

Understanding the determinants of healthy ageing: The Canadian Longitudinal Study on Aging

Harry Shannon



CLSA Core team

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Scientific Working Group	See our website – www.clsa-elcv.ca

2012



European Year for **Active Ageing**
and **Solidarity between Generations** 2012



Outline of talk

- Aging of the population
- Some health changes with age
- Canadian Longitudinal Study on Aging
 - Outline
 - Sampling
- Discussion points

Aging of the population

in high income societies

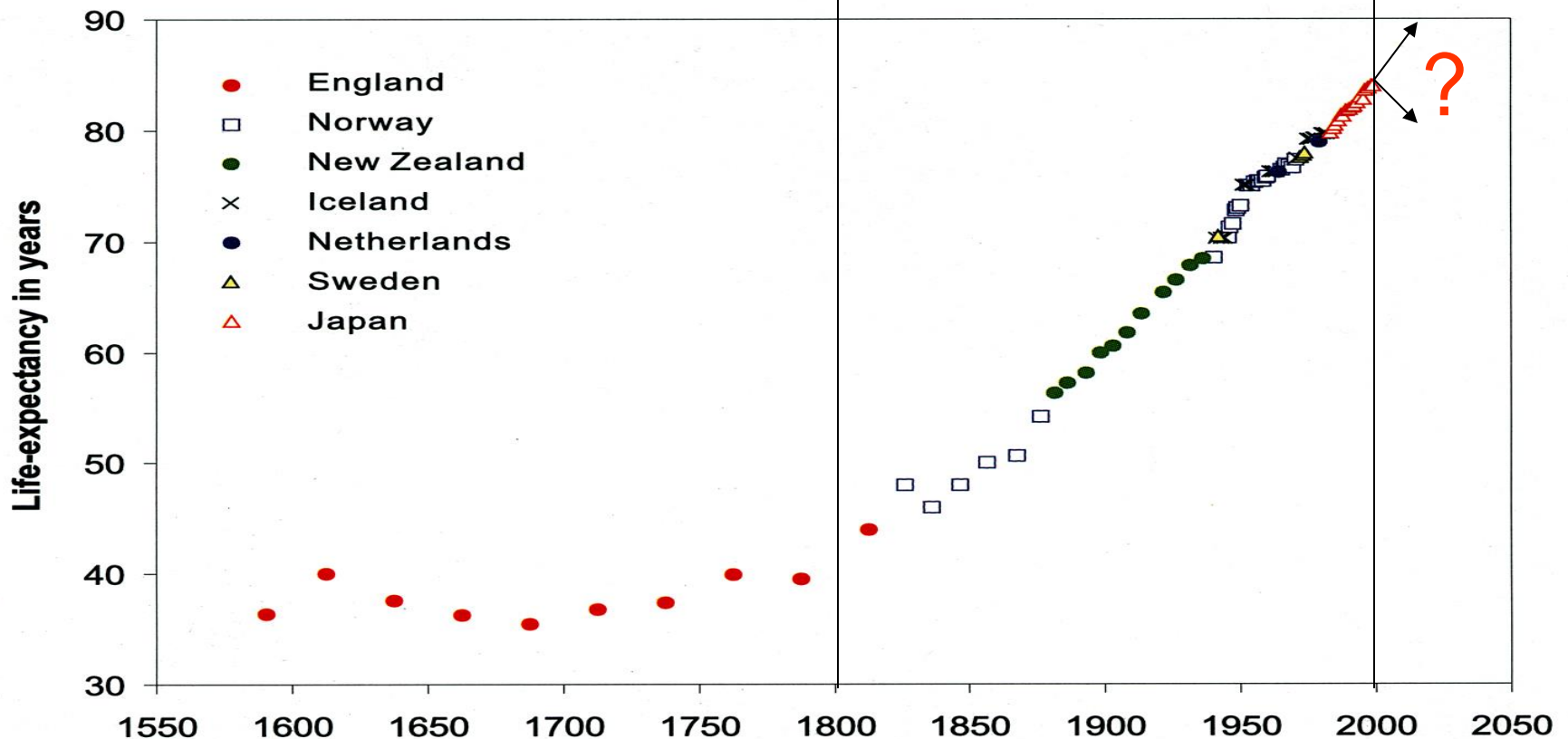
Increase in life expectancy, 1600 - 2000

Oepen and Vaupel, Science 2002; C Finch adaptation

Phase 1
early urban

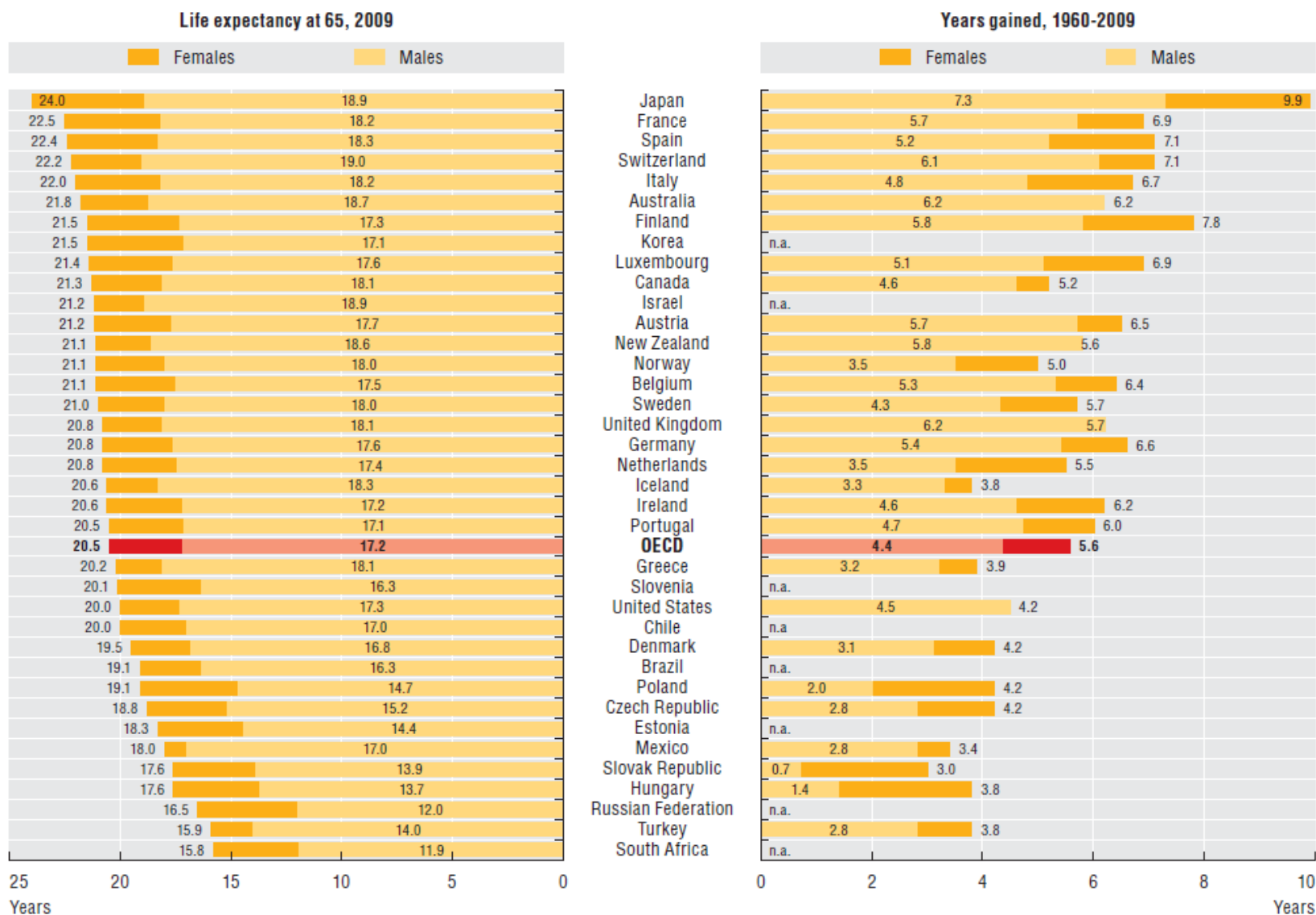
Phase 2
sanitation-nutrition

Phase 3?
regeneration
modern medicine
Social Policy Innovation



Life expectancy after age 65

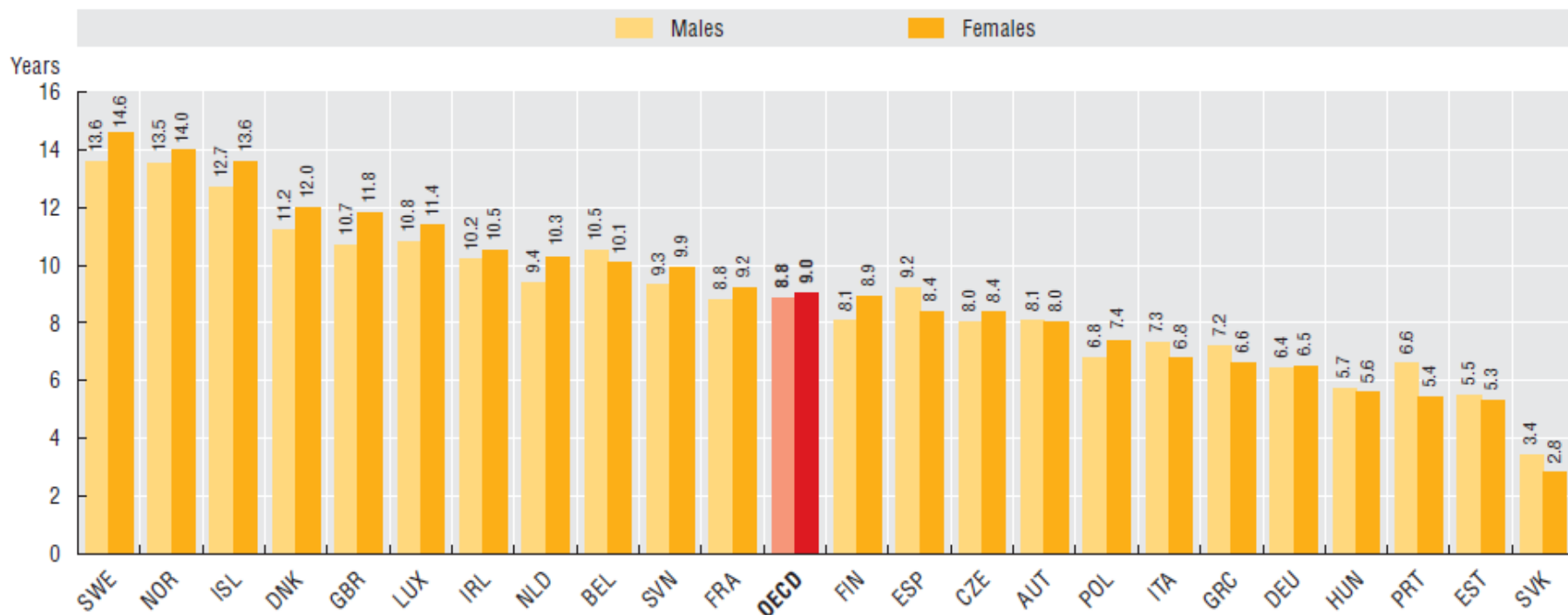
8.1.1 Life expectancy at age 65, 2009 and years gained since 1960 (or nearest year)



