

Epidemiology of Aging

(EPID 210)

Instructor: Rebecca E. Graff, ScD

Fridays, January 11 – March 22, 2019, 8:45am – 10:15am

Mission Hall 1105

About Me

- Rebecca E. Graff, ScD
- Assistant Professor, Department of Epidemiology and Biostatistics
- Office Hours by Appointment
- Rebecca.Graff@ucsf.edu
 - Email Policy

About You

Discussion:

WHAT IS THE EPIDEMIOLOGY OF AGING?

COURSE INTRODUCTION

Guest Instructors

- Steve Cummings (January 18)
 - Biology of Aging
- Kenneth Covinsky (February 8)
 - Clinical Perspectives on Aging
- Peggy Cawthon (March 1)
 - Disability, Functional Impairment, Comorbidity, Frailty
- Kala Mehta (March 22)
 - Global Health and Aging Populations

Course Objectives

- Understand theories of biological and social processes that underlie the development of diseases and disorders in aging populations
- Apply epidemiological and statistical methods to questions asked in aging populations, especially in a longitudinal context
- Identify major risk factors associated with diseases and disorders in older populations

Course Website

- <https://courses.ucsf.edu/course/view.php?id=5481>
- Submission of all assignments
 - By class time
 - Excepting presentation slides (8:00am)

Course Requirements

- Class Participation (25%)
- Measurement Assignment (15%)
- Student Presentation (25%)
- Debate (25%)
- Debate Write-up (10%)

Key Dates

January 18	Rank three possible topics for your measurement assignment and student presentation
February 1	Measure assignment due
February 8	Identify one possible topic for the debate
February 22	One-page outline of debate arguments due
February 22 - March 8	Student presentations
March 15	Debate
March 22	Debate write-up due

Questions?

EPIDEMIOLOGY OF AGING OVERVIEW

What is Aging?

- Biologically: a gradual accumulation of a wide variety of molecular and cellular damage resulting in a loss of adaptive response to stress (loss of physiological reserves) and in a growing risk of age-associated disease
 - Neither linear nor consistent
 - Only loosely associated with age in years

Beyond Biology

- Shifts in roles and social positions
- Loss of close relationships
- Discussion: what else?

What is the Epidemiology of Aging?

- No one correct answer!
 - Geriatric epidemiology?
 - Life span epidemiology?
- Cooperative with demography, social gerontology, psychology, physiology / basic science, geriatricians, etc.

What Defines Old Age?

- Most common threshold: 65 years
- Early studies included adults ≥ 60 years
 - E.g., Systolic Hypertension in the Elderly Program (1985)
- Majority of older adults experience few health problems until ≥ 70 years
- “Oldest old”: 80 or 85 years

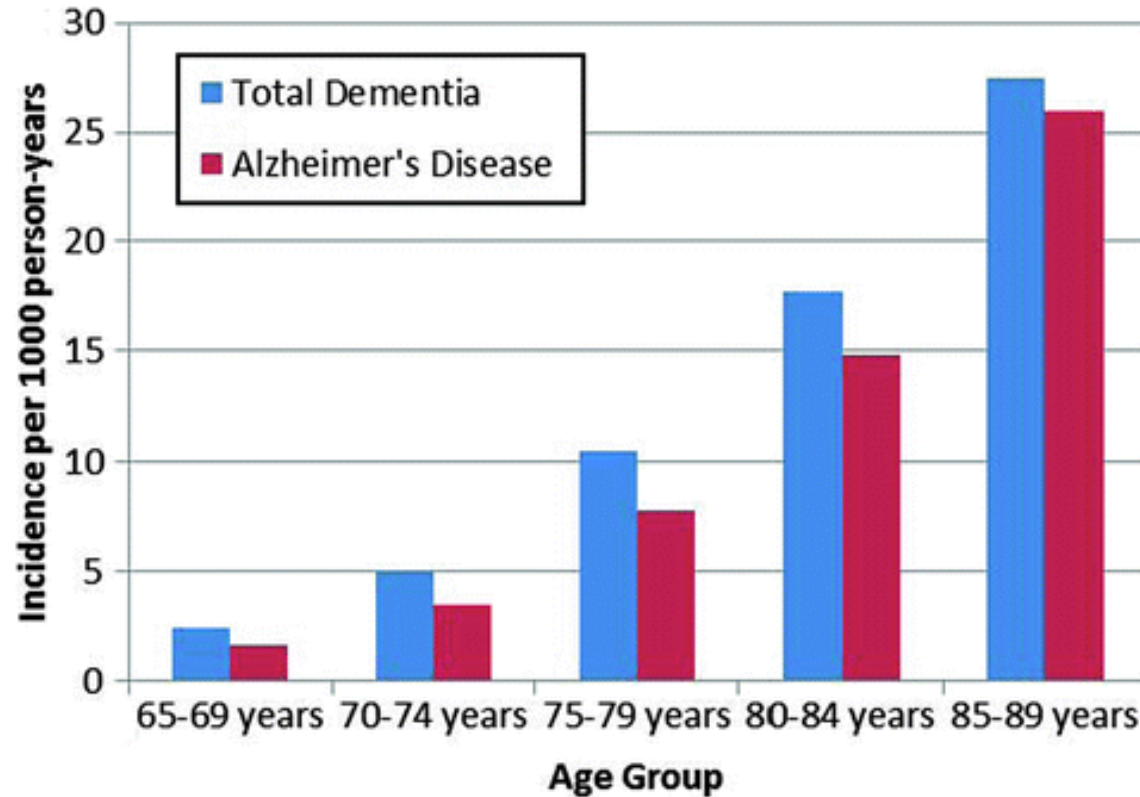
Discussion:

**WHAT DEFINES AN AGE-RELATED
DISEASE?**

Defining an Age-Related Disease

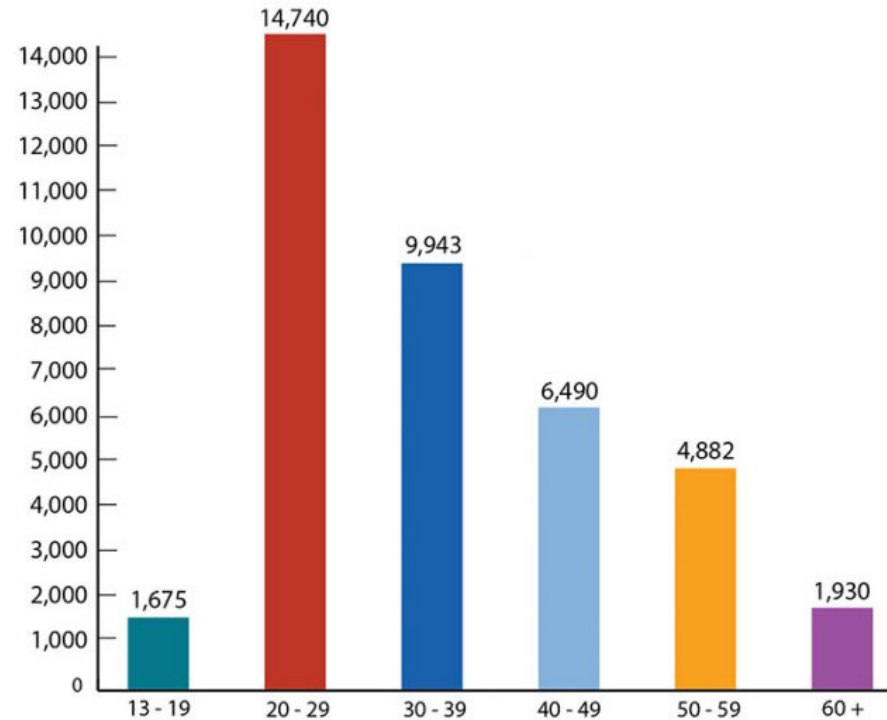
- Age is a significant risk factor
 - Often an exponential increase of disease with age
- Increasing frequency with increasing senescence
- Examples?

