Canadian Longitudinal Study on Aging as a Platform for Studying Transitions and Trajectories of Aging and Health

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Gilbrea Centre on Aging, March 5th, 2014
Historians may well conclude that the most significant event of the 20th century was ...?

the growth of world population.
And in the 21st century, the most significant event may likely be ...?

the aging of humanity.
Gender and Aging

- NUMBERS
- MORBIDITY
- POVERTY
Trends in Global Aging

Percent of Population Aged 65 & Over: History and UN Projection

1950: 4% Developed World, 4% Developing World
1970: 4% Developed World, 4% Developing World
1990: 5% Developed World, 6% Developing World
2010: 13% Developed World, 16% Developing World
2030: 23% Developed World, 25% Developing World
2050: 26% Developed World, 23% Developing World

Source: UN (2005)
Number of Years for Percent of Population Age 65 or Older to Rise from 7% to 14%

<table>
<thead>
<tr>
<th>More developed countries</th>
<th>Less developed countries</th>
</tr>
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<tbody>
<tr>
<td>France 1865-1980</td>
<td>Azerbaijan 2000-2041</td>
</tr>
<tr>
<td>115</td>
<td>41</td>
</tr>
<tr>
<td>Sweden 1890-1975</td>
<td>Chile 1998-2025</td>
</tr>
<tr>
<td>85</td>
<td>27</td>
</tr>
<tr>
<td>Australia 1938-2011</td>
<td>China 2000-2026</td>
</tr>
<tr>
<td>73</td>
<td>26</td>
</tr>
<tr>
<td>United States 1944-2013</td>
<td>Jamaica 2008-2033</td>
</tr>
<tr>
<td>69</td>
<td>25</td>
</tr>
<tr>
<td>Canada 1944-2009</td>
<td>Tunisia 2008-2032</td>
</tr>
<tr>
<td>65</td>
<td>24</td>
</tr>
<tr>
<td>53</td>
<td>23</td>
</tr>
<tr>
<td>Poland 1966-2013</td>
<td>Thailand 2003-2025</td>
</tr>
<tr>
<td>47</td>
<td>22</td>
</tr>
<tr>
<td>United Kingdom 1930-1975</td>
<td>Brazil 2011-2032</td>
</tr>
<tr>
<td>45</td>
<td>21</td>
</tr>
<tr>
<td>Spain 1947-1995</td>
<td>Colombia 2017-2037</td>
</tr>
<tr>
<td>45</td>
<td>20</td>
</tr>
<tr>
<td>26</td>
<td>19</td>
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</table>

* Dates show the span of years when percent of population age 65 or older rose (or is projected to rise) from 7 percent to 14 percent.

## Population Totals in Canada by Age Group and Year

<table>
<thead>
<tr>
<th>AGE</th>
<th>MALES</th>
<th>BOTH SEXES</th>
<th>FEMALES</th>
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<tbody>
<tr>
<td>80+</td>
<td>229898</td>
<td>670192</td>
<td>440294</td>
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<tr>
<td>75-79</td>
<td>255599</td>
<td>622194</td>
<td>366595</td>
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<tr>
<td>70-74</td>
<td>364298</td>
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<td>469693</td>
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<tr>
<td>65-69</td>
<td>497996</td>
<td>1084588</td>
<td>586592</td>
</tr>
<tr>
<td>60-64</td>
<td>578596</td>
<td>1190087</td>
<td>611491</td>
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<tr>
<td>55-59</td>
<td>618096</td>
<td>1238387</td>
<td>620291</td>
</tr>
<tr>
<td>50-54</td>
<td>673295</td>
<td>1339986</td>
<td>666691</td>
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<tr>
<td>45-49</td>
<td>844194</td>
<td>1674182</td>
<td>829988</td>
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<tr>
<td>40-44</td>
<td>1076892</td>
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<td>35-39</td>
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<td>2344675</td>
<td>1171184</td>
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<td>30-34</td>
<td>1311991</td>
<td>2597873</td>
<td>1285882</td>
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<tr>
<td>25-29</td>
<td>1282190</td>
<td>2528572</td>
<td>1246382</td>
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<td>20-24</td>
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<td>15-19</td>
<td>984993</td>
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<td>10-14</td>
<td>980292</td>
<td>1912979</td>
<td>932687</td>
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<td>5-9</td>
<td>998293</td>
<td>1953079</td>
<td>954786</td>
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<tr>
<td>0-4</td>
<td>1000393</td>
<td>1953280</td>
<td>952887</td>
</tr>
</tbody>
</table>