Source: OECD, 2011

Disability-free life expectancy after 65

8.1.2 Healthy life years at age 65, European countries, 2009



Source: OECD, 2011

Disability worldwide

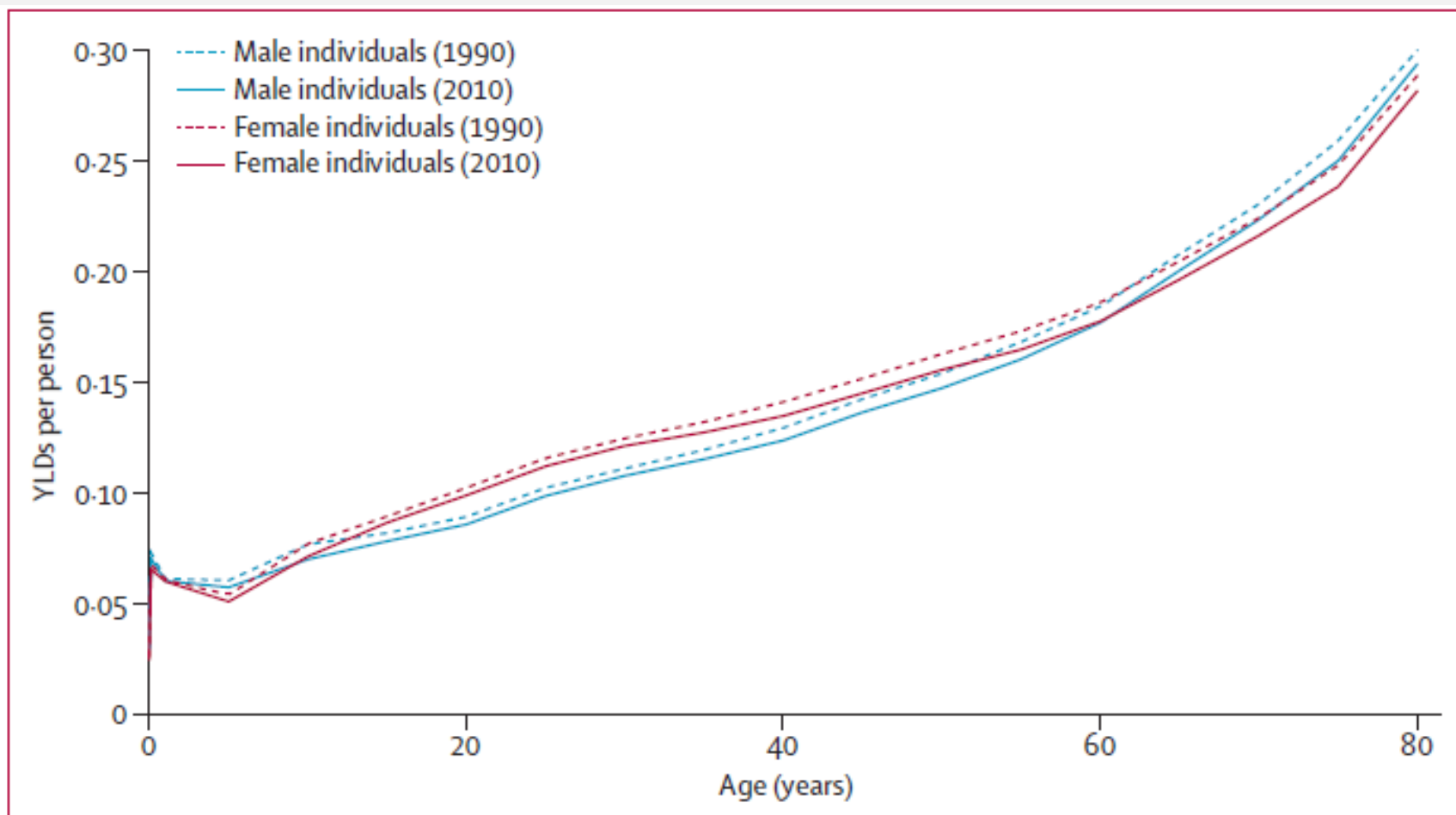


Figure 3: Global years lived with disability (YLDs) per person in 1990 and 2010 for all ages, by sex

Source: Lancet, 15 Dec 2012

Historical expectation

- Genesis: Adam 930 y
 Methusaleh 969 y
 Noah 950 y

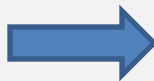
- Psalms 90:10:

The days of our years are threescore years and ten, or even by reason of strength fourscore years

UK projection

‘Around one-third of babies born in 2012 in the United Kingdom are expected to survive to celebrate their 100th birthday’

(UK) Office for National Statistics, March 2012



View of ageing

‘I do not hesitate to assert that the duration of the period of maturity is greatly within our control; and that, although the termination of the journey of human life is absolute and certain, yet that not only the length of that journey, but the manner of its division into various stages, and the degree of ease and pleasure with which we may travel, depend essentially on ourselves’

Barnard van Oven, 1853, cited by Cole and Edwards,
in: Thane (ed), ‘The Long History of Old Age’

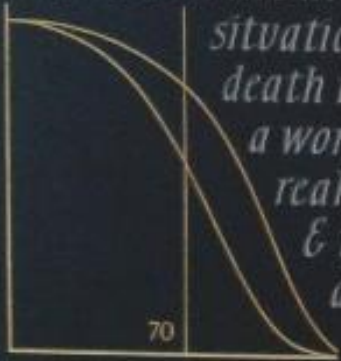
Historical views of 'older workers': first part of the 20th Century

- “women begin to break down in their thirties”
- “men [over 40] lack the essential flexibility of body and mind and suffer with impaired health”

Common attitudes of businesses described by Alsaker (1939); cited by Veit (2012)

DEATH IN OLD AGE IS INEVITABLE BUT DEATH BEFORE OLD AGE IS NOT

In previous centuries seventy years used to be regarded as humanity's allotted span of life and only about one in five lived to such an age. Nowadays, however, for non-smokers in Western countries, the situation is reversed; only about one in five will die before seventy and the non-smoker death rates are still decreasing, offering the promise, at least in developed countries, of a world where death before seventy is uncommon. But, for this promise to be properly realised, ways must be found to limit the vast damage now being done by tobacco & to bring home, to not only the many millions of people in developed countries but also the far larger populations elsewhere, the extent to which those who continue to smoke are shortening their expectation of life by so doing. **RICHARD DOLL**



The Independent, 9 October 2012

Was she really 132? World's 'oldest ever person' Antisa Khvichava dies in remote Georgian village

JOHN HALL  MONDAY 08 OCTOBER 2012



517



197



3



14

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Justin Lee Collins guilty of harassing ex-girlfriend

The great hadner



CBC, 4 December 2012

World's oldest person, 116, dies in Georgia

The Associated Press Posted: Dec 4, 2012 9:32 PM ET | Last Updated: Dec 5, 2012 1:25 AM ET 9



Stay



Mobil

A 2010 photo shows Besse Cooper on her 114th birthday in a nursing home in Monroe, Ga. Cooper, who was the oldest person in the world, died Tuesday at the age of 116. (David Tulis/Athens Banner-Herald/Associated Press)

The Independent, 18 October 2012



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Nonagenarian former wrestler, Ramajit Raghav, breaks his own record after becoming father, again aged 96

Ramjit, who credits his astonishing virility to a life-long abstinence from drugs and alcohol, told reporters he: "can make love like any 25-year-old man"

ROB WILLIAMS  | THURSDAY 18 OCTOBER 2012

From 'The Oldie' magazine



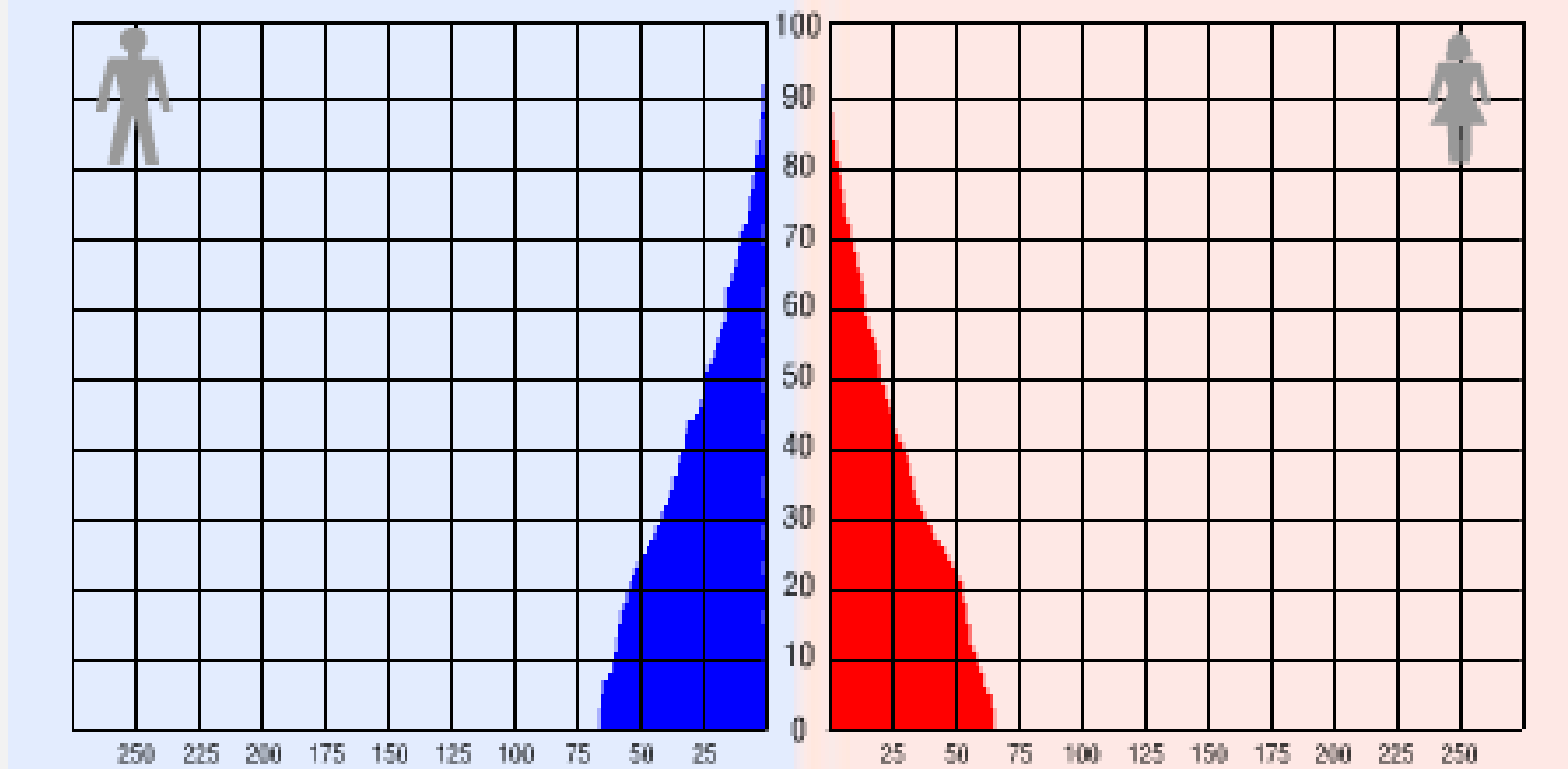
'Remind me – am I getting up or going to bed?'



"What part of Canada that I know nothing about are you from?"