Age and Dementia



Age and HIV

New HIV Diagnoses in the United States by age, 2016

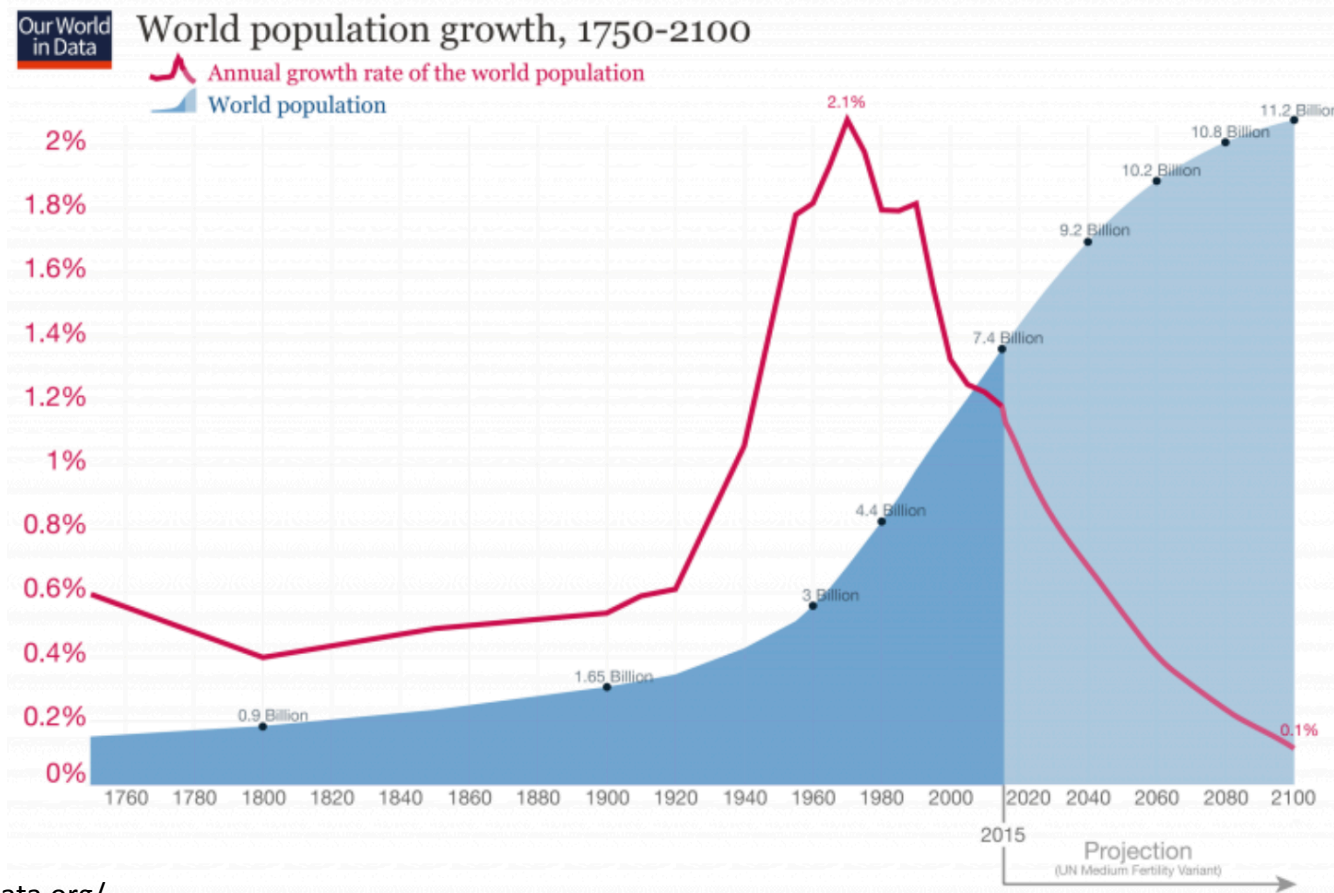


Key Terminology

- Life expectancy
- Life span
- Longevity
- Dependency ratio
- Disability
- Comorbidity / multimorbidity

BASIC DEMOGRAPHY

Global Demographic Context



Discussion:

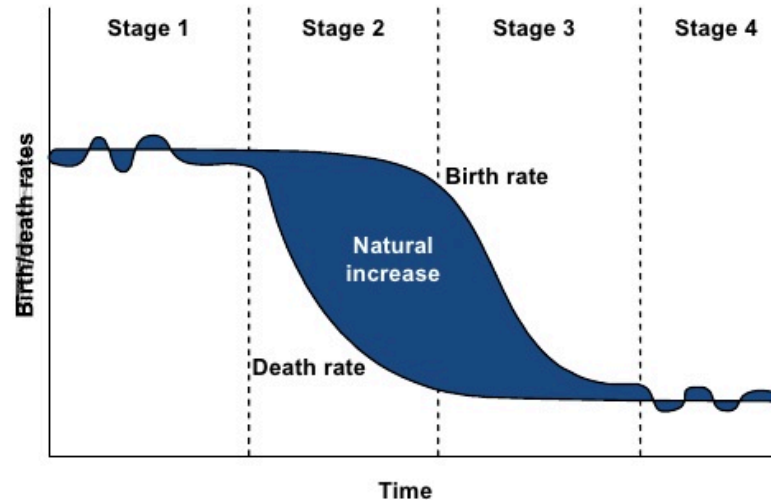
**WHY IS POPULATION SIZE
INCREASING AS GROWTH RATES
ARE DECREASING?**

The Demographic Transition

- Transition from high fertility and mortality → low fertility and mortality
- Typically results in a period of robust population growth

The Demographic Transition

The Classic Stages of Demographic Transition



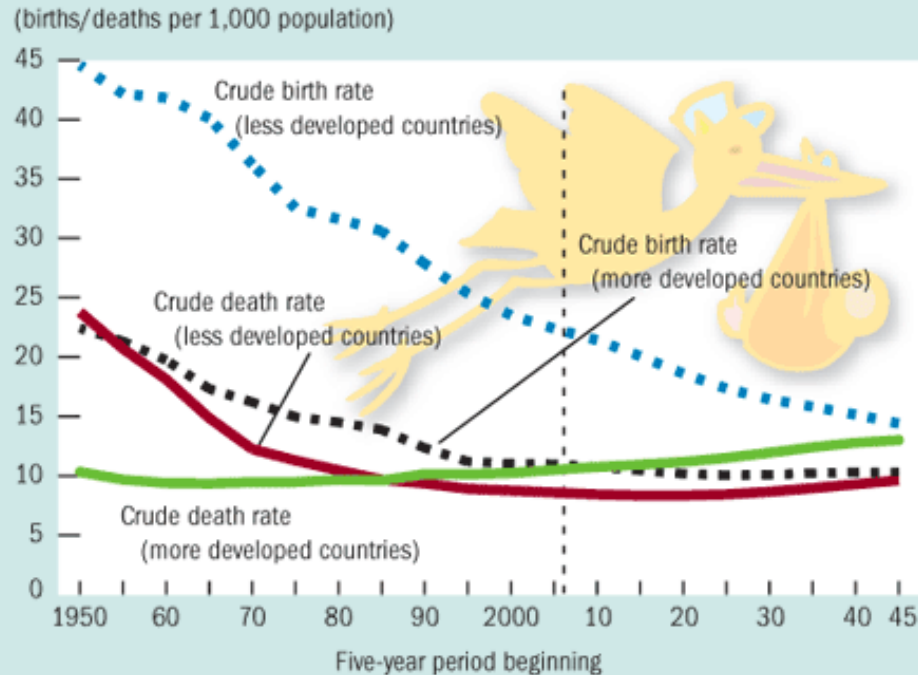
Note: Natural increase is produced from the excess of births over deaths.

