td>5.9</td>
</tr>
<tr>
<td>1950</td>
<td>6.2</td>
</tr>
<tr>
<td>1975</td>
<td>4.5</td>
</tr>
<tr>
<td>2000</td>
<td>2.4</td>
</tr>
<tr>
<td>2015</td>
<td>1.8</td>
</tr>
</tbody>
</table>

Source: gapminder.org
Brazil population pyramid 1950

Source: Populationpyramid.net
Brazil population pyramid 2015

Source: Populationpyramid.net
# Life expectancy world-wide

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>59.6</td>
<td>62.5</td>
<td>64.2</td>
<td>67.5</td>
<td>69.0</td>
</tr>
<tr>
<td>Women</td>
<td>63.7</td>
<td>67.1</td>
<td>69.1</td>
<td>72.9</td>
<td>74.8</td>
</tr>
</tbody>
</table>

Japan's doctors propose raising 'outdated' retirement age to 75

Campaigners say 65 to 74-year-olds should be classified as pre-old age to empower those who want to work or volunteer.
Canadian Longitudinal Study on Aging (CLSA)

- 3 co-principal investigators supported by more than 160 co-investigators from 26 institutions

- Multidisciplinary - biology, genetics, medicine, psychology, sociology, demography, nursing, economics, epidemiology, nutrition, health services

- Largest study of its kind to date in Canada for breadth and depth: following 50,000 participants for ≥20 years
Aim and Vision

• **AIM**: To examine life/health transitions and capture trajectories to enable the *identification of modifiable factors with the potential to inform interventions* (prevention/treatment/impact) to improve the health of populations as they age.

• **VISION**: To create a research *platform* infrastructure to enable state-of-the-art, interdisciplinary population-based research and evidenced-based decision-making that will lead to better health and quality of life for Canadians as they age.
The Journey so far...

- **Team Design Objectives Content**
- **Acceptability Bio-specimens Recruitment Data Linkage**
- **Pilot work**
- **Recruitment and Baseline Data Collection**
- **First Follow Up Data Collection**

2001 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 2017

**International peer review**
Study Design
50,000 women and men aged 45 - 85 at baseline

Target: 20,000
Randomly selected within provinces

Target: 30,000
Randomly selected within 25-50 km of 11 sites

2010 - 2015

2015

2018

Participants aged 45 to 85 at baseline (51,338)

Baseline FU-1 FU-2 FU-3 FU-4 FU-5 FU-6

20 Years

Active follow-up every 3 years

Data Linkage

CLSA Research Platform

Questionnaire
• By telephone (CATI)

Questionnaire
• In person, in home (CAPI)

Clinical/physical tests
Blood, urine
• @ Data Collection Site

CLSA Research Platform

CLSA Research Platform
National in Scope

Home Interviews & Data Collection Site Visits
Recruitment & follow-up

Telephone Interviews
Recruitment & follow-up
Defining the cohort

• Men and women living in any of 10 provinces in Canada aged 45-85 at recruitment

• Capturing baby boomers (born between 1946-1964) plus members of the “silent” generation (i.e. those born before 1945)
Recruiting the Cohort

1. Partnership with Statistics Canada
   • Canadian Community Health Survey 4.2 Healthy Aging (2008-09) CCHS 4.2
     • CCHS participant agreement to share contact information with the CLSA – a first for Statistics Canada

2. Partnership with provincial Ministries of Health (MOH)
   • Health Card Registration databases
   • Mailouts, return Consent-to-Contact form, CLSA follow up

3. Random Digit Dialing
   • Leger Marketing and CLSA CATI
Cohort Exclusion Criteria at Baseline

Driven by CCHS 4.2 exclusion criteria 1. to 5.

1. Residents of the 3 territories
   • Northwest Territories, Nunavut, Yukon
2. Living in an institution
3. Living on a First Nation Reserve
4. Full time members of the armed forces
5. Temporary visa holders

CLSA Added Criteria

• Cognitively impaired (at baseline)
• Unable to communicate in French or English

1 to 5 exclude <4% of the target population
Terminology

• Tracking Cohort
  • Target - 20,000 participants from all 10 provinces, followed through Computer Assisted Telephone Interviews (60 minutes at baseline)
  • 21,241 recruited*

• Comprehensive Cohort
  • Target - 30,000 participants living within 25 km (or 50 km) of a CLSA Data Collection Site (DCS)
  • Followed through in-home interviews (60 minute) and physical assessments (2-3 hours) at a DCS
  • 30,097 recruited*
Study Content and Data Collection
CLSA Questionnaire modules
All 51,338 participants

Demographic/Lifestyle
- Age
- Gender
- Education
- Marital status
- Sexual orientation
- Language
- Ethnicity
- Wealth/income
- Veteran Identifier
- Smoking, alcohol
- Nutritional risk
- Physical activity
- Health care utilization
- Medication use
- Supplement use

Health
- General health
- Women’s health
- Chronic conditions
- Disease symptoms
- Sleep
- Oral health
- Injuries, falls
- Mobility
- Pain, discomfort
- Functional status
- ADL, IADL
- Cognition
- Depression
- PTSD
- Life Satisfaction