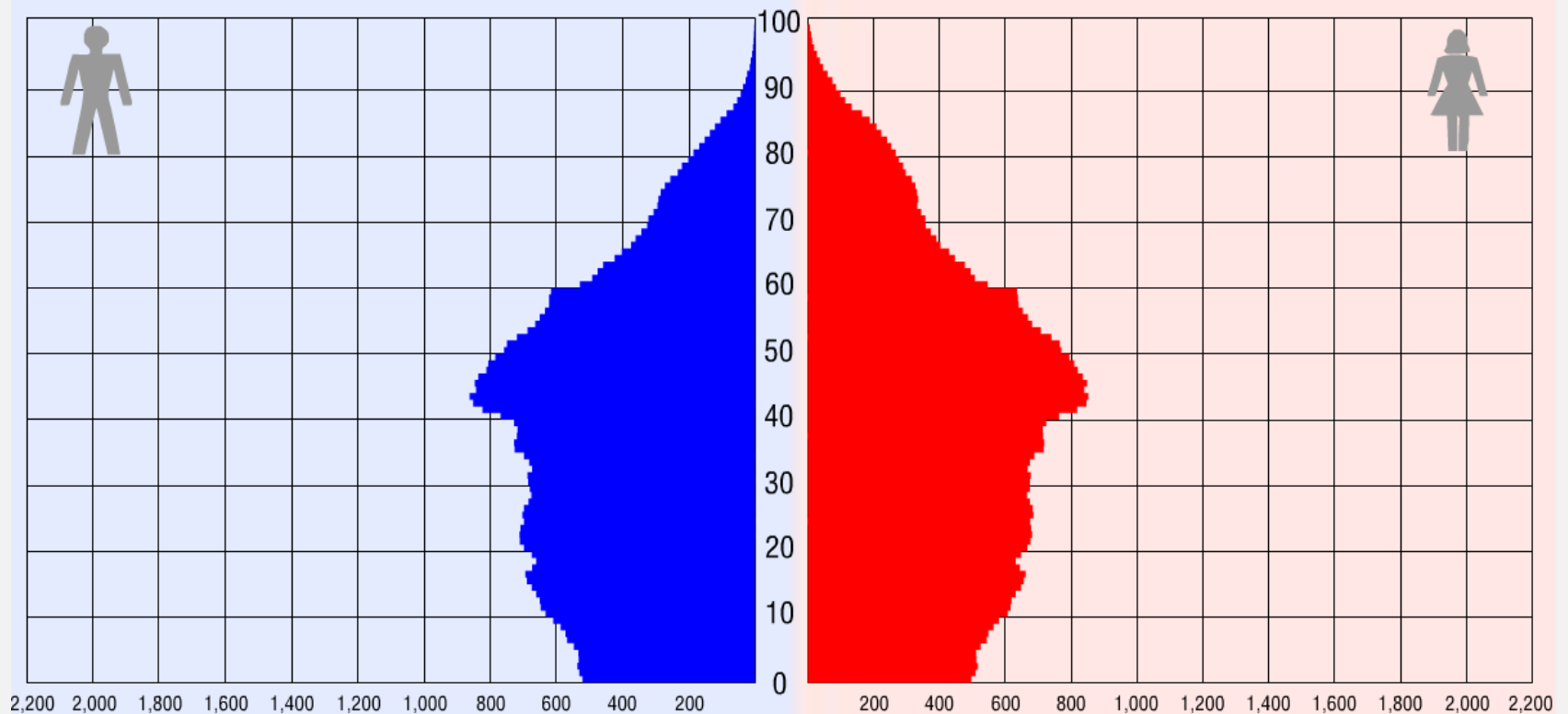
From: New Yorker

Age pyramid of population of Canada, 1901 (5.3 m people)



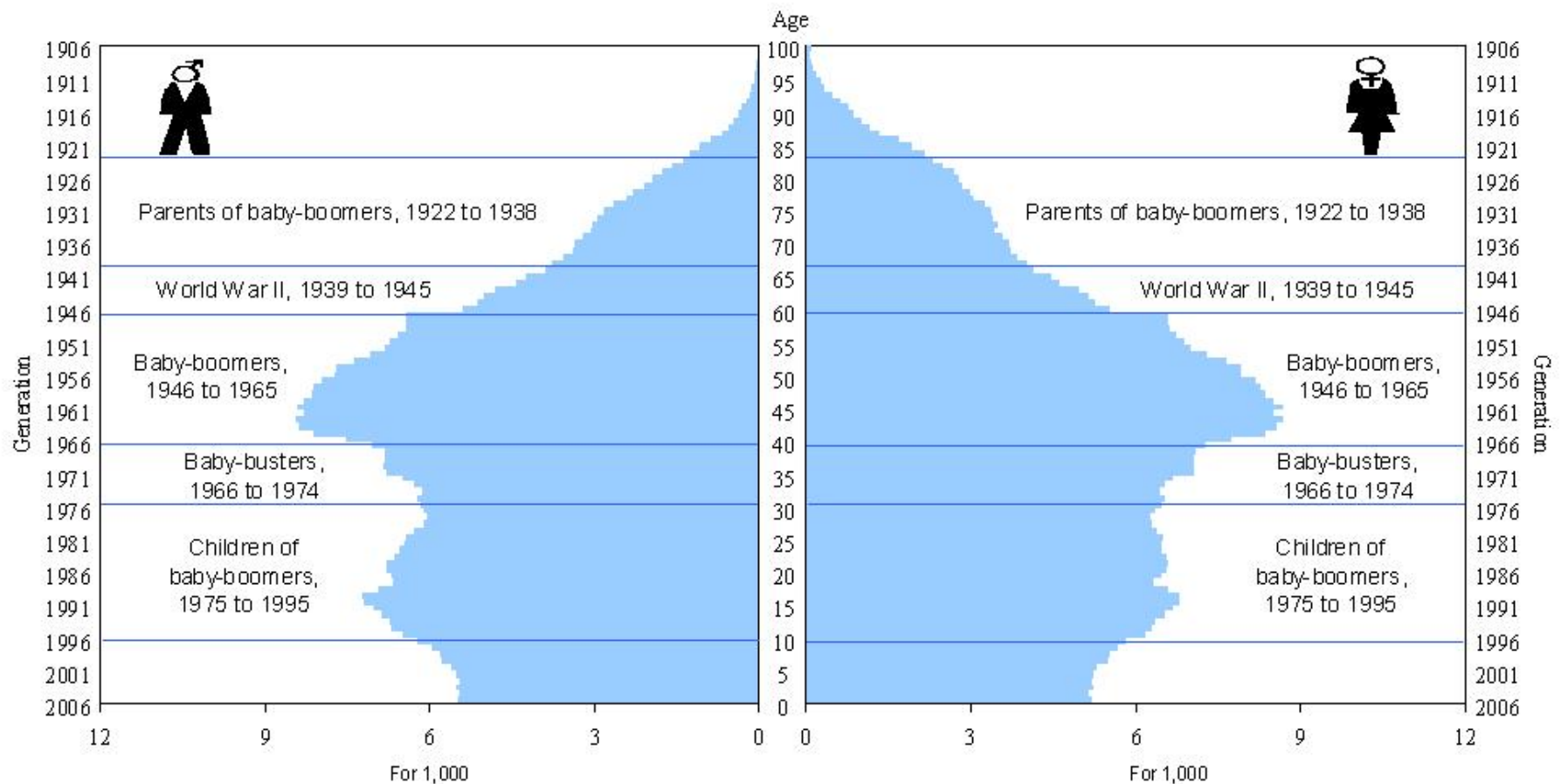
Source: Statistics Canada, 2008

Age 'pyramid' of population of Canada, 2006 (32.5 m people)



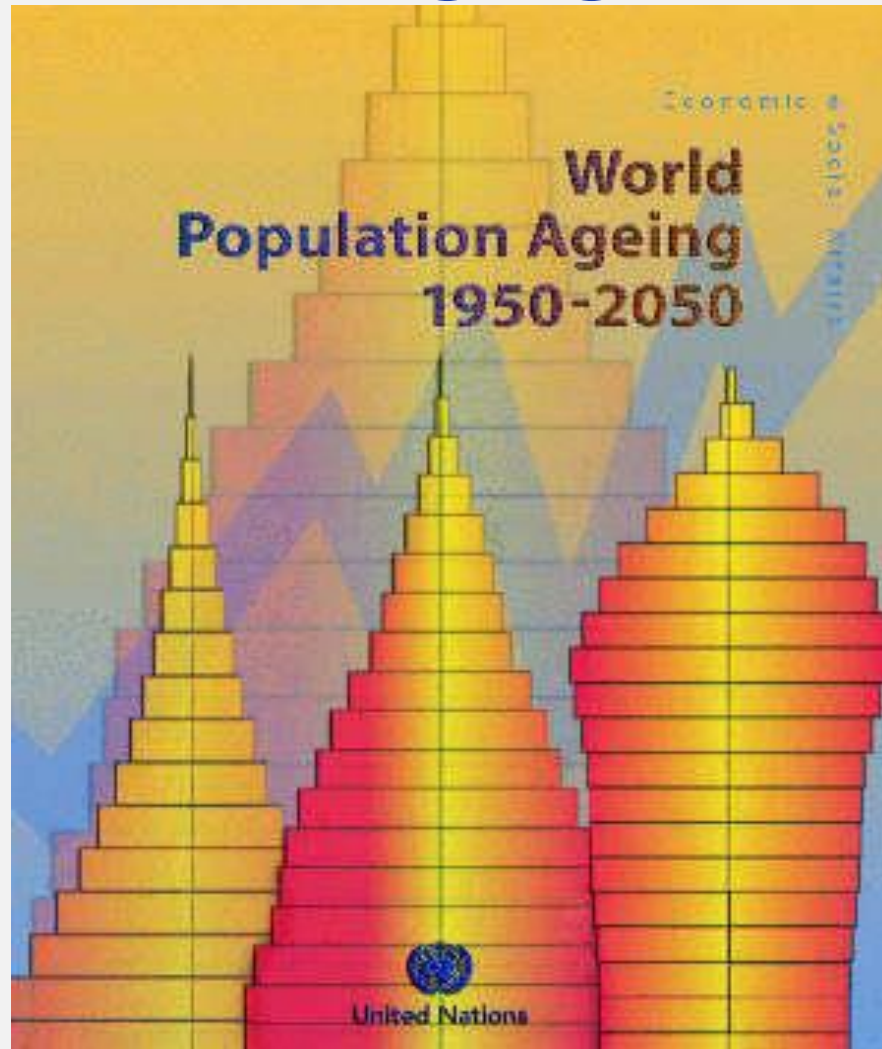
Source: Statistics Canada, 2008

Different cohorts in Canada's population 'pyramid', 2006



Source: Statistics Canada, 2008

Population aging - worldwide



Source: U.N.