Population Momentum

- Phenomenon in which an immediate drop to replacement level fertility can still result in decades of population growth
 - A history of high fertility results in a high proportion of women of reproductive ages
 - Results in high crude birth rates even after age-specific rates have dropped
- Typical consequence of the demographic transition

Decreasing Growth Rates

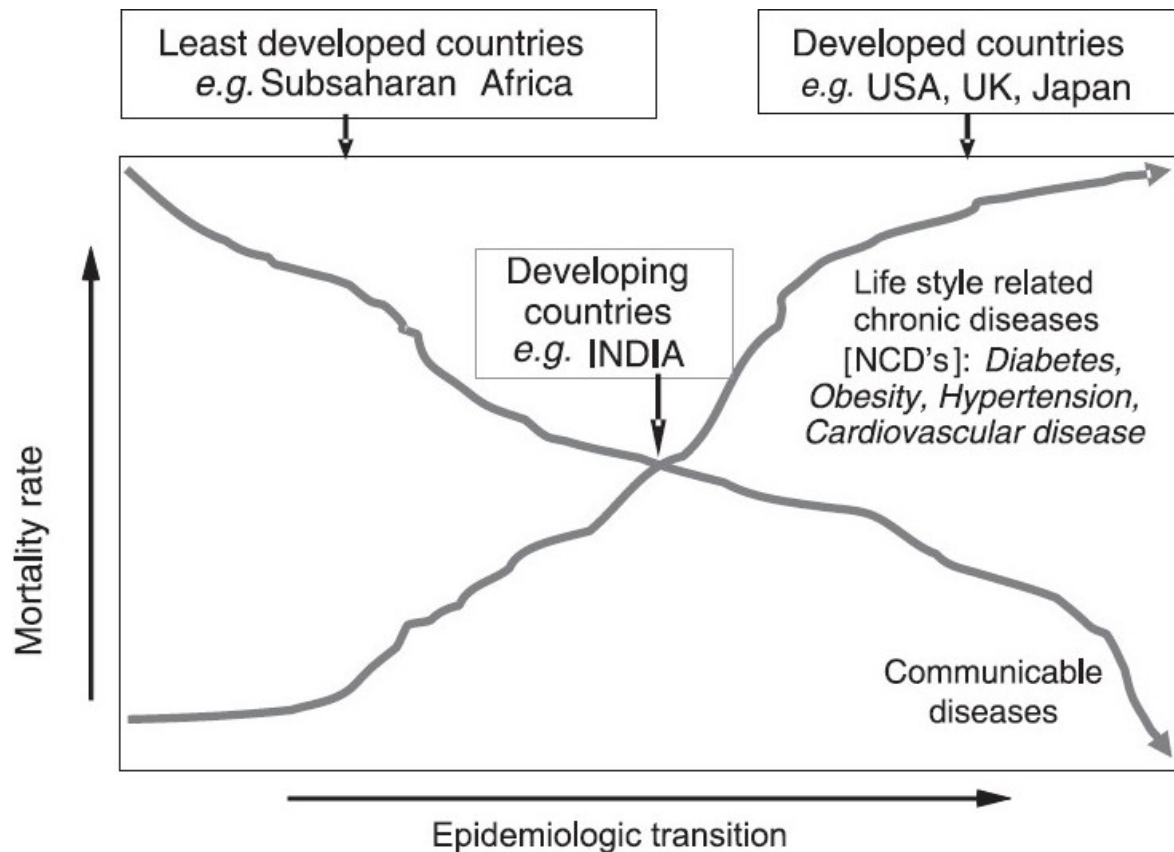
Slower growth of the world's population is largely due to the decline in birth rates—particularly in less developed countries—over the past 50 years.



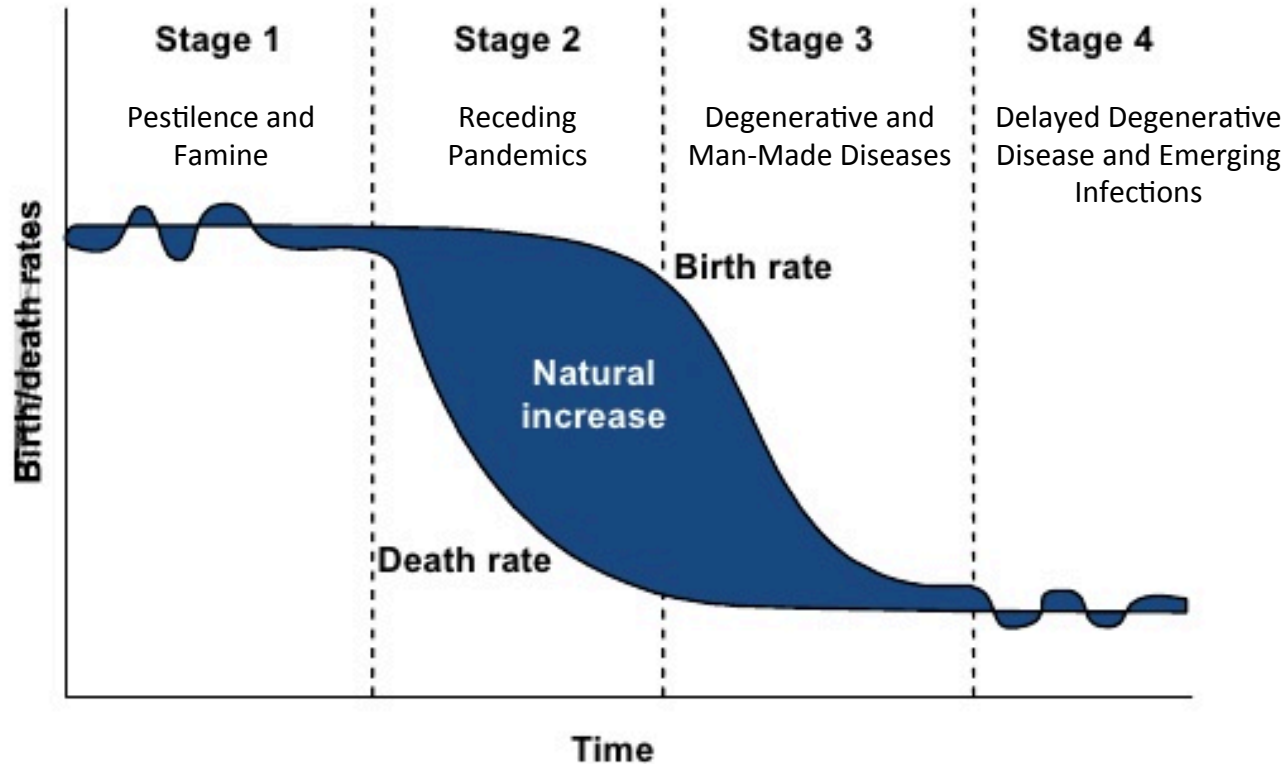
Discussion:

**HOW DOES THE DEMOGRAPHIC
TRANSITION IMPACT THE
DISTRIBUTION OF CAUSES OF
DEATH?**

Reversal of Infection and Chronic Disease



The Epidemiologic Transition

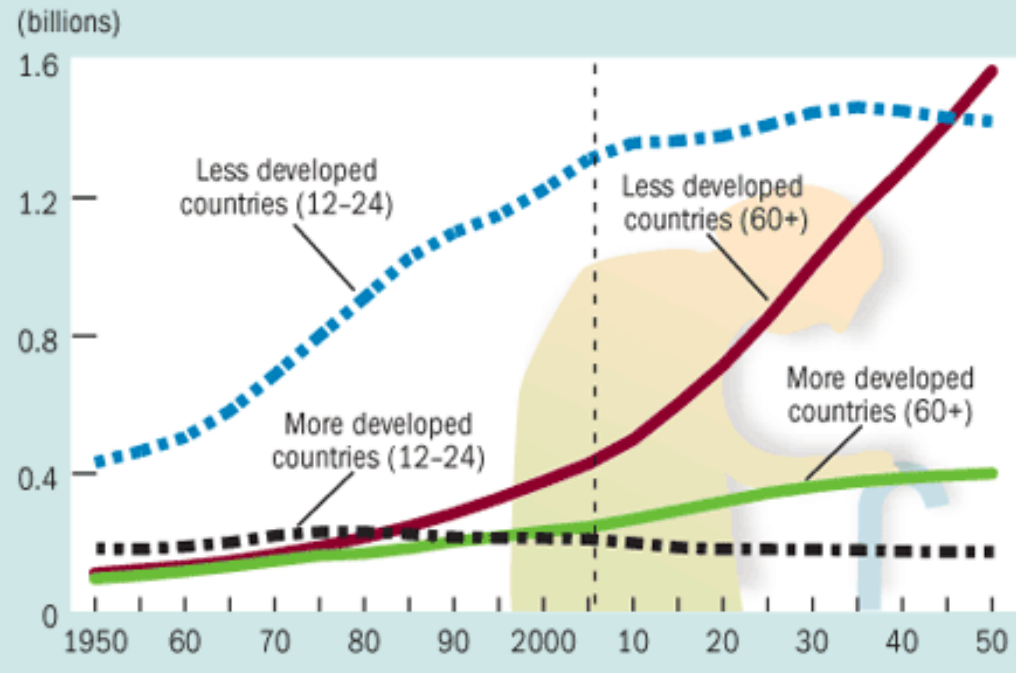


Discussion:

**HOW DOES THE DEMOGRAPHIC
TRANSITION AFFECT THE SIZE OF
THE ELDERLY POPULATION?**

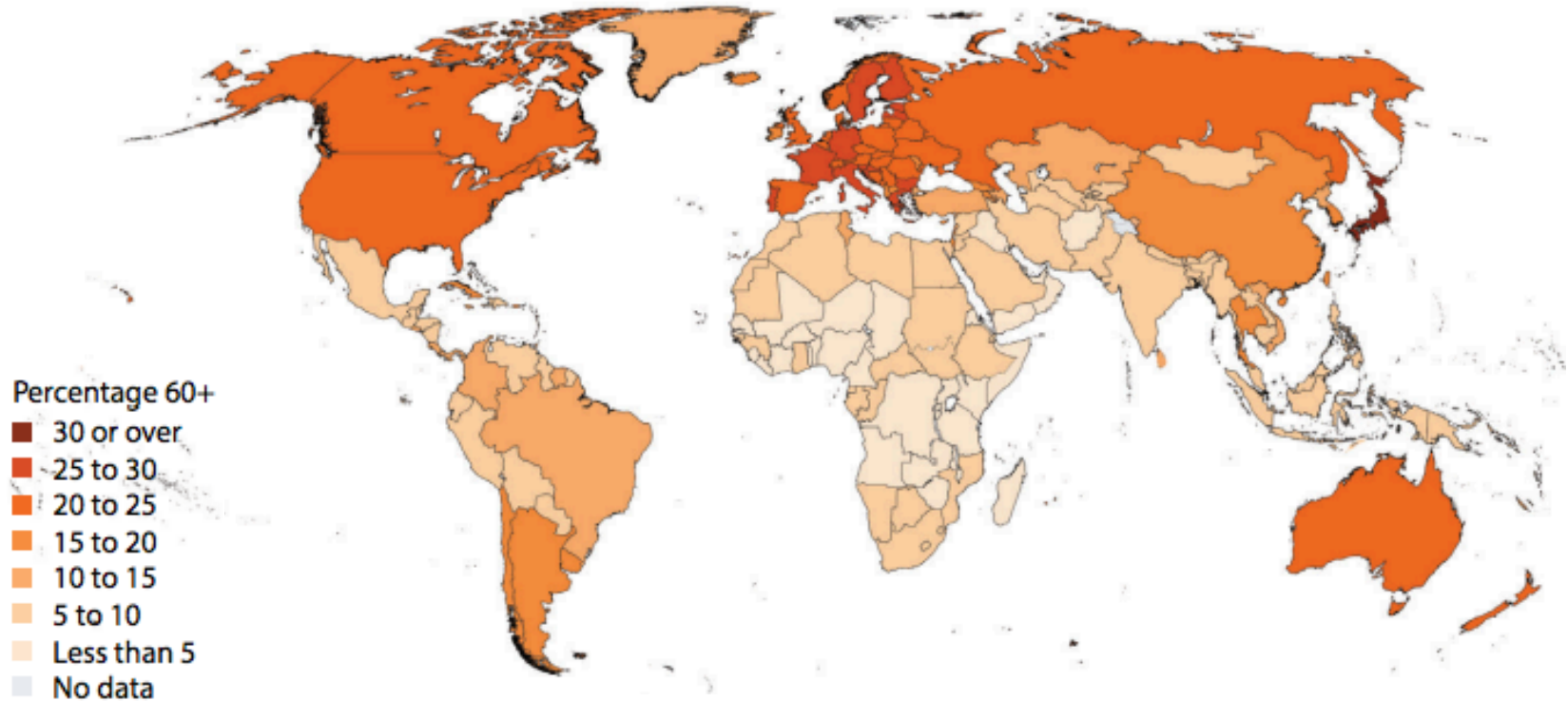
Aging Population

The world's population is aging and, in developed countries, the size of the elderly population has already surpassed that of the 12-24 age group.