Social
- Social networks
- Support
- Participation
- Inequality
- Online communication
- Care receiving
- Care giving
- Retirement status
- Labour force participation
- Retirement planning
- Transportation
- Mobility, Migration
- Built environments
- Home ownership
Work-related content in CLSA

- Current or last job
- Duration in that job
- Main occupation through career
- Reasons for retirement (or ending retirement)
- Possible use of Job Exposure Matrices
CLSA Data Collection

Data Collection Site

Physical Assessments:
- Height, Weight, BMI
- Bone Density, Body Composition, Aortic Calcification
- Blood Pressure, ECG, c-IMT
- Pulmonary Function
- Vision & Hearing
- Performance testing

Cognitive Assessments:
- Neuropsychological Battery
  - Memory
  - Executive function
  - Reaction time

Biospecimen Collection:
- Blood
- Urine
# CORE BIOMARKERS: Baseline

<table>
<thead>
<tr>
<th>Category</th>
<th>N</th>
<th>Biomarkers</th>
</tr>
</thead>
</table>
| **HEMATOLOGY** Data Collection Sites (DCS) | 25,425  | • Erythrocytes  
• Granulocytes  
• Hematocrit  
• Hemoglobin  
• Lymphocytes  
• Platelets  
• MCHC  
• MPV  
• RDW |
| **CHEMISTRY** Calgary Laboratory Services (CLS) | 27,170  | • Albumin  
• Alanine aminotransferase (ALT)  
• C-reactive protein (CRP)  
• Creatinine  
• Cholesterol  
• Ferritin  
• Free T4  
• HDL  
• LDL  
• Non-HDL  
• Thyroid stimulating hormone (TSH)  
• Triglycerides  
• 25-Hydroxyvitamin D  
• Hemoglobin A1c (n = 26961) |
| **GENETICS** Genetic and Epigenetic Centre (GEC) | 10,000  | • Genome-wide genotyping  
• DNA extracted from buffy coat on samples (n = 26,884)  
• 820K UK Biobank Axiom Array (Affymetrix) |
| **EPIGENETICS** Genetic and Epigenetic Centre (GEC) | 1,500   | • DNA methylation  
• DNA extracted from PBMCs  
• 850K Infinium MethylationEPIC BeadChip (Illumina) |
| **METABOLOMICS** Kyoto, Japan | 1,000   | • Mass spectrometry |

Available mid-2018

Updated July 14, 2017
Work-related content in CLSA

- Current or last job
- Duration in that job
- Main occupation through career
- Reasons for retirement (or ending retirement)
- Possible use of Job Exposure Matrices
Defining response rates

**Response Rates:** We defined response rates as the number of participants divided by the estimated number of those sampled who were eligible.

(A) \( \text{Pre – Recruitment Rate} = \frac{\text{Number of Pre–Recruits}}{\text{Estimated Number Eligible in Sample}} \)

(B) \( \text{Conversion Rate} = \frac{\text{Number of Participants}}{\text{Number of Eligible Pre–Recruits}} \)

\[ \text{Response Rate} = A \times B \]
### Response rates

<table>
<thead>
<tr>
<th>SAMPLING FRAME</th>
<th>Pre-recruitment Rate</th>
<th>Conversion Rate</th>
<th>Overall Response Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provincial Health Registry Mail-Outs</td>
<td>0.10</td>
<td>0.58</td>
<td>0.06</td>
</tr>
<tr>
<td>Random-Digit Dialing</td>
<td>0.29</td>
<td>0.38</td>
<td>0.11</td>
</tr>
</tbody>
</table>

Also, recruitment cost per participant lower for RDD.
Baseline Demographics
## Socio-demographic Characteristics

**unweighted**

<table>
<thead>
<tr>
<th></th>
<th>Tracking</th>
<th>Comprehensive</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>N=51,338</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45-54</td>
<td>5,832 (27.5)</td>
<td>7,595 (25.2)</td>
<td>13,427 (26.2)</td>
</tr>
<tr>
<td>55-64</td>
<td>6,564 (30.0)</td>
<td>9,856 (32.7)</td>
<td>16,420 (32.0)</td>
</tr>
<tr>
<td>65-74</td>
<td>4,634 (21.8)</td>
<td>7,362 (24.5)</td>
<td>11,996 (23.4)</td>
</tr>
<tr>
<td>75-85</td>
<td>4,211 (19.8)</td>
<td>5,284 (17.6)</td>
<td>9,495 (18.5)</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>10,835 (51.0)</td>
<td>15,320 (50.9)</td>
<td>26,155 (50.9)</td>
</tr>
<tr>
<td>Male</td>
<td>10,406 (49.0)</td>
<td>14,777 (49.1)</td>
<td>25,183 (49.1)</td>
</tr>
<tr>
<td><strong>Language</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>English</td>
<td>17,483 (82.3)</td>
<td>24,291 (80.7)</td>
<td>41,774 (81.4)</td>
</tr>
<tr>
<td>French</td>
<td>3,758 (17.7)</td>
<td>5,806 (19.3)</td>
<td>9,564 (18.6)</td>
</tr>
<tr>
<td>Born in Canada</td>
<td>18,513 (87.2)</td>
<td>24,644 (81.9)</td>
<td>43,099 (84.1)</td>
</tr>
</tbody>
</table>
## CLSA Participants by Province