Ageing in the Twenty-First Century: A Celebration and A Challenge



UNFPA Report
October 2012



In collaboration with: UNDESA, FAO, ILO, OHCHR,
UNAIDS, UNDP, UN Habitat, UNHCR, UNICEF, UN Women,
WFP, WHO, ECA, ECE, ECLAC, ESCAP, ESCWA, GAA,
HelpAge USA, IFA, INPEA, IOM

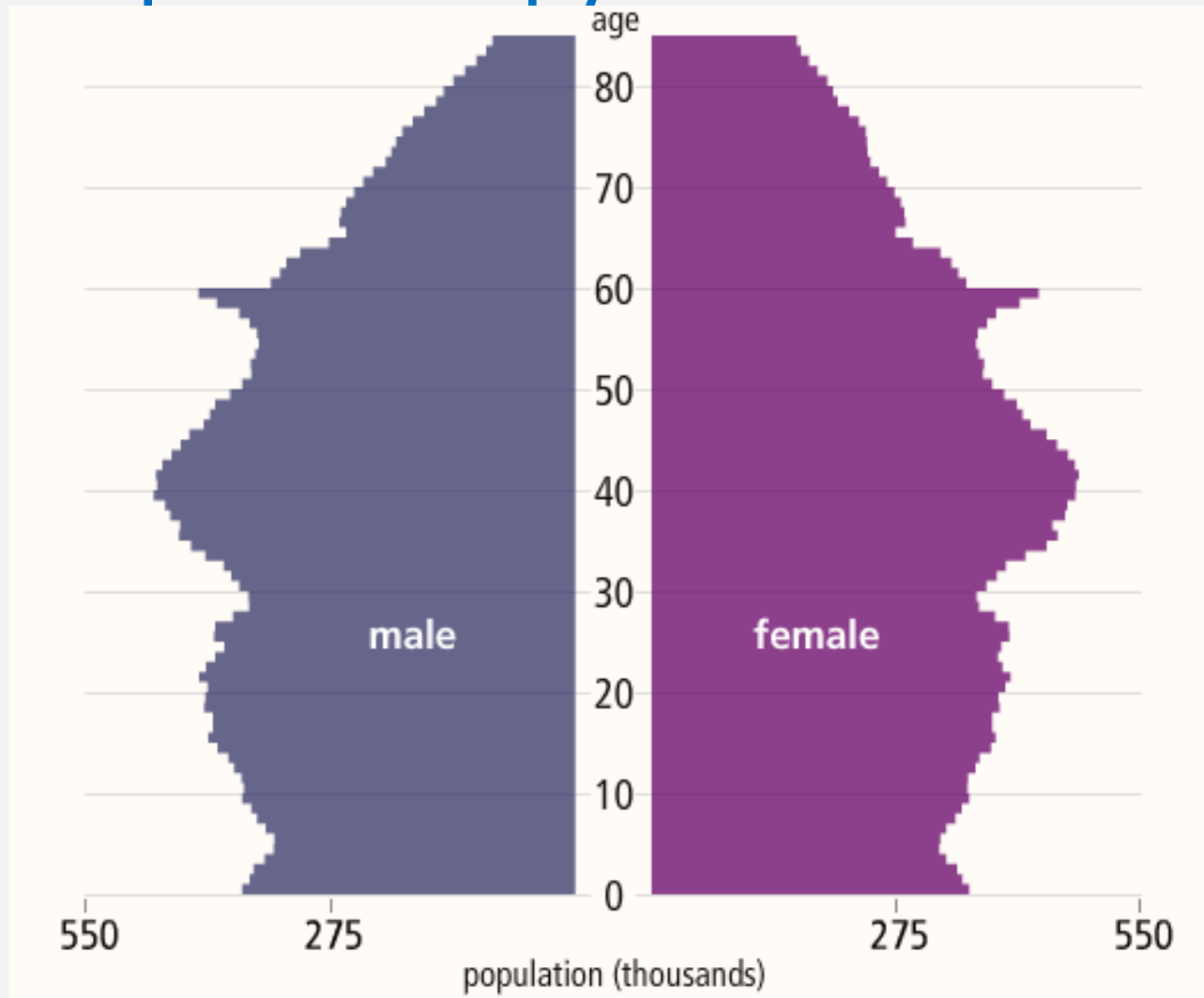


Percentage of population over 60

Region	2012	2050 projected
Africa	6	10
Asia	11	24
Latin America / Caribbean	10	24
Oceania	15	25
North America	19	27
Europe	22	34
World total	11.5	21.8

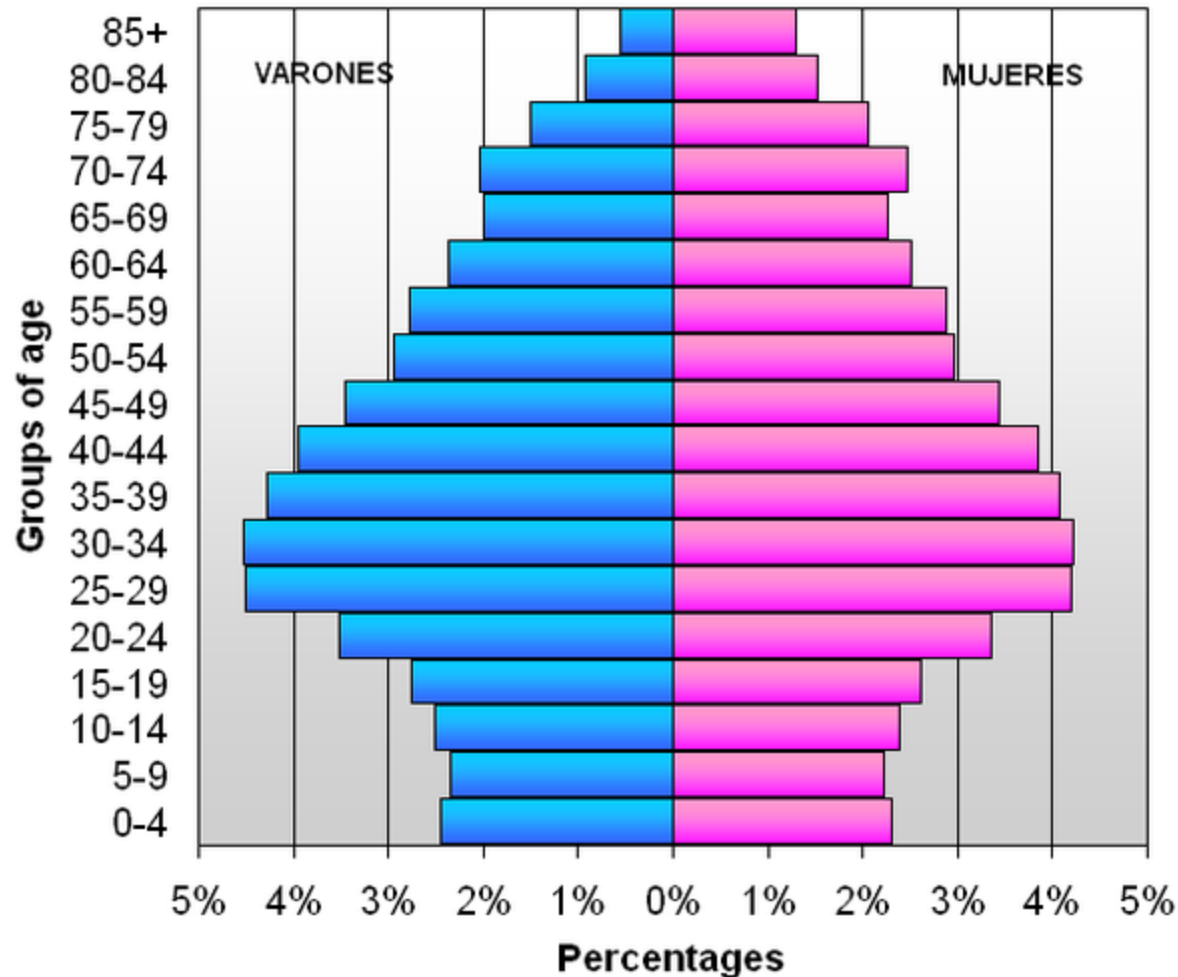
Source: UNFPA

Population 'pyramid' U.K. 2006



Source: UK Office of National Statistics

Population 'pyramid' Spain 2005



Source: 'Instituto Nacional de Estadística' of Spain. 1st January 2005 census

Daily Express, 23 October 2012



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Monday 12th November 2012



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UK NEWS

MILLIONS MUST WORK FOREVER



Nearly 1.5 million people who are over 65 still work /
Posed by model

Tuesday October 23, 2012

By Sarah O'Grady

Have your say(24)

THE pensions crisis means millions of Britons will never be able to retire, an alarming report has found.

Nearly 1.5 million people who are over 65 still work. And more than half of them say they have no option but to carry on as they do not have sufficient [savings](#) .

Relationship between age and health

Musculoskeletal system

- Gradual ↓ in strength
 - In early 50s, 80% that of early 30's
 - Mean decline 3% per year after 70
- Flexibility/mobility of joints ↓
- Bones lose calcium
 - Can be moderated by regular weight-bearing exercise

Cardio-respiratory system

- Functional breathing capacity
 - Reduced by 40% from 30 to 65
- O₂ exchange rate ↓
- Blood vessels lose flexibility
- Arteries thicken / harden

Hearing

- Hearing ↓, especially ability to hear high-pitched sounds
- Ability to locate source of sound ↓
- Noise-induced hearing loss irreversible
- Ability to hear conversation in noisy environment ↓

Vision

- Flexibility of lens ↓
 - Can be corrected with glasses
- Amount of light reaching back of eye ↓
 - Up to 75% loss between 20 and 50
- Dark adaptation ↓
- Colour sensitivity ↓
- More affected by glare

Skin

- Stretches less easily
- Permeability ↑

Mental processes - 1

- Peak in 30s and 40s; only small decline in 50s and 60s
- Motivation ↑
- Verbal command ↑
- With normal aging:
 - Happiness ↑
 - Negative affect ↓
 - Anxiety, depression ↓
 - Occupational stress ↓

Mental processes - 2

- Small, generally positive relationship with age with respect to personality and adjustment
- Distinguish crystallized cognition and fluid cognition
- Working memory ↓
- Difficulty in dividing attention (multi-tasking)

Other effects of aging

- More sleep problems
- Prevalence of chronic diseases ↑
- Possible prescription or over-the-counter drug abuse
- Recovery from injuries / illnesses longer

Caution

- Much of what's 'known' is based on cross-sectional studies
- Also, there is greater variation in health at older ages than at younger ones (hence hypothesis that effects of ageing can be prevented)

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 c. 25% of what determines longevity
(and disease?)