1991 TOTALS: 13938100 (MALES) + 28117600 (BOTH SEXES) + 14179500 (FEMALES)
Compression of morbidity

Fries’ paradigm based on the premise that:

• The length of human life is fixed
  AND
• Chronic disease can be postponed

• Predicted that the increase in life expectancy would plateau in the coming decades, particularly life expectancy from age 65 which excludes early life mortality
Fries potential scenarios

1. Present Morbidity
2. Life Extension
3. Shift to the Right
4. Compression of Morbidity

- Morbidity at 55 years
- Death at 76 years
- Morbidity at 55 years
- Death at 80 years
- Morbidity at 60 years
- Death at 81 years
- Morbidity at 65 years
- Death at 78 years
Evidence suggests otherwise

• Is average life expectancy approaching an upper limit to life expectancy?
  • the evidence that the average life span is 85 years is unconvincing
  • there is no evidence for further rectangularization of survival curves

• Will age at first infirmity increase?
  • there is no evidence for over-all declines in incidence of morbidity: on the contrary
  • evidence for actual “(de)compression” of morbidity is ambiguous
Historical increases of life expectancy
Oepen and Vaupel, Science 2002; C Finch adaptation

Phase 1
early urban

Phase 2
sanitation-nutrition

Phase 3?
regeneration
modern medicine
Social Policy Innovation

Life-expectancy in years

1550 1600 1650 1700 1750 1800 1850 1900

England
Norway
New Zealand
Iceland
Netherlands
Sweden
Japan
The demographic causes of aging of the population, in terms of fertility rates and mortality rates, are generally predictable. A variety of population projections are available, prepared by UN, EU and National Statistic Institutes.

What is less predictable is the interaction of these forces with social context, health status, economic changes, cultural influences and hence international migrations.
Risk factors for Disease, Disability, and Longevity

- Risk factors
  - Many factors contribute
  - Gender difference remains unexplained
  - Social inequalities
  - Age discrimination
  - Community context
  - Loss of prediction
  - Paradoxes in prediction

- New opportunities
  - Larger number of very old people
  - Longer term follow-up
  - Longitudinal data – identify optimal trajectory
  - Common risk factors
Physiologic reserve - Hypothetical Trajectory to Illness, Functional Limitation & Disability

Younger age

Time

Older age

Physiologic reserve

- hip fracture
- pneumonia
- congestive heart failure

Functional limitation

Disability
Exceptional survival – Understanding physiologic and Social reserve

• Do systems decline together?
• Is there a common underlying “rate” of aging across organ systems?
• How physiologic vulnerabilities mitigated by psychosocial reserves?
• Is social frailty as important as physiological and functional frailty?
RESEARCH ON AGING

• For this reason further research on biodemography, dynamic of health, epidemiology, economics, psychology, social sciences and aging are needed.

• Longitudinal data are essential in order to sort causal relationships among demographic, biological, psychosocial and economic factors, and health.

• Cross-national comparison are important, considering variability across societies, in terms of status and well-being of older persons, experiences of health and mortality, family and social support.
The Canadian Longitudinal Study on Aging (CLSA)

A key strategic initiative of CIHR

More than 160 researchers - 26 institutions

Multidisciplinary - biology, genetics, medicine, psychology, sociology, demography, economics, epidemiology, nursing, nutrition, health services, biostatistics, population health
Canadian Longitudinal Study on Aging (CLSA)

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.
Our Aim

To study aging as a dynamic process and the inter-relationship among intrinsic and extrinsic factors from mid-life to older age.
Innovation - Cell to Society

