Canadian Longitudinal Study on Aging: Advancing the Science of Aging through Interdisciplinary Research

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Ottawa, January 20th, 2009
The Aging Revolution

- The rapid and continuing increase in human survival.
- New scientific understanding of the ageing process.
- The changing nature of old age and its determinants.
- Expectations, adjustments and policy.
Demographic Futures

Upward trend in life expectancy continue, cease, or reverse?

+ Effective interventions against age-related diseases
+ Improved environment for ageing
+ Life-cycle deceleration (delayed reproduction)

- Adverse effects of excess nutrition
- Adverse effects of alcohol and drug abuse
- Adverse effects of increasingly sedentary lifestyles
- Life-cycle acceleration (early maturation)
Why ageing occurs

Intrinsic

Extrinsic

How ageing is caused
What Accounts for the Individuality of Human Ageing?
## Genetic Heritability of Human Lifespan

*Cournil & Kirkwood* *Trends in Genetics* 2001

### Twin Studies
- McGue et al (1993) 0.22
- Herskind et al (1996) 0.25
- Ljungquist et al (1998) <0.33

### Traditional Family Studies
- Philippe (1978) 0-0.24
- Bocquet-Appel & Jakobi (1990) 0.10-0.30
- Mayer (1990) 0.10-0.33
- Gavrilova et al (1998) 0.18-0.58
- Cournil et al (2000) 0.27

Genes account for 25% of what determines longevity
Extrinsic Factors
Beyond Biology

- Nutrition
- Lifestyle
- Social
- Psychological
- Physical Environment
- Chance
Need for Integration to Understand Aging and Health

Environmental influences (e.g., rural, socio-economic, exercise, nutrition)

Chronic diseases (e.g., diabetes, cancer, dementia, arthritis, cardio)

Genetics (e.g., telomeres / oxidative stress, psychological & cognitive abilities, immune functions)

Infections

Health Services Utilization

Time
Policy Needs

Changing demographics #1 priority of Canadian Federal and Provincial Governments

Healthy aging is important to the Canadian public and policy makers

Canada differs from other countries in its:

- health and social policy
- health care delivery systems
- climate, environment, geography, and
- retirement policy and pension programs

Seniors of tomorrow have different needs and expectations

- major implications & challenges for the health care system and for social programs
Scientific Evidence

More than 70 longitudinal studies worldwide

- Most studied people over age of 65
- Many collected lot of information on social factors or retirement but lack detailed information on health, especially clinical and biological measures or vice versa
- Few looked at the aging process from a mid-life to old age perspective
- Few were population-based studies able to capture the changing individual within a changing context and incorporate multiple levels of inquiry, the cell, the individual and society
- Few studies focused on how individuals cope or adapt to changing circumstances and how it impacts their well-being
Principal Investigators

Lead PI: Parminder Raina - McMaster University

Co-PI: Christina Wolfson - McGill University

Co-PI: Susan Kirkland - Dalhousie University
Birth and Aging of the CLSA

- Aylmer meeting - 2001
- Protocol development - 2002-2003
- International Peer Review - 2004
- Pilot Phase 1 - 2005
- Pilot Phase 2 - 2006
- Launch - 2008
The Canadian Longitudinal Study on Aging (CLSA)

A key strategic initiative of CIHR

The Canadian Longitudinal Study on Aging

More than 160 researchers - 26 institutions

Multidisciplinary - biology, genetics, medicine, psychology, sociology, demography, economics, epidemiology, nursing, nutrition, health services, biostatistics, population health
Design Considerations

- Cross-Sectional versus Longitudinal?
- Breadth versus Depth?
- National versus Regional?
- Integrating scientific and policy agenda?
Overall Aims of the CLSA

- To examine aging as a dynamic process.

- To investigate the inter-relationship among intrinsic and extrinsic factors from mid life to older age.

- To capture the transitions, trajectories and profiles of aging: successful aging.

- To provide infrastructure and build capacity for sustained high quality research on aging in Canada.
Future of Research on Aging in Post-Genomic Era

- Age-related changes---”complexity”
  - INDIVIDUAL LEVEL
  - SOCIETAL AND CONTEXTUAL LEVEL

- Innovative study design that advance science of aging and health as well as inform health and social policy

- Need for interdisciplinary long-term longitudinal studies
Innovation - Cell to Society

- Mid life to old age
- Quantitative traits
  - Physical
  - Social
  - Psychological
- Gene-environment interactions
- Disease, disability, psychosocial consequences
- Adaptation

CLSA ELCV
CLSA Program of Research

- Biological Function
  - Genetics/epigenetics
- Physical Function
  - Mobility/Chronic diseases/Injury
- Psychological Function
  - Cognition/Mental Health/Coping
- Social Function
  - Work and retirement/Social Participation/Housing/Economics
Interdisciplinary Research Agenda

- Methods
- Policy
- Sociology
- HSR
- Psychology
- Biology/genetics
- Clinical
- Lifestyle
## Focus of Measurement