Canadian Longitudinal Study on Aging

Support from:

- Canadian Institutes for Health Research
- Canada Foundation for Innovation
- Statistics Canada
- Provinces
- Participating universities

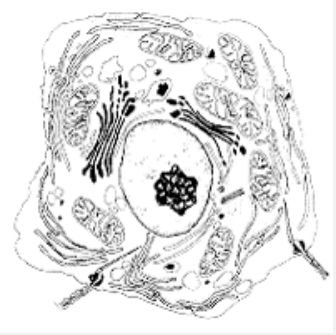
CLSA – The Concept

A research platform which will allow researchers:

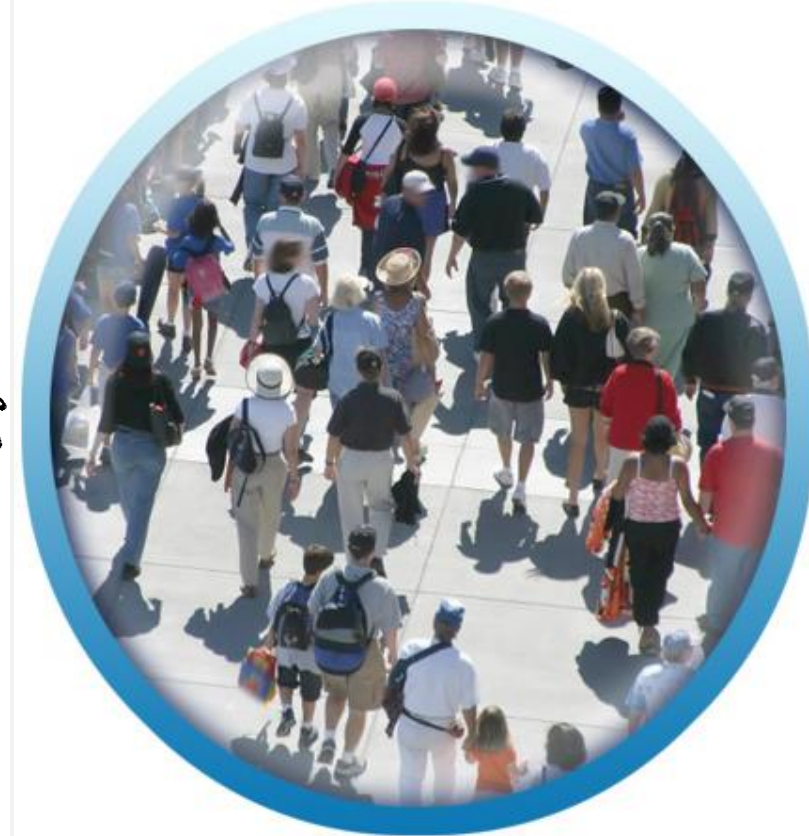
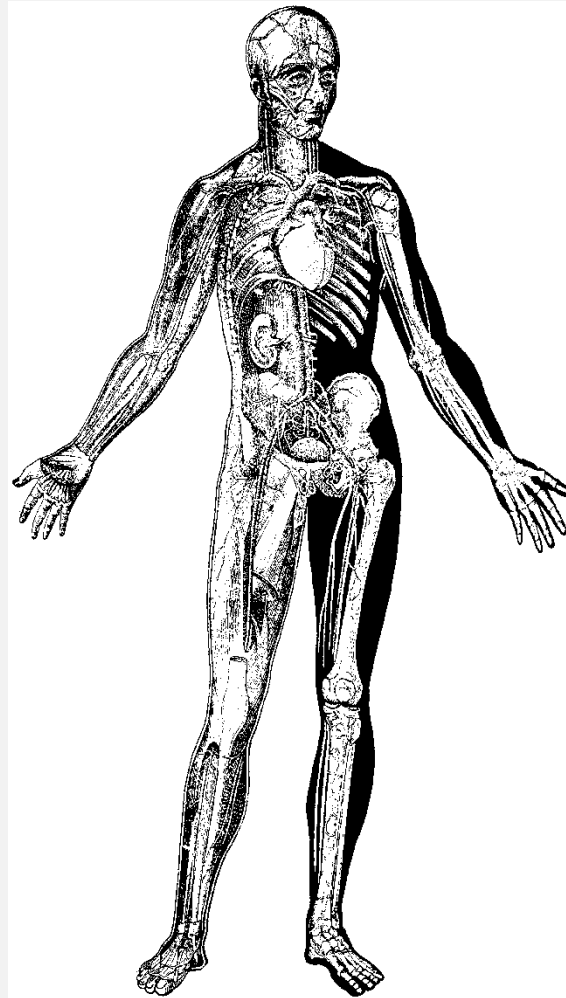
- To study aging as a dynamic process
- To investigate the inter-relationship among intrinsic and extrinsic factors from mid life to older age
- To capture the transitions, trajectories and profiles of aging, especially healthy, successful aging
- To provide infrastructure and build capacity for sustained high quality research on aging in Canada

Theories of aging

- *Rate-of-living:*
 - limited amount of energy and resources to expend in a lifetime
- *Homeostasis:*
 - after stressors, ability to return to previous (normative) level is impaired as we age
- *Life-course:*
 - biological, social, environmental factors affect nature and trajectory of aging



Innovation - Cell to Society

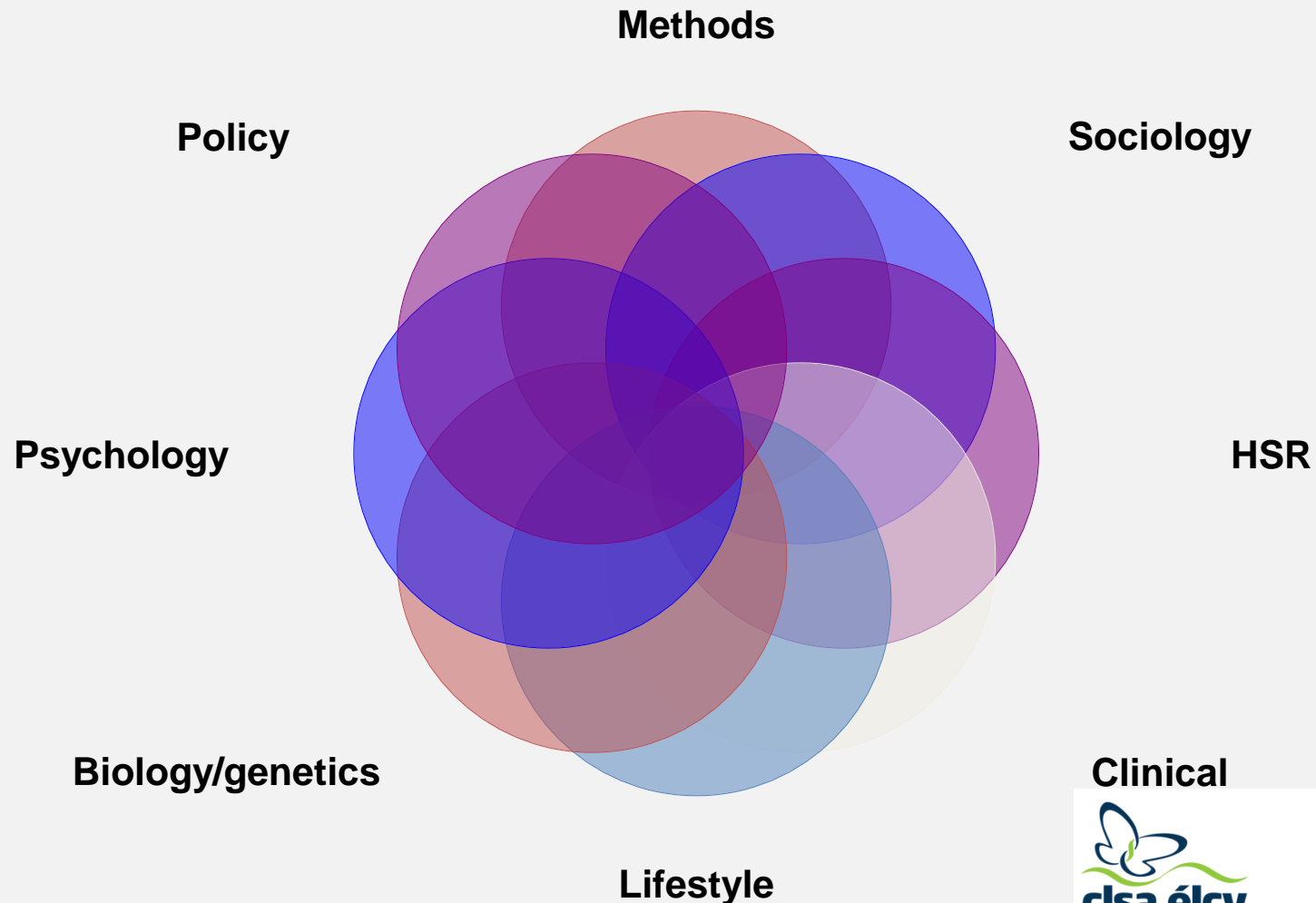


- ▶ Mid life to old age
- ▶ Quantitative traits
 - ▶ Physical
 - ▶ Social
 - ▶ Psychological
- ▶ Gene-environment interactions
- ▶ Disease, disability, psychosocial consequences
- ▶ Adaptation



Canadian Longitudinal Study on Aging
Étude longitudinale canadienne sur le vieillissement

Interdisciplinary Research Agenda



Canadian Longitudinal Study on Aging
Étude longitudinale canadienne sur le vieillissement

Overall design

- ‘Tracking Cohort’
 - 20,000 people representative of population:
 - telephone interviews only
- ‘Comprehensive Cohort’
 - 30,000 people close to (mostly < 25 km from) one of 11 Data Collection Sites across Canada:
 - home interviews
 - clinical, functional, cognitive, blood and urine measures (+ storage of blood, DNA, urine)

Overview - Follow-up

- 20+ year follow-up, until death, loss to follow-up or end of study funding
- Assessment every 3 years, first wave being collected 2012-2015
- 'Keeping Contact' short phone interview at mid-point between waves
- Linkage to administrative databases
- Linkage to environmental databases – e.g., air pollution, Google API

Eligibility at baseline

- Aged between 45 and 85
 - Pre- Boomers: Born between 1925 and 1945
 - Boomers: Born between 1946 and 1967
- Permanent residents, not in institution, not in Canadian Armed Forces, can be interviewed in English or French, not living on Indian reserves, living in one of provinces

Depth and Breadth of CLSA

PHYSICAL & COGNITIVE MEASUREMENTS

- Height & weight
- Waist and hip measurements
- Bioimpedance
- Arterial pressure
- Mean heart rate
- Grip strength, timed up-and-go, chair raise, 4-m walk
- Standing balance
- Vision
- Hearing
- Spirometry
- Bone density
- Aortic calcification
- ECG
- Carotid intima-media thickness
- Cognitive assessment

HEALTH INFORMATION

- Chronic disease symptoms (11 chronic conditions)
- Medication intake & compliance
- 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
- Coping, adaptation
- Work-to-retirement transitions
- Job-demand/effort reward
- Retirement planning
- Social inequalities
- Mobility-lifespace
- Built environments
- Wealth