Mid life to old age

Quantitative traits
  - Physical
  - Social
  - Psychological

Gene-environment interactions

Disease, disability, psychosocial consequences

Adaptation
Overall Aims of the CLSA

- The progression of **health** from middle-age to early old age to older old age
- The determinants of **well-being and quality of life**
- Risk Factors (including genetics) of **Chronic diseases**
- **Cognitive functioning** and **mental health**
- **Disability** and the compression of morbidity
- The examination of socioeconomic and health **inequalities** in an aging population
- **Social participation, social relationships and care giving** in an aging population
- **Retirement** and **post retirement** labor market activity
Participant Recruitment

Vancouver
Victoria
Surrey
Calgary
Winnipeg
Hamilton
Ottawa
Montreal
Sherbrooke
Halifax
St. John's
## Canadian Longitudinal Study on Aging

### CLSA Tracking (n=20,000)
- Sampling Frame: CCHS, provincial health registration databases, and RDD
- 45-54: 6,000
- 55-64: 6,000
- 65-74: 4,000
- 75-85: 4,000

### CLSA Comprehensive (n=30,000)
- Sampling Frame: provincial health registration databases, and RDD
- 45-54: 9,000
- 55-64: 9,000
- 65-74: 6,000
- 75-85: 6,000
Participants (50,000)\n
Enrolled

Questionnaire Data (50,000)

Physical Exam and Biological Specimen (30,000)

Active Follow-up (F) Every 3 years
- Questionnaire
- Physical exam
- Biological samples

Maintaining Contact Interview (MC) mid-wave
- Update contact information
- Short Questionnaire

Passive Follow-up Every 3 years
- Health care utilization
- Disease registries
- Mortality databases

Data and Biological Sample Repositories

Researchers
Depth and Breadth of CLSA

PHYSICAL & COGNITIVE MEASUREMENTS
- Height & weight
- Waist and hip measurements
- Blood Pressure
- Grip strength, timed up-and-go, chair raise, 4-m walk
- Standing balance
- Vision (retinal imaging, Tonometer & visual acuity)
- Hearing (audiometer)
- Spirometry
- Body composition (DEXA)
- Bone density (DEXA)
- Aortic calcification (DEXA)
- ECG
- Carotid Plaque sweep (ultrasound)
- Carotid intima-media thickness (ultrasound)
- Depression
- Cognitive assessment (30 min. battery)

HEALTH INFORMATION
- Chronic disease symptoms (disease algorithm)
- Medication and supplements intake
- Women’s health
- Self-reported health service use
- Oral health
- Preventative health
- Administrative data linkage health services & drugs & other administrative databases

PSYCHOSOCIAL
- Social participation
- Social networks and support
- Caregiving and care receiving
- Mood, psychological distress
- PTSD
- Coping, adaptation
- Injuries and consumer products
- Work-to-retirement transitions
- Retirement planning
- Social inequalities
- Mobility-lifespace
- Built environments & Contextual Factors
- Income, Wealth and Assets

LIFESTYLE & SOCIODEMOGRAPHIC
- Smoking
- Alcohol consumption
- Physical activity (PASE)
- Nutrition (nutritional risk and food frequency)
- Birth location
- Ethnicity/race/gender
- Marital status
- Education
Bio specimens
42 aliquots per participant
CLSA Infrastructure

- National Coordinating Centre (McMaster)
- Biorepository and Bioanalysis Centre (McMaster)
- IT Infrastructure (McMaster)
- Statistical Analysis Centre (McGill)
- Genetics and Epigenetics Centre (UBC)
- 4 Computer-Assisted Telephone Interview Sites
  - Victoria, Winnipeg, Sherbrooke and Halifax
- 11 Data Collection Sites
  - Victoria, Vancouver, Surrey, Calgary, Winnipeg, Hamilton/Toronto, Ottawa, Montreal, Sherbrooke, Halifax and St. John’s
Sampling and Subject Selection

CLSA collaborated with Statistics Canada to develop Sampling Strategy

- **Target population**: People aged 45-85 living in private occupied dwellings in the ten provinces

- **Excluded**:
  - Residents of the three territories
  - Persons living on Indian reserves or Crown lands
  - Persons living in institutions
  - Full-time members of the Canadian Forces
  - Residents of some remote regions
Sampling

• Choose representative sample of eligible Canadians
  • 20K Tracking cohort; 30K Comprehensive cohort
  • Specified numbers in age-sex groups by province