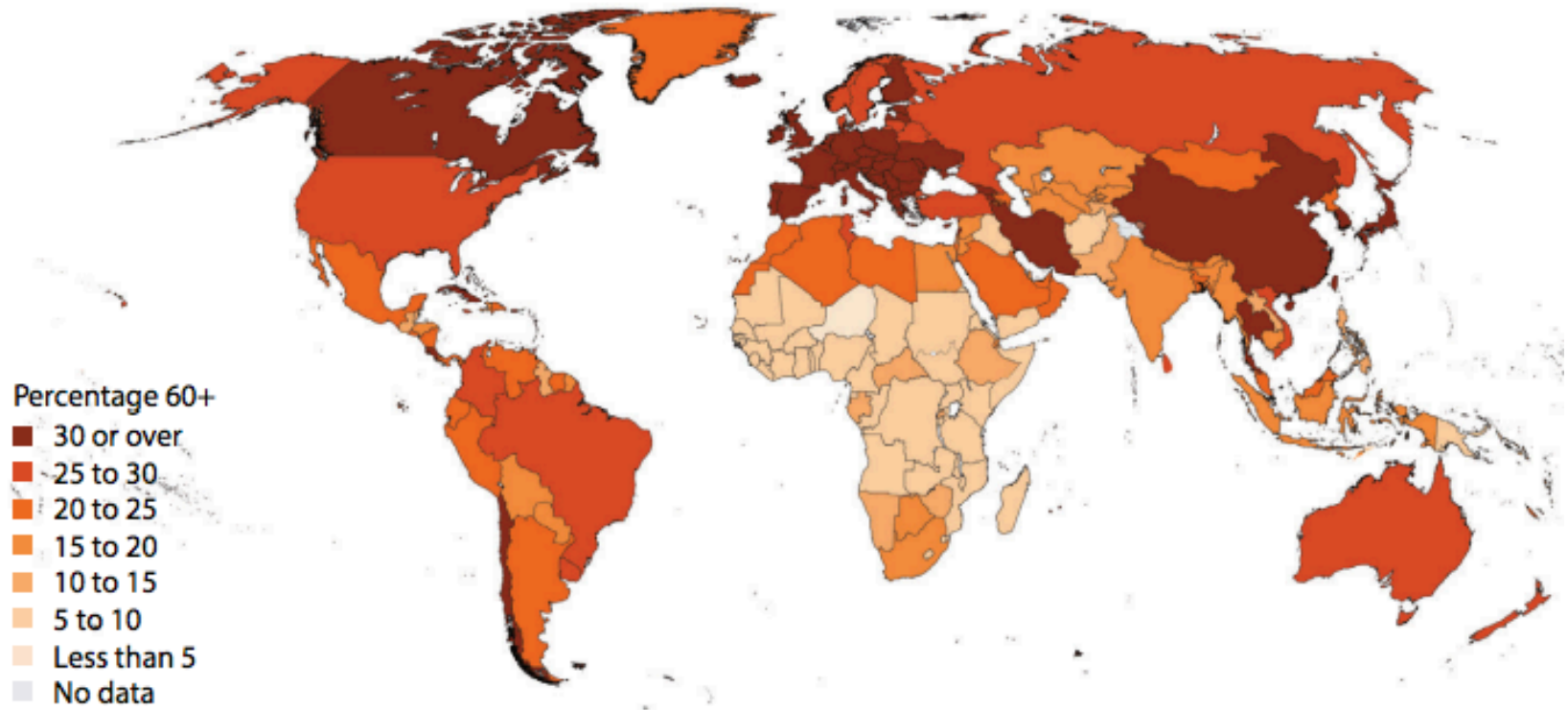
An Alternative View

2015

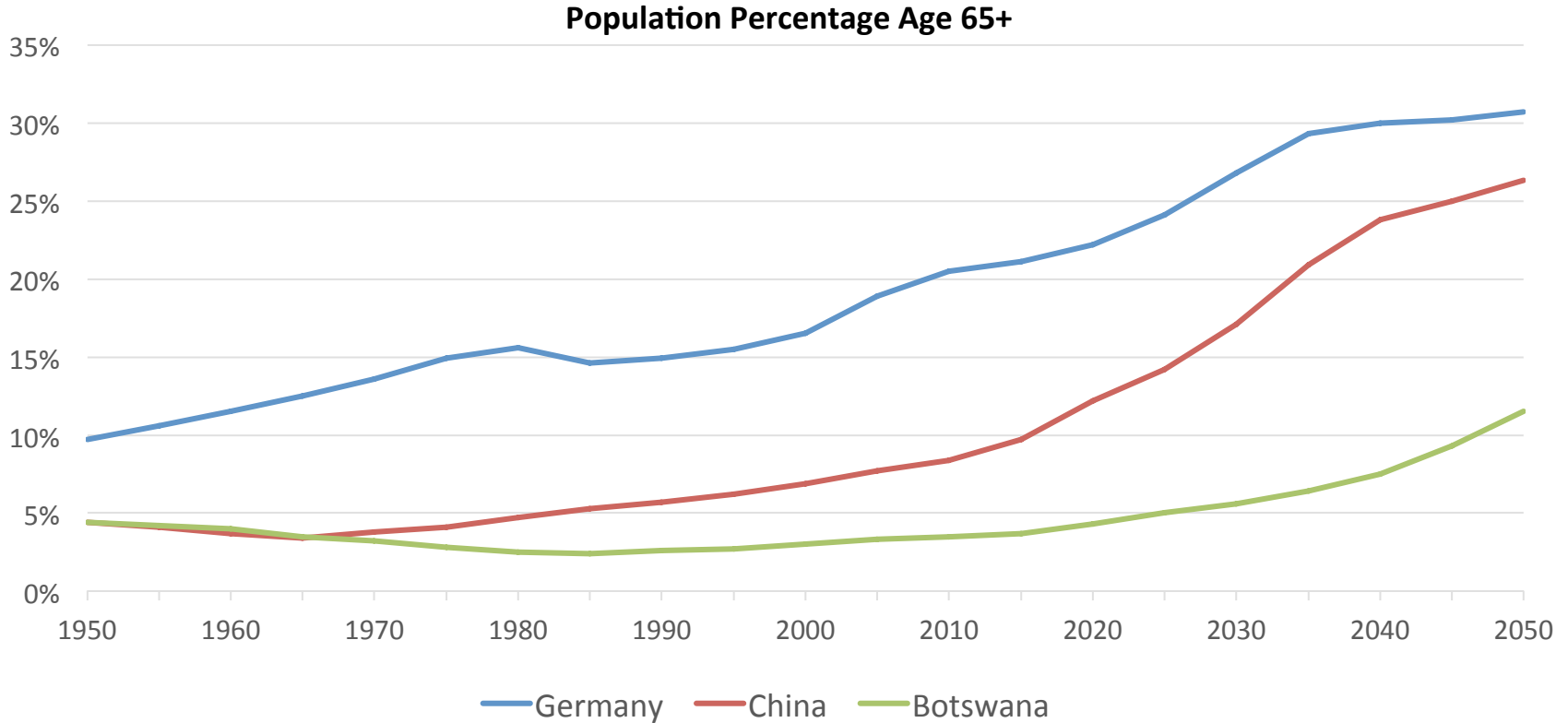


An Alternative View

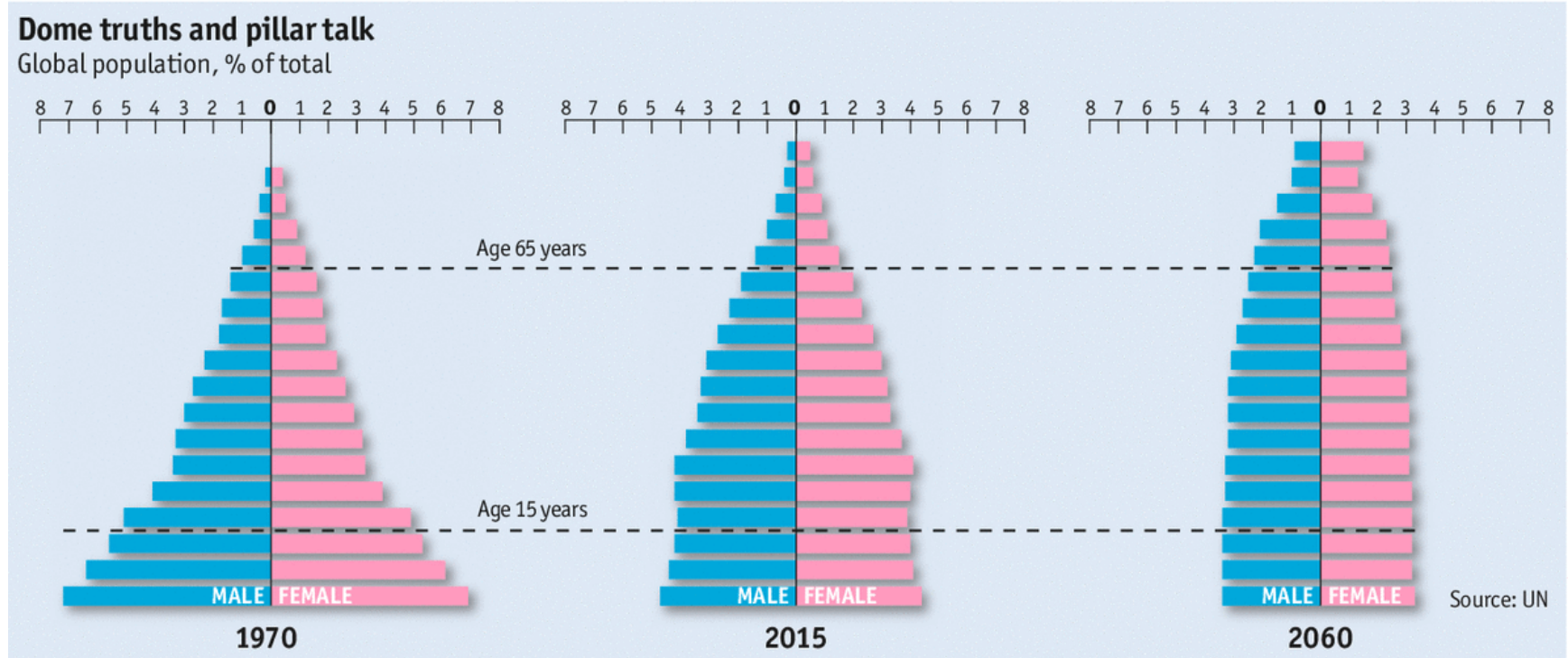
2050



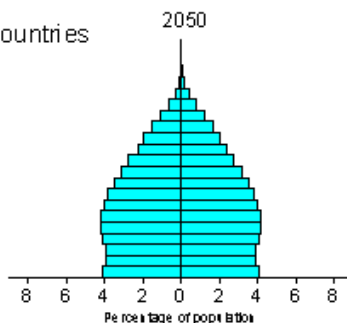
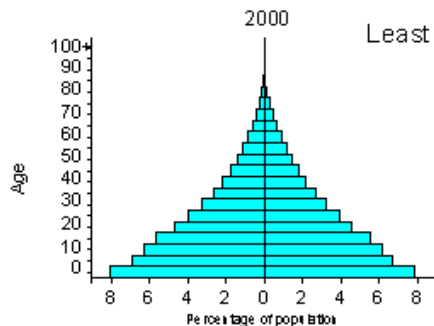
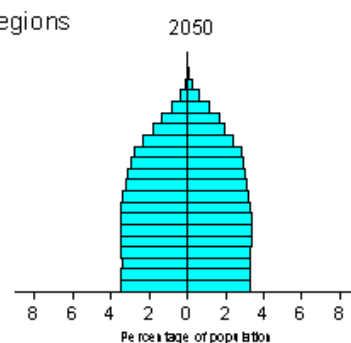
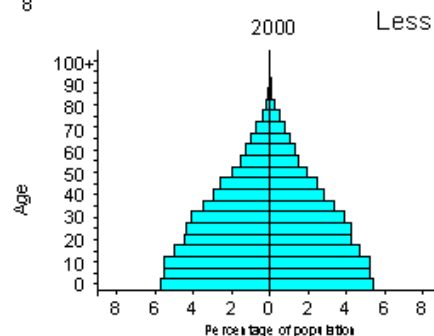
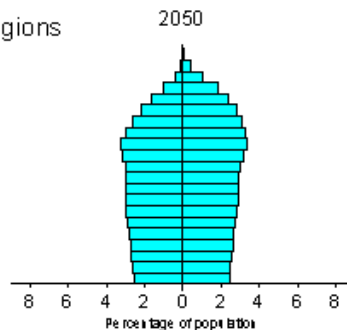
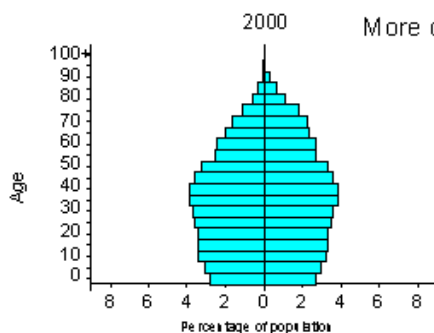
Examples by Country