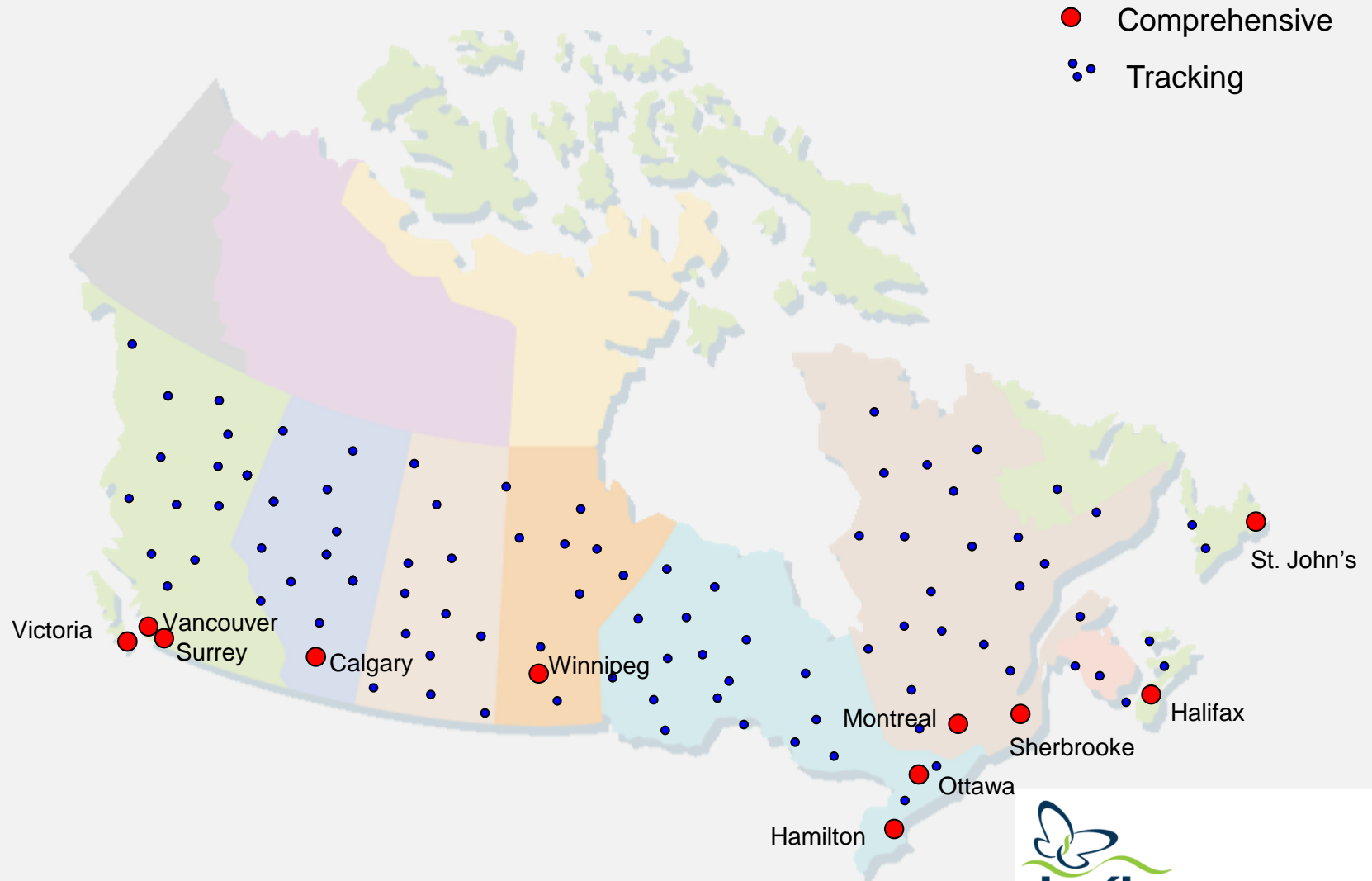
LIFESTYLE & SOCIODEMOGRAPHIC

- Smoking
- Alcohol consumption
- Physical activity
- Nutrition
- Birth location
- Ethnicity/race/gender
- Marital status
- Education
- Income



Canadian Longitudinal Study on Aging
Étude longitudinale canadienne sur le vieillissement

Participant Recruitment



Canadian Longitudinal Study on Aging

CLSA Tracking
(n=20,000)

45-54	55-64	65-74	75-85
↓	↓	↓	↓
6,000	6,000	4,000	4,000

CLSA Comprehensive
(n=30,000)

45-54	55-64	65-74	75-85
↓	↓	↓	↓
9,000	9,000	6,000	6,000

Equal numbers of men and women

Potential Sampling Frames

- Canadian Community Health Survey (CCHS) Participants
- Provincial Health Registration Databases
- Random Digit Dialing (RDD)

**ALL OF THE
ABOVE**

Dealing with low response rates

- Currently, c. 15K recruited (target 50K)
- Response rates by either Health Registry sampling or RDD appear to be c. 10%
- Also, preliminary unweighted data suggest that compared to the general population (CCHS results):
 - People more highly educated are over-represented
 - Immigrants are under-represented
- (How much) Does low response matter in a longitudinal study?
- Representativeness vs. heterogeneity in independent variables?

Data Collection Sites (DCS)

11 ACROSS CANADA

- 5 participants per day (40 weeks)
- 50 mL blood
- Urine sample
- Hematology tests (AcT DIFF, Beckman Coulter)



Storage System

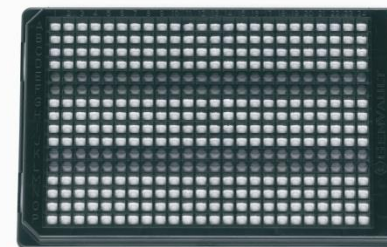
Tubes



- 500-µL V bottom, screw-top tubes (Matrix Tubes, Thermo Fisher Scientific)
- Open-bottomed boxes for fast scanning
- Standard 96 well format
- Potential for 'pick and place' robotic retrieval and storage box compression ('defragging')

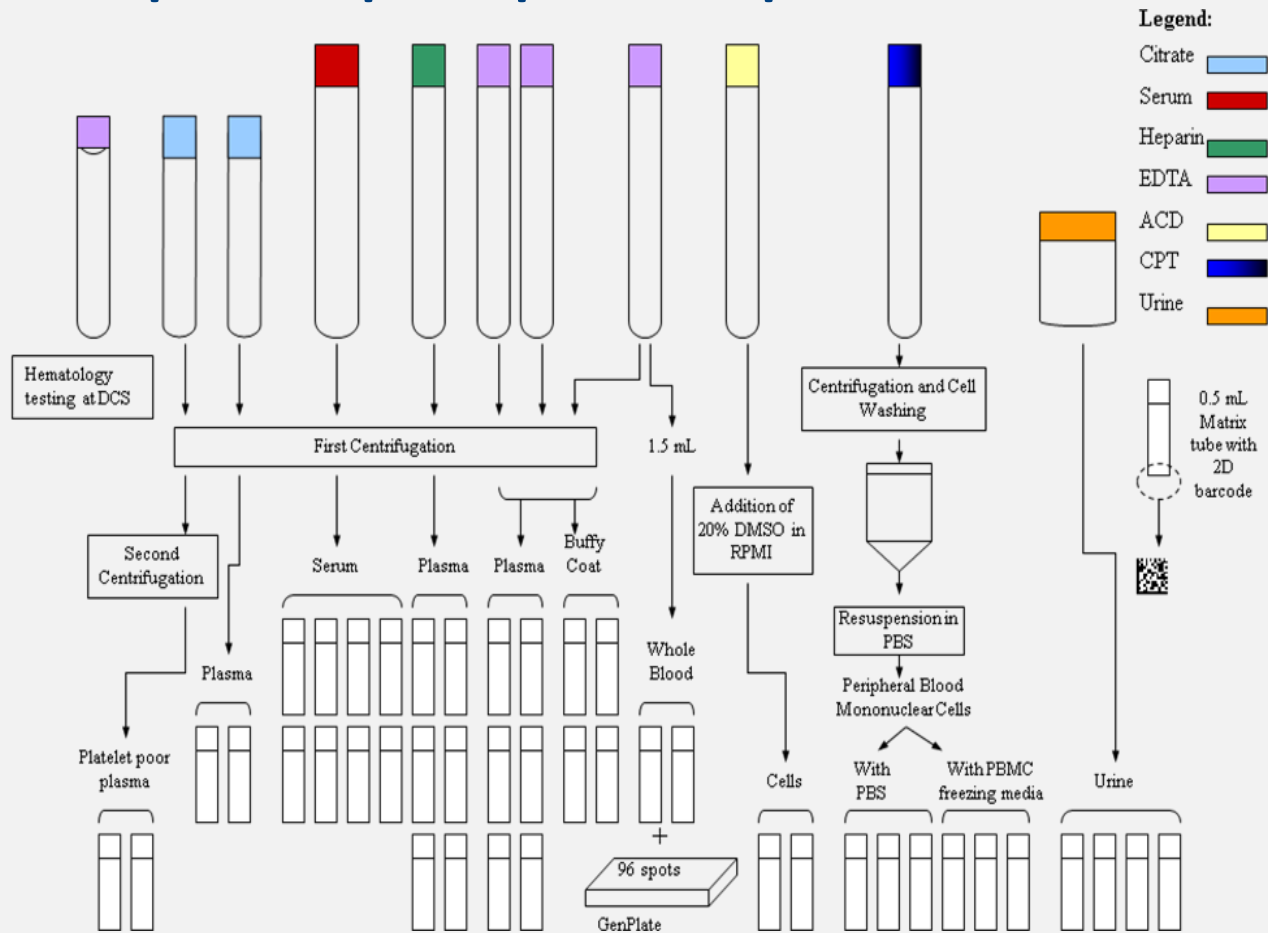
Microwell Plates

- 3-section GenPlates (GenVault) with FTA paper
- Standard 96 well format
- Dried overnight in GenVault FastDryer and sealed with an adhesive foil cover



Bio specimens

42 aliquots per participant



Shipping

Matrix boxes

- Pre-charged vapor shippers (-160°C)
- Weekly shipments to BBC (overnight courier)
- Equipped with data loggers



GenPlates

- Envelopes with dessicant

Quality

Standard protocols to minimize process variation

Supplies

- Received by the BBC and packaged for monthly shipments to the DCS
- Barcode labels for supplies generated at BBC
- Lot numbers and expiry dates tracked centrally

Biospecimens

- Scanned at each stage of processing and handling to provide a detailed history of the biospecimen
- Characteristics of samples documented
- Sample integrity maximized
 - Maximum time from collection to storage is 2 h
 - Storage at -160°C

Biorepository and Bioanalysis Centre (BBC)

HAMILTON

Biorepository

- 31 nitrogen tanks (5 million aliquots)
- Autofilled from a bulk nitrogen tank
- Cryocarts
- Personal Archive, dry storage at room temperature (humidity controlled)
- LIMS (LabWare)
- CryoMORE, (Air Liquide) safety monitorin



FUTURE

ASKION C-line®
work bench



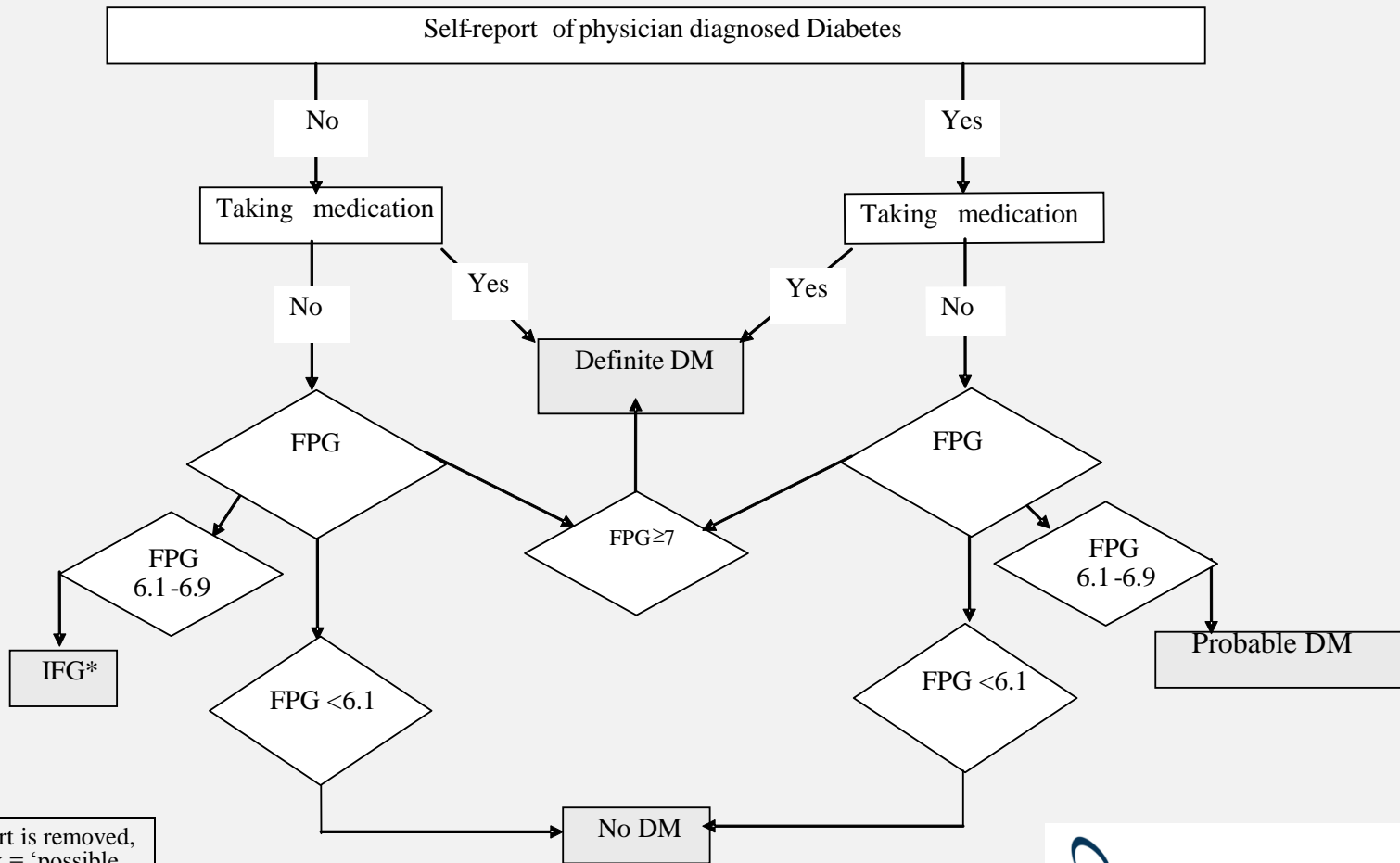
Biorepository and Bioanalysis Centre (BBC)