• Options for methods of selection:
  • Statistics Canada
  • Using provincial health registries
  • Random digit dialing
Tracking Cohort of the CLSA (n=20,000)
Baseline Recruitment and Data Collection

• First selection of 20,000 started in late 2011
  • Completed 60 minute questionnaire by telephone on about 20,000 individuals
  • Plan to release these data in the summer of 2014
• In August 2013 our maintaining contact interviews (30 minute telephone interview)
  • Minimize loss to follow-up
  • Collect additional data
Comprehensive Cohort of the CLSA (n=30,000)
Implementation Plan for the Comprehensive Cohort (n=30,000)

- Cohort of 30,000 persons to be recruited within 25 to 50 km radius of 11 data collection sites (DCS)
  - Victoria (3000), Vancouver (1500), Burnaby (1500), Calgary (3000), Winnipeg (3000), Hamilton (3000), Ottawa (3000), Montreal (3000), Sherbrooke (3000), Halifax (3000), St. John’s (3000)
Comprehensive Cohort
Rolling Recruitment

❖ First batch of 10,000 people to be recruited across all sites (Fall-2012 to mid-2013)
  ❖ Maintaining contact by phone (end of 2013- end 2014)
    ❖ Completed almost 18,000 In home (IH) Interviews
      ❖ IH + Physical assessment + biosample over 16,000

❖ Second batch of 10,000 (mid-2013 to mid-2014)
  ❖ Maintaining contact: (end of 2014-end of 2015)

❖ Third batch of 10,000 (mid-2014 to mid 2015)
  ❖ Maintaining contact: (end of 2015-end of 2016)
Data and Sample Access

• Data and Sample Access is Open
  • All researchers have access to data
    • No special access to the “creators” of the platform
    • Individual level data versus aggregate data
    • Genetic versus Health (Depression) versus Social data

• Ethical and Legal Considerations
  • How the data are used and what purpose?
  • Public sector versus Private sector access to data
Applications to date…

- Injury and consumer products (PHAC)
- Neurologic health conditions (PHAC)
- Veteran’s health (Veteran’s Affairs)
- Hearing and Cognition (U of T and UBC)
- Air Pollution and Health Outcomes (Core sub-study of the CLSA)
- CLSA validation studies
- CLSA-Brain (core sub-study of the CLSA-not funded yet)
Global Observatory on Aging

• EU FP7 funded Project: Creating a network of about 30 cohorts across Canada, Europe, Israel, China, and USA
  • CHANCES: Healthy Aging (already funded)
    • 10 Cohorts (Harmonization)
  • Part of several applications to EU for March 2014 competition
    • Multi-morbidity
    • Frailty biomarkers
    • Urbanization and Aging
<table>
<thead>
<tr>
<th>Role</th>
<th>Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead PI</td>
<td>Parminder Raina (McMaster)</td>
</tr>
<tr>
<td>Co-PI</td>
<td>Christina Wolfson (McGill) and Susan Kirkland (Dalhousie)</td>
</tr>
<tr>
<td>Key Site Co-Investigators</td>
<td>Gerry Mugford and Patrick Parfrey (Memorial), Hélène Payette (Sherbrooke), Ron Postuma, Brent Richards, Mark Lathrope (McGill), Larry Chambers and Vanessa Taler (Ottawa), Lauren Griffith, Harry Shannon, Cynthia Balion, Paola Mutti, Mike Veall, Christopher Patterson, (McMaster), Mary Thompson and Chang Bo (Waterloo), Debra Sheets, Holly Tuokko and Lynne Young (Victoria), Verena Menec (Manitoba), David Hogan, Eric Smith and Marc Poulin (Calgary), Max Cynader, Teresa-Liu Ambrose and Michael Kobor (UBC) and Andrew Wister and Scott Lear (SFU)</td>
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<tr>
<td>Scientific Working Group</td>
<td>See our website – <a href="http://www.clsa-elcv.ca">www.clsa-elcv.ca</a></td>
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praina@mcmaster.ca

CLSA funded by the Government of Canada through CIHR and CFI, and provincial governments and universities

www.clsa-elcv.ca