### Biomedical
- Activities of daily living/disability/injuries
- Frailty/co-morbidities
- Chronic diseases
- Cognitive function
- Mental Health
- Oral health
- Vision, hearing
- Medications
- Health Care Use
- Institutional care
- Genetics/Biology
  - Disease susceptibility/longevity genes
  - DNA repair
  - Antioxidant defence
  - Apoptosis, programmed cell death
  - Immunosenescence
  - Telomere loss
- Nutrition

### Psychosocial
- Lifestyle/behaviours
- Social networks and social support
- Care giving/Care receiving
- Social care
- Everyday competence, adaptive functioning, coping
- Personality, emotion, psychopathology
- Work to retirement transitions
- Structural inequalities
- Built environments/physical environment/Housing
- Economics/Wealth
- Demographics
- Healthy aging and well being
- Linkage to secondary data bases
  - Health care use
  - Disease registries e.g. Cancer
  - Drugs
  - Environmental
Biological Samples

- **Blood based Sample Types**
  - Serum
  - Plasma, heparin
  - Plasma, EDTA
  - Plasma, citrate
  - Whole blood, EDTA
  - Buffy coat
  - Buffy Coat with Trizol
  - Whole Blood, Acid Citrate Dextrose + Dimethyl Sulfoxide
  - Peripheral Blood Mononuclear Cells

- **Urine (no preservative)**
Passive Data Collection

- Data linkage at the individual level to existing databases:
  - Administrative databases: physician services, hospitalizations, medications
  - Homecare, community services, mental health
  - Vital statistics: mortality
  - Disease registries: cancer, diabetes surveillance, notifiable diseases, trauma, agricultural injuries
  - Motor vehicle registration and accidents
Data Linkage

- Data linkage at the macro level to existing databases:
  - By geographical region (postal code)
    - Pollution: air, water
    - Climate: temperature, precipitation
    - Motor vehicle density
Innovation - Cell to Society

- Mid life to old age
- Quantitative traits
  - Physical
  - Social
  - Psychological
- Gene-environment interactions
- Disease, disability, psychosocial consequences
- Adaptation
Example Research Questions: Cognition as a Quantitative Trait

Cognition as a precursor:
- Is decline in cognition (memory, executive function and psychomotor speed) in mid and later life associated with changes in health outcomes?

Cognition as a mediator
- How do cognitive functions mediate or moderate relations between biological/physical status and adaptive functioning and/or social participation?
Example Research Questions: Cognition as a Quantitative Trait

Cognition as an outcome
- Are epigenetic changes over time associated with cognition?

Adaptation
- How do individuals with cognitive change adapt to maintain performance in everyday functioning?
CLSA Architecture

Every 3 years age 45-84

Data collection on all 50,000

Questionnaires, Database linkage

Inception Cohort: 50,000

In-depth data collection on 30,000 (at 10 sites)

Clinical, Biological, Physical

Follow-up over 20 years

Every 3 years age 45-84
EQUIPMENT AND INFRASTRUCTURE SUPPORTING RESEARCH ON AGING

**National Network of Facilities**

- **Biological Processing Centre**
  Bio-banking, biomarker discovery & analysis (located in Hamilton).

- **Computer-Assisted Telephone Interview Centers**
  Collect health and psychosocial data (located in Halifax and Sherbrooke).

- **Data Collection Centers**: collection of nutrition, physical, clinical data, & biological specimens (*see below).

- **National Coordinating Center**: 
  Oversight, project management, communication for overall initiative (located in Hamilton).

- **Genetics and Epigenetics Centre**
  Genotyping, epigenetic analysis, & bioinformatics, (located in Vancouver).

- **Data Management and Statistics**
  Assimilation, distribution and analysis of all CLSA data (located in Montreal).

**INFRASTRUCTURE**

**CLSA AREAS OF RESEARCH**

- **BIOLOGICAL FUNCTION**
- **PHYSICAL FUNCTION**
- **PSYCHOLOGICAL FUNCTION**
- **SOCIAL FUNCTION**

* Located in St. John’s, Halifax, Sherbrooke, Montreal, Ottawa, Hamilton, Winnipeg, Calgary, Vancouver & Victoria.
Collaboration with Statistics Canada

- CCHS 4.2: Healthy Aging and CLSA
  - CLSA expertise for content development
  - Recruitment for CLSA
  - Cross-sectional versus Longitudinal
Launch

- First selection of 20,000 started in late 2008 in collaboration with Statistics Canada CCHS Healthy Aging module

- Remaining 30,000 will be recruited in 2010

- CFI application for national infrastructure in October 2008
Sources of Funding

- Major funding from:
  - CIHR, CIHR-IA
- Other Funding Partners
  - FRSQ- Réseau Québécois de Recherche sur le Vieillissement
  - Michael Smith Foundation-BCNAR
  - OMHLTC-ORC
- In kind Support
  - Statistics Canada, McMaster, McGill and Dalhousie
Acknowledgements

- Dr. Anne Martin-Mathews
- Dr. Linda Mealing
- Institute of Aging Advisory Board
- Statistics Canada
- Investigators
- Staff
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