Rectangularization of Survival



Population “Pyramids” by Development

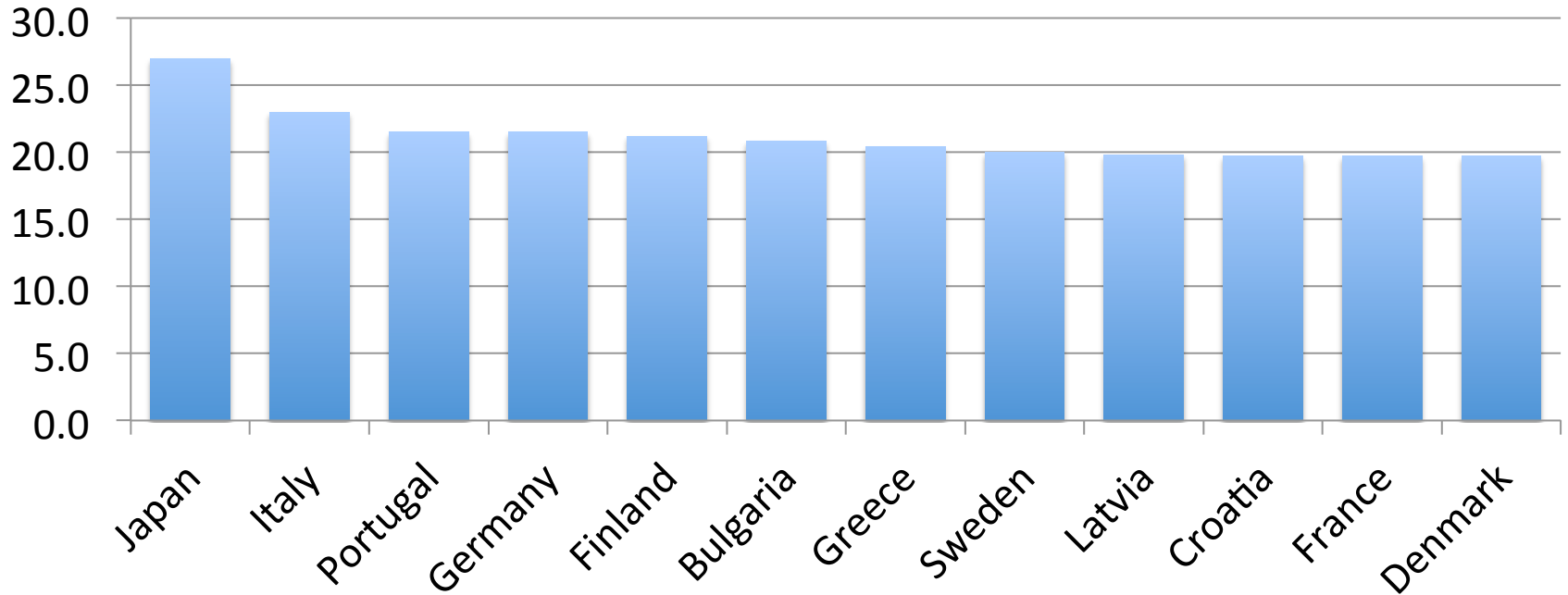


Discussion:

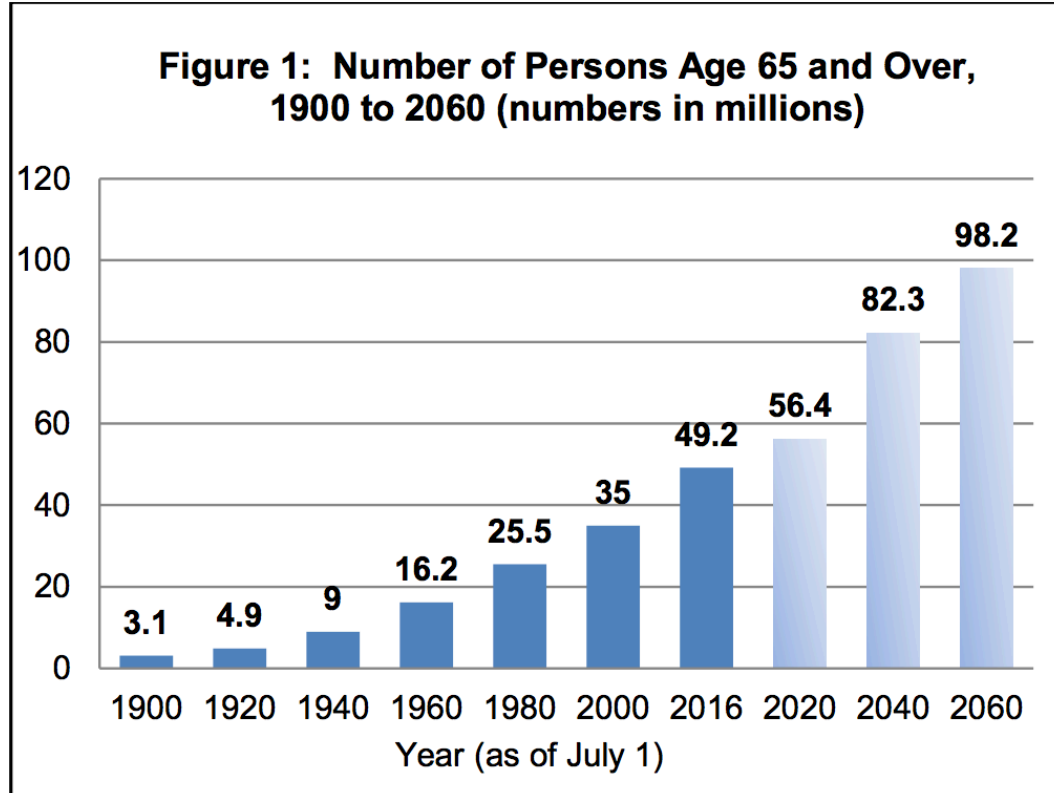
**HOW DOES THE UNITED STATES
COMPARE TO OTHER HIGH-INCOME
COUNTRIES WITH RESPECT TO
AGING?**

World's Oldest Countries

% of Population 65+ (2017)