### Unweighted

<table>
<thead>
<tr>
<th>Province</th>
<th>Tracking</th>
<th>Comprehensive</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>British Columbia</td>
<td>2613 (12.3)</td>
<td>6254 (20.8)</td>
<td>8867 (17.3)</td>
</tr>
<tr>
<td>Alberta</td>
<td>2103 (9.9)</td>
<td>2958 (9.8)</td>
<td>5061 (9.9)</td>
</tr>
<tr>
<td>Saskatchewan</td>
<td>1382 (2.7)</td>
<td>0</td>
<td>1382 (2.7)</td>
</tr>
<tr>
<td>Manitoba</td>
<td>1477 (7.0)</td>
<td>3114 (10.4)</td>
<td>4591 (9.0)</td>
</tr>
<tr>
<td>Ontario</td>
<td>4705 (22.2)</td>
<td>6417 (21.3)</td>
<td>11122 (21.7)</td>
</tr>
<tr>
<td>Quebec</td>
<td>3601 (17.0)</td>
<td>6057 (20.1)</td>
<td>9658 (18.8)</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>1355 (2.6)</td>
<td>0</td>
<td>1355 (2.6)</td>
</tr>
<tr>
<td>Nova Scotia</td>
<td>1546 (7.3)</td>
<td>3075 (10.2)</td>
<td>4621 (9.0)</td>
</tr>
<tr>
<td>Prince Edward Island</td>
<td>1138 (2.2)</td>
<td>0</td>
<td>1138 (2.2)</td>
</tr>
<tr>
<td>Newfoundland</td>
<td>1251 (5.9)</td>
<td>2219 (7.4)</td>
<td>3470 (6.8)</td>
</tr>
</tbody>
</table>
First Follow Up
2015-2018
First Follow-Up: **New Content Added**

- *Child maltreatment*
- **Elder abuse**
- Epilepsy screening
- Decedent interview
- Unmet health-care needs
- Preventive health behaviours (screening, vaccination, etc)
- Enhanced hearing, oral health and transportation modules
- Gender identity questions
- Subjective cognitive decline
- Loneliness

*Childhood Experiences of Violence Questionnaire. Walsh et al 2012
**National Initiative for the Care of the Elderly (NICE)
Follow up considerations

• Keeping participants engaged
• Tracing participants who have moved
• Attention to changes in life circumstances that may affect ability to participate
  • Cognitive, sensory, mobility impairment
• Ensuring that changes in content permit the ongoing examination of transitions and trajectories
Passive Data Collection Work in progress

• Linkage is an important CLSA strategy
  • Great potential for collecting information that is difficult to get from participants due to time, accuracy limitations; and/or may even be unknown to participants
  • Potential to obtain historical data prior to CLSA entry

• Types of databases
  • Individual level administrative provincial health databases
  • Vital statistics/disease registries
  • Population level databases of community characteristics, climate, pollution
Retention at first follow-up

Comprehensive cohort

Completed 22179
Withdrawn 1018
Died 567
TOTAL 23764

Retention = \frac{22179}{22179 + 1018} = 96\%
Retention at first follow-up

Tracking cohort

Completed \( X \)
Withdrawn \( Y \)
Died \( Z \)
TOTAL \( X+Y+Z \)

Retention = \( \frac{X}{X+Y} = R\% \)
CLSA Approved Projects
Selected Approved Projects

- **Labour Force Participation: Retirement Transitions, Expectations and Planning**
  University of Waterloo

- **Measuring Frailty in Older Canadians: An Analysis of the Canadian Longitudinal Study on Aging (CLSA)**
  McMaster University

- **Factorial invariance of the CES-D**
  University of Saskatchewan

- **Sleep and its Covariates in the CLSA**
  McGill University

- **Social Support, Social Participation, and Depression among Caregivers and Non-Caregivers in Canada: A Population Health Perspective**
  Western University

- **Epidemiology of Menopause in Canada**
  York University
Selected Approved Trainee Projects 2017

• A Model of Health: Using data modelling techniques to improve health outcomes for older Canadian adults by optimizing the development and delivery of physical activity interventions
  Simon Fraser University

• Potential metabolic and functional benefits of a comprehensive evaluation of physical activities for Canadian adults
  University of New Brunswick

• Impact of the Lifestyle Factors on the Health Aging of Individual
  Simon Fraser University

• Examining multimorbidity among middle-aged Canadians
  University of Manitoba

• Frailty and mobility limitations in older Canadians with musculoskeletal diseases compared to other chronic medical conditions
  McMaster University

• Characterization of cardiovascular disease burden and health of Canadian cancer survivors
  University of Alberta
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Canadian Longitudinal Study on Aging: www.clsa-elcv.ca