Biorepository

- Installation May 2012
- LIMS implementation April
- Hiring BBC coordinator



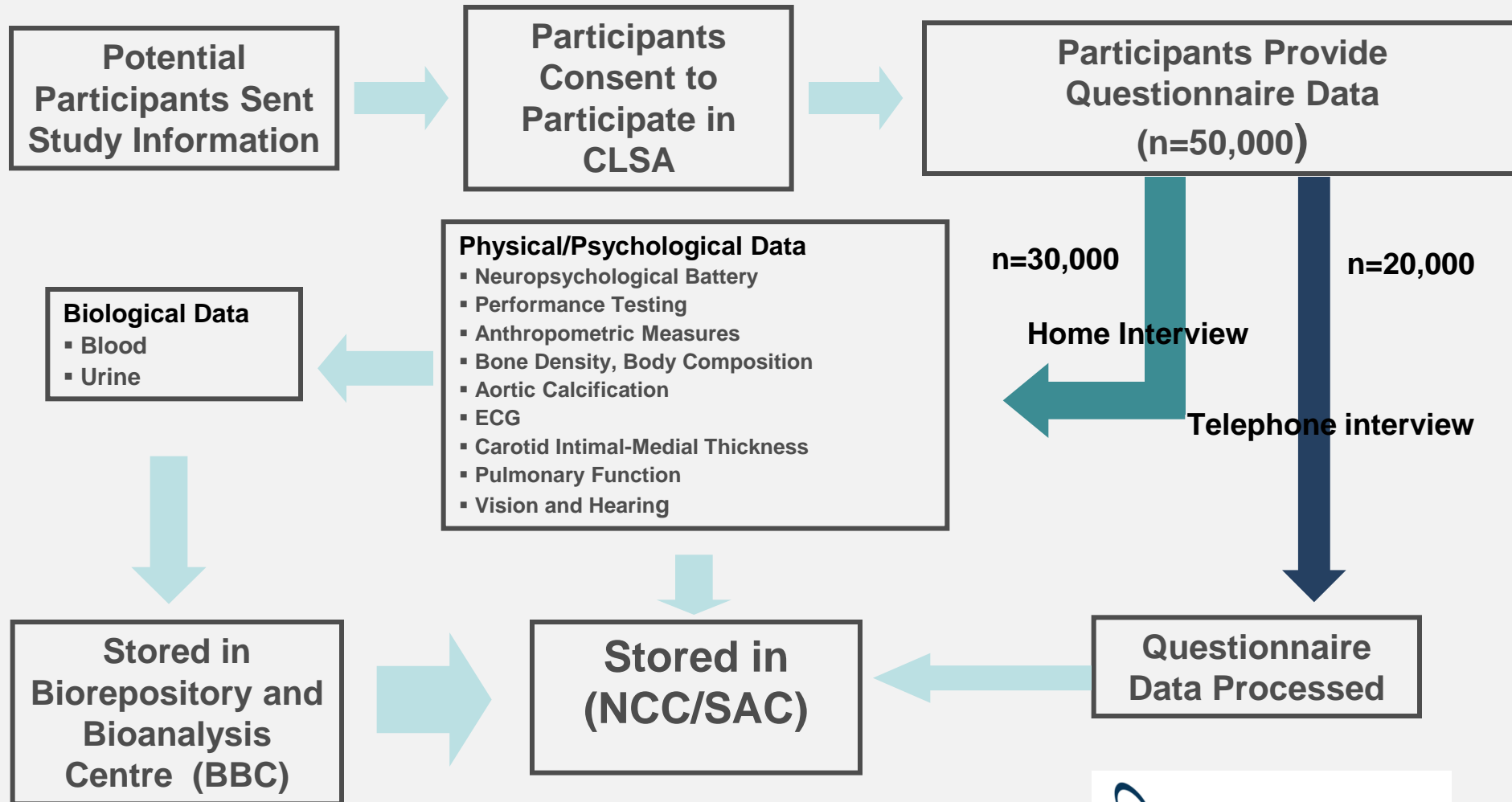
Diabetes Algorithm



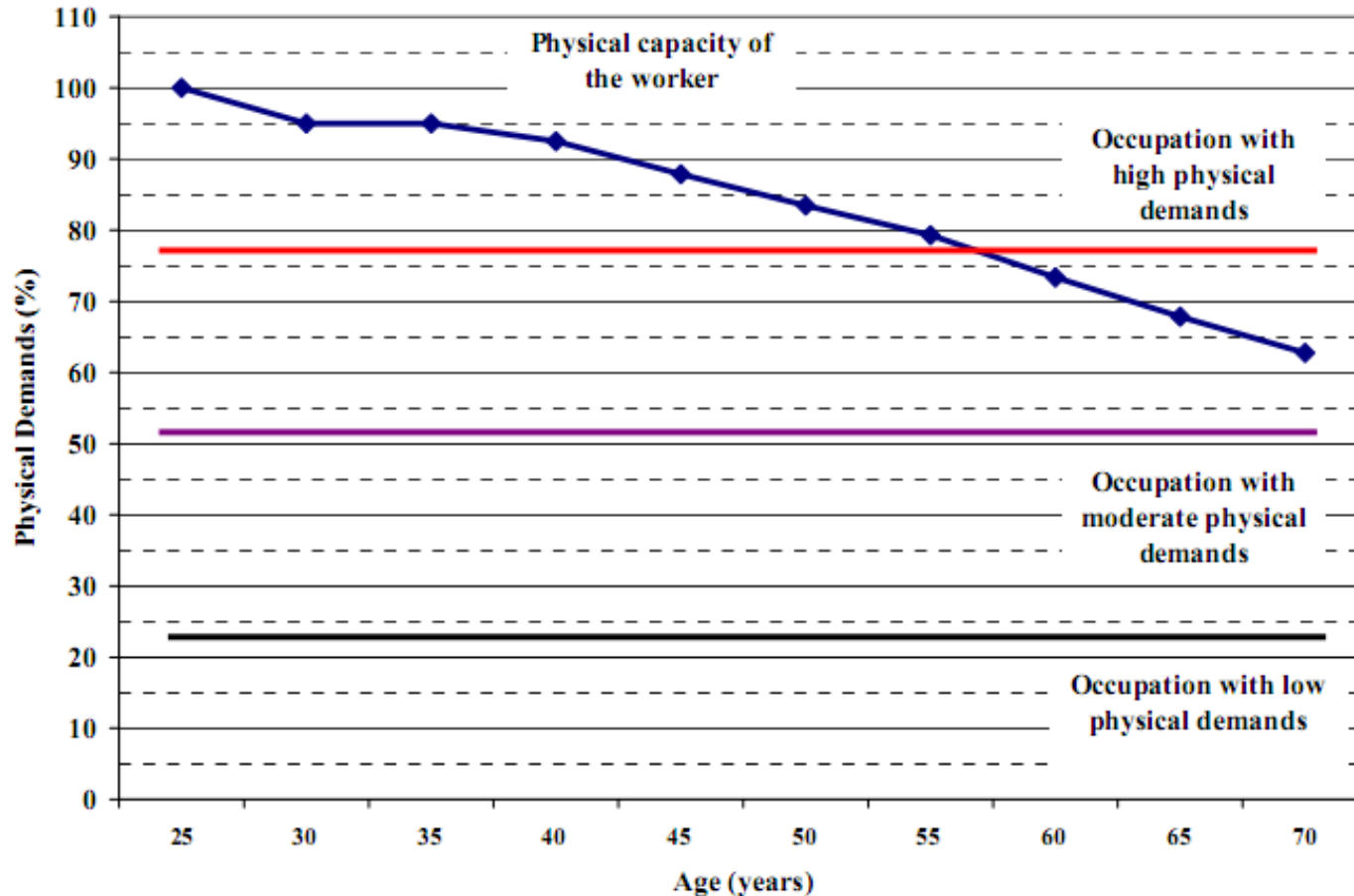
*If self-report is removed, then this box = 'possible diabetes'



CLSA Data Collection



Hypothetical relationship between age, worker capacity and job demands



Smith P with permission. Adapted from Ilmarinen 2002.

Shakespeare's fifth age of man

And then the justice,
In fair round belly with good capon lined,
With eyes severe and beard of formal cut,
Full of wise saws and modern instances;
And so he plays his part.