United States Demographics



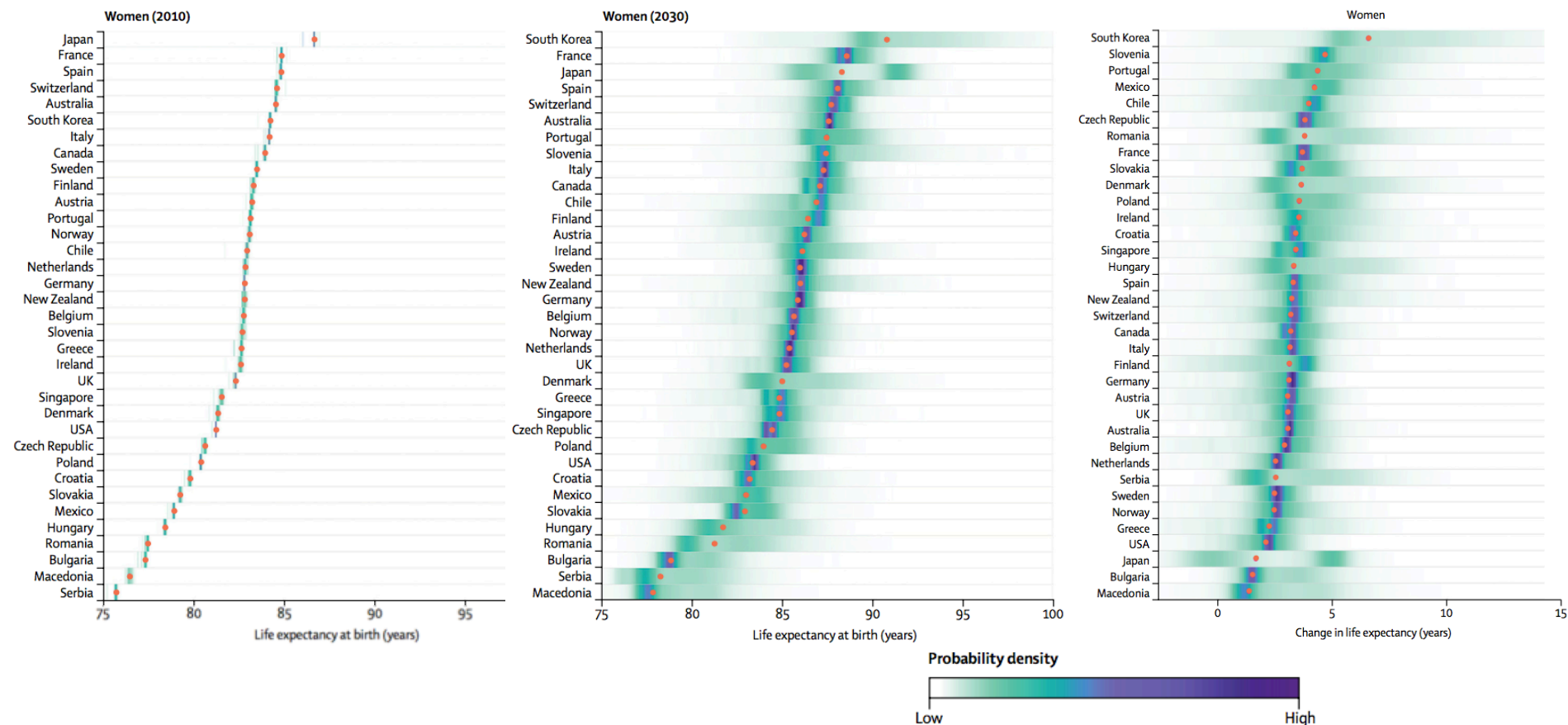
Life Expectancy in the US

- Birth in 1900: 47.3 years
- Birth in 2016: 78.6 years
- Upon reaching age 65 in 2016:
 - Females: 20.6 years
 - Males: 18.0 years

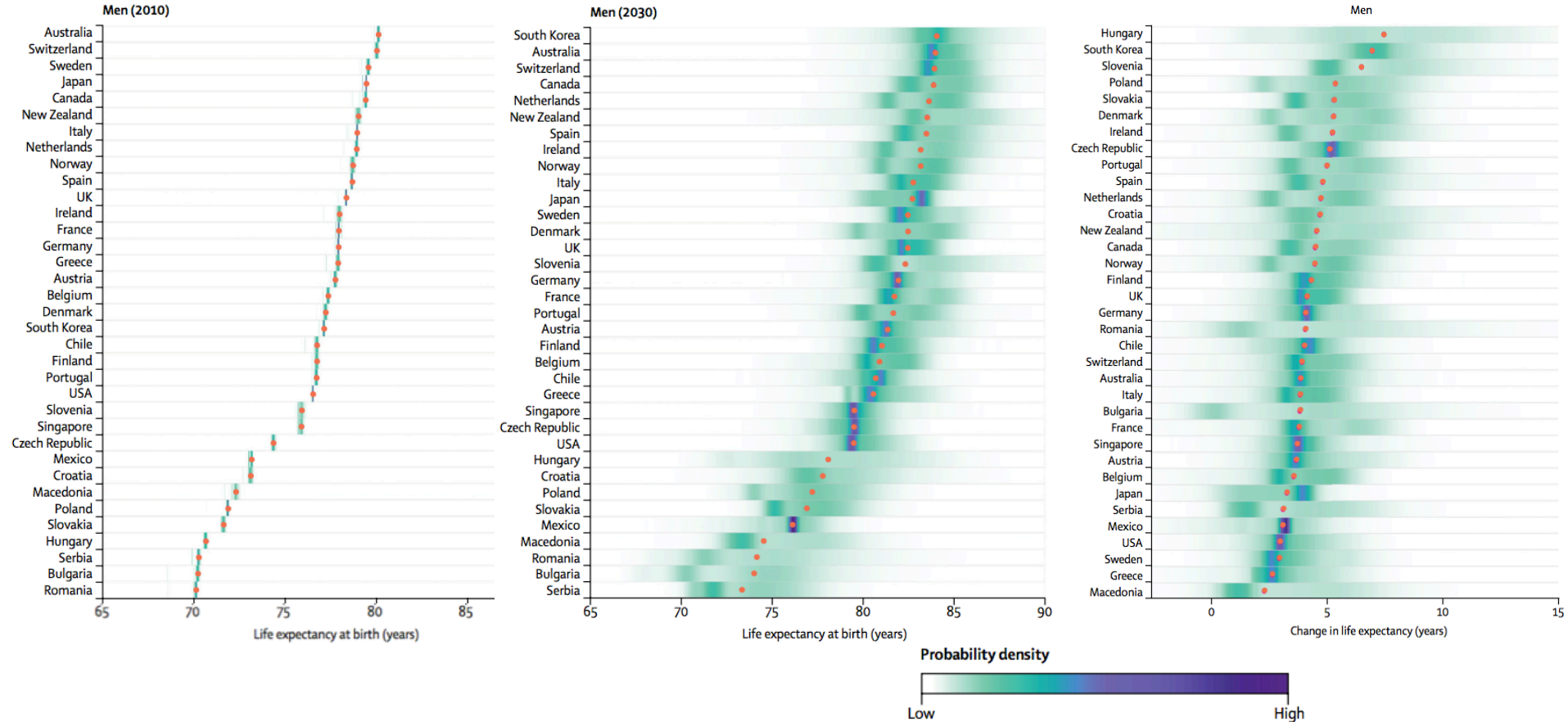
Discussion:

**WHAT IS EXPECTED TO HAPPEN TO
LIFE EXPECTANCY IN THE FUTURE?**

Women: 2010 - 2030



Men: 2010 - 2030

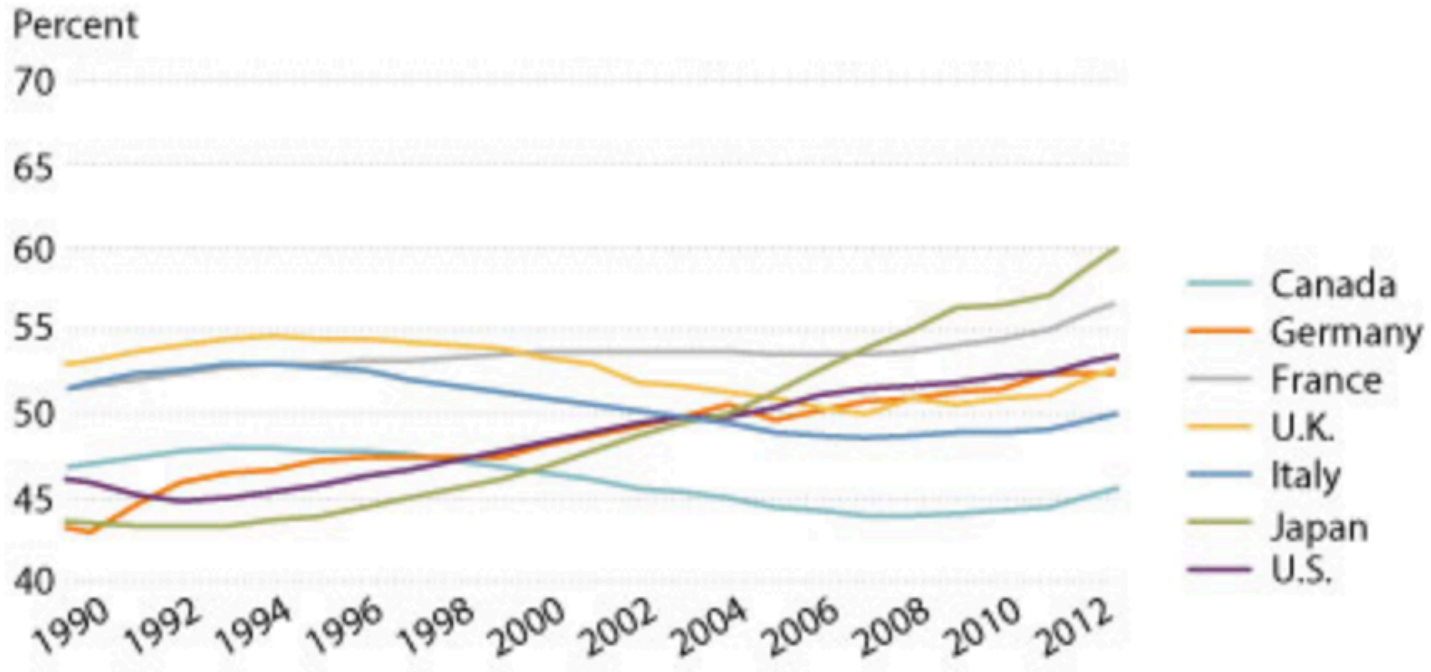


Discussion:

**WHAT ARE THE SOCIETAL
IMPLICATIONS OF LONGER LIFE
EXPECTANCY?**

Dependency Ratio

A. Age Dependency Ratio in G-7 Countries



Consequences

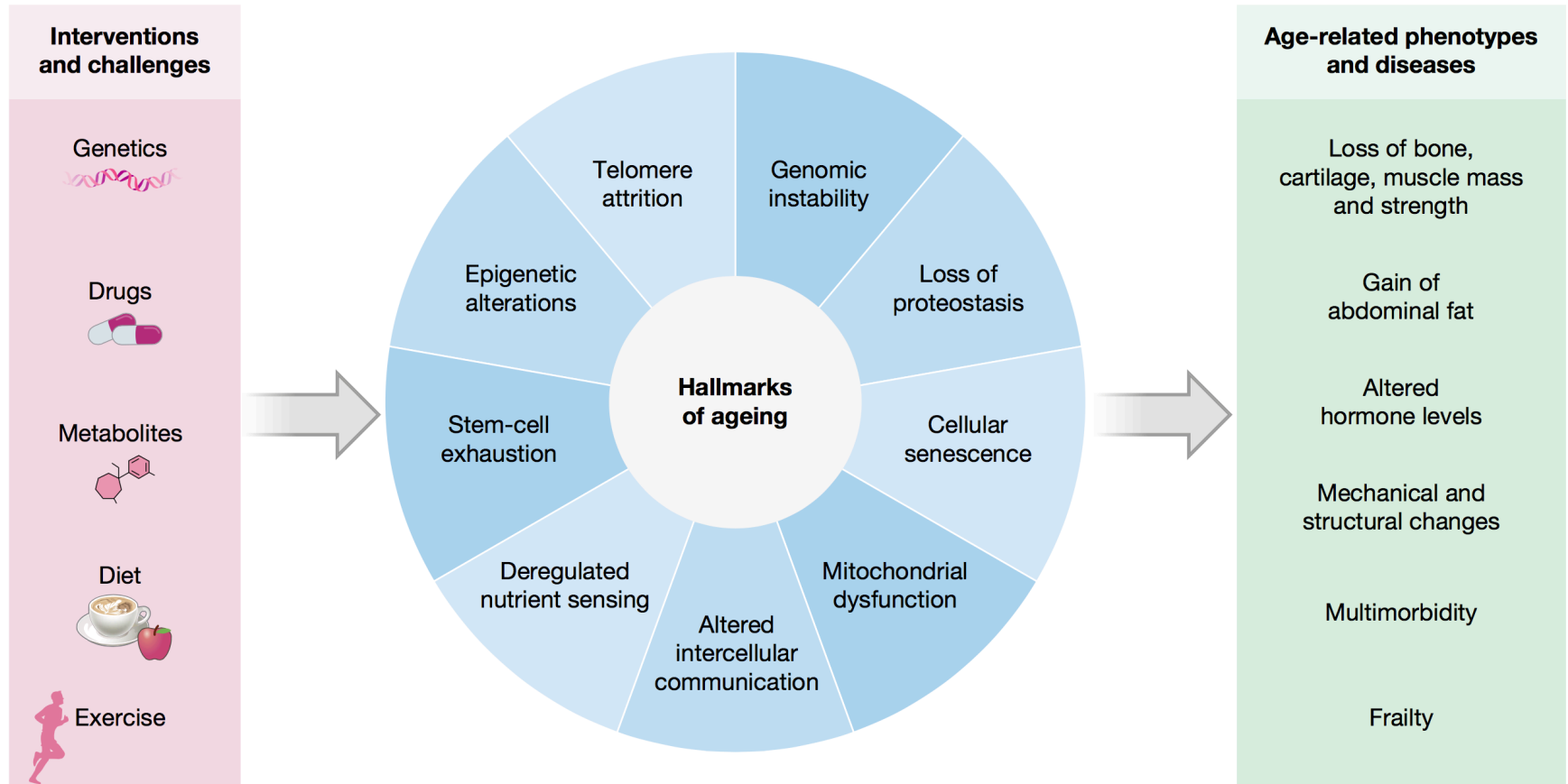
- Health services
- Social services
- Pensions
- Inequality
- Long-term economic changes
- Others?

ON HEALTHY AGING

Defining Healthy Aging

- Little consensus
 - Disease-free state?
 - Functional ability?
- WHO: process of developing and maintaining the functional ability that enables wellbeing in older age

Factors Associated with Healthy Aging



Relevant Endpoints

- Longevity
- Healthy survival
- Survival
- Functional status
- Etc.

Discussion:

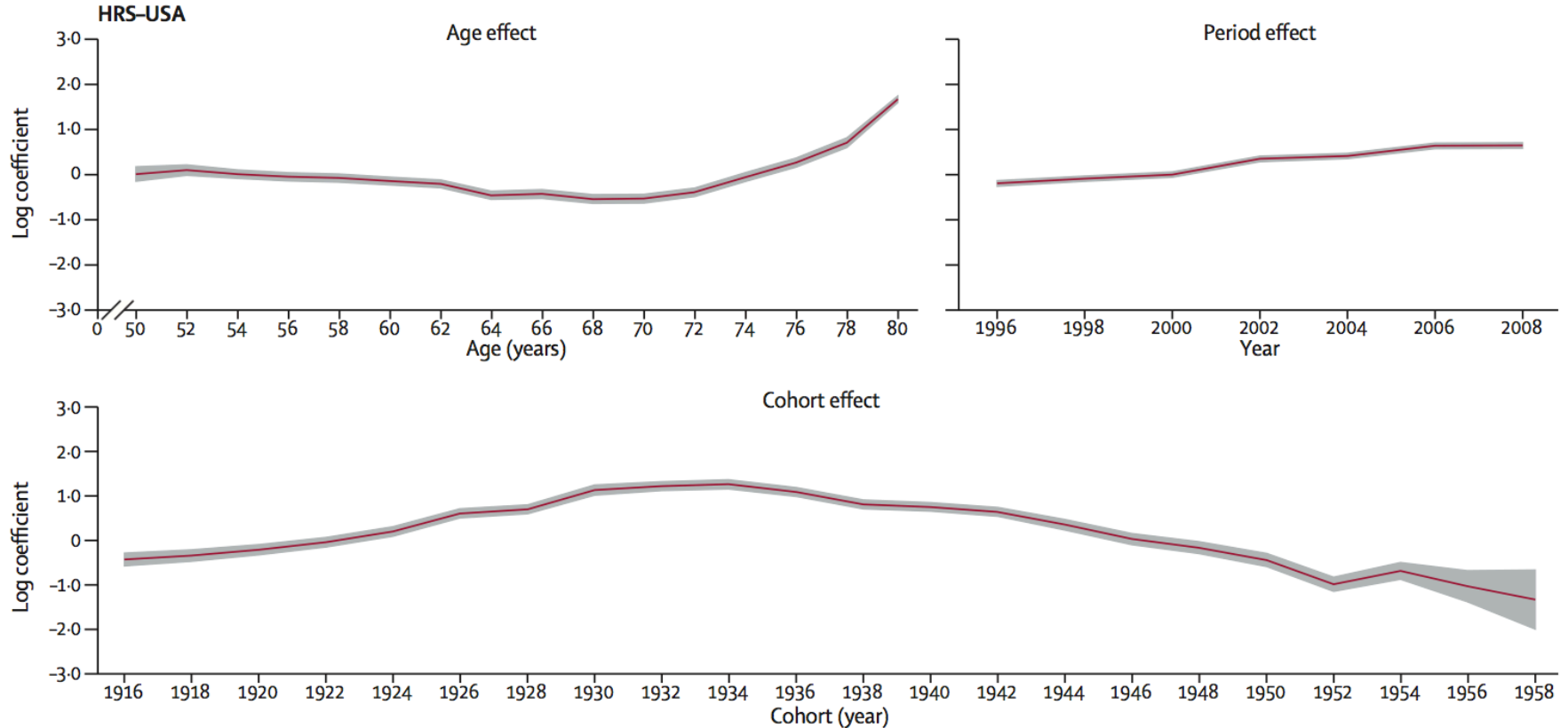
**WHAT DOES LONGER LIFE
EXPECTANCY MEAN WITH RESPECT
TO HEALTHY AGING?**

Three Primary Hypotheses