Shakespeare's sixth age of man

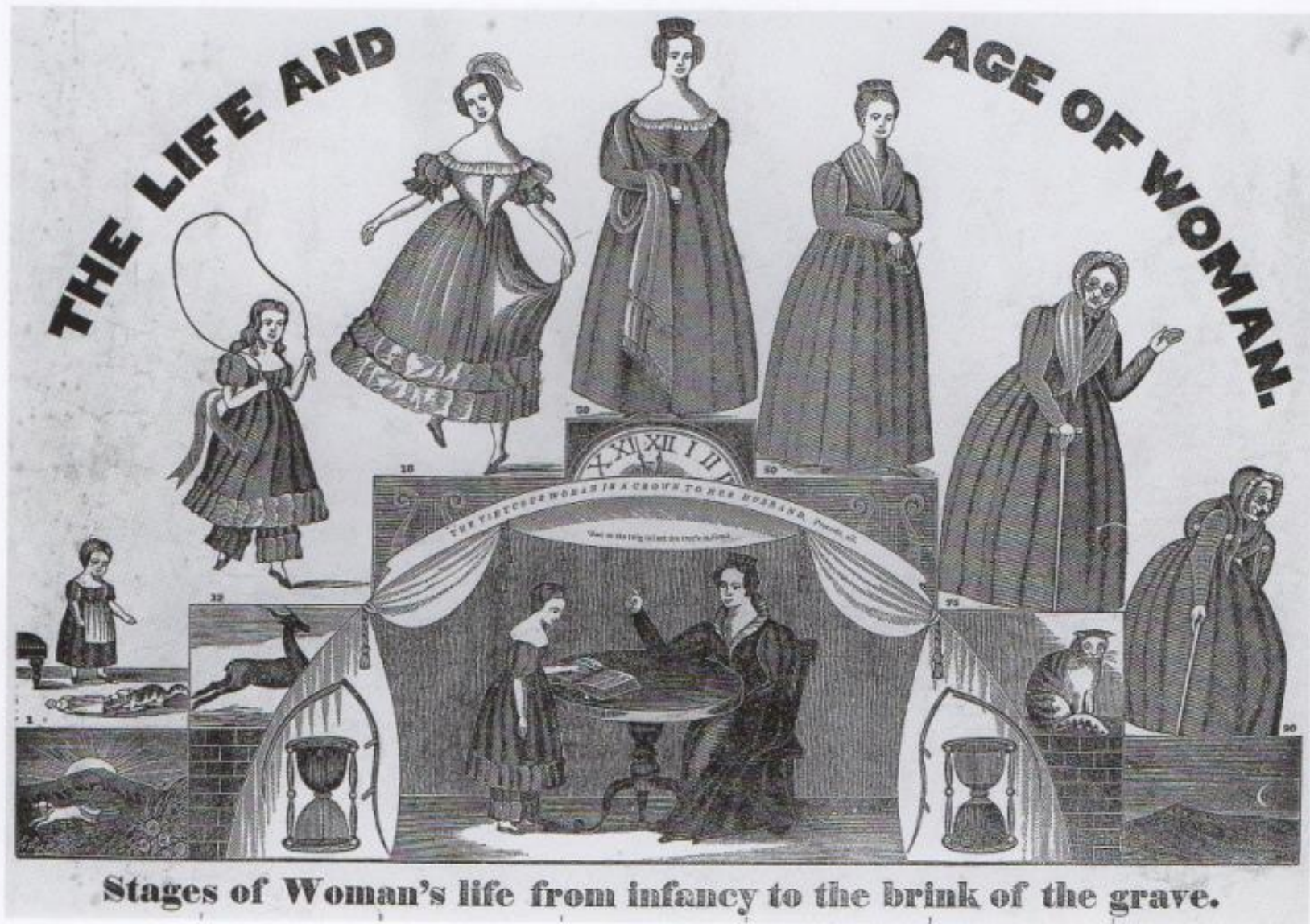
The sixth age shifts
Into the lean and slipper'd pantaloon,
With spectacles on nose and pouch on side,
His youthful hose, well saved, a world too wide
For his shrunk shank; and his big manly voice,
Turning again toward childish treble, pipes
And whistles in his sound.

Shakespeare's seventh age of man

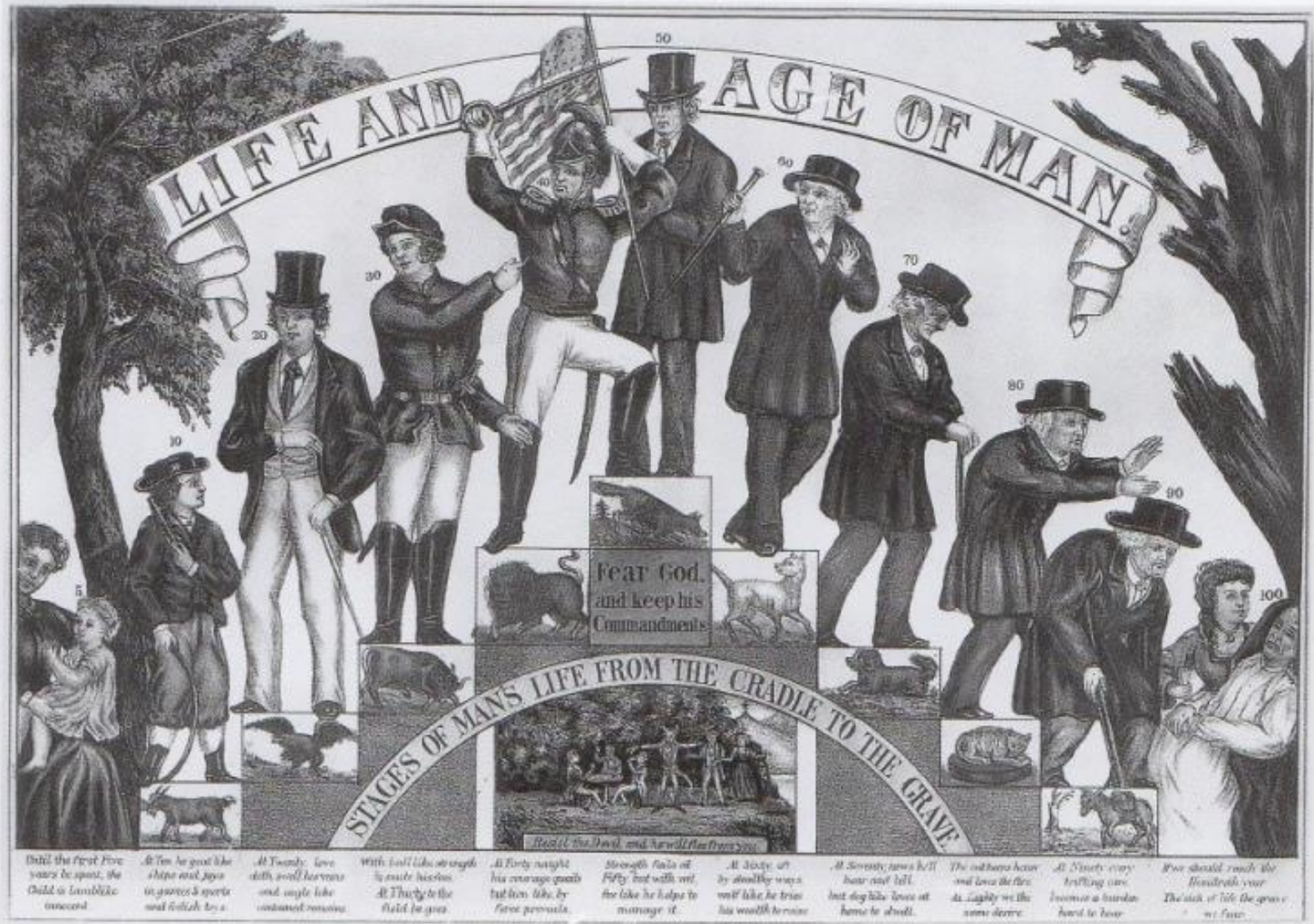
Last scene of all,
That ends this strange eventful history,
Is second childishness and mere oblivion,
Sans teeth, sans eyes, sans taste, sans
everything.

Jaques in *As You Like It*

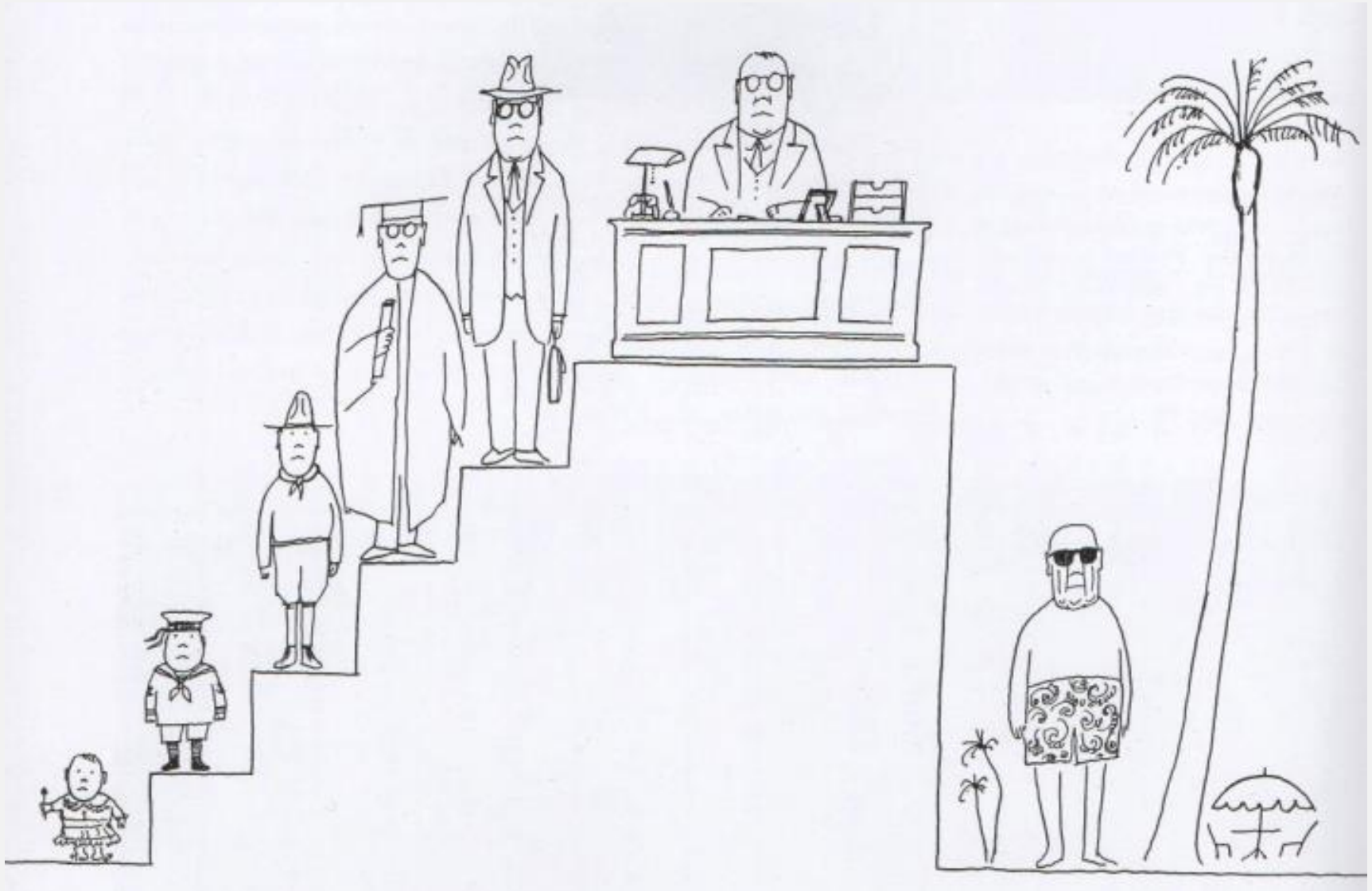
Currier and Ives, 1850: women



Currier and Ives, 1850: men



Saul Steinberg, Untitled, 1954



Other longitudinal studies

- E.g., SHARE – Survey of Health, Ageing and Retirement in Europe
 - 20 countries
 - > 55,000 people
 - Data freely available
- Includes England:
 - English Longitudinal Study on Ageing (ELSA)

Availability of CLSA data

- Basic descriptive analyses to be done by core CLSA team
- Data will be readily available to ‘outsiders’
 - committee to review applications + uses of data to ensure data access & confidentiality policies of CLSA are followed
- Some access to participants will be allowed
- Includes use of blood and urine samples
- See www.clsa-eclv.ca

Discussion Points

- Value of the CLSA platform
- Data access and IP policies
- Opportunities for collaboration for the core data collection CLSA
- Opportunities for analyses of the data and biological samples
- Opportunities for sub-studies

Contact

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Canadian Longitudinal Study on Aging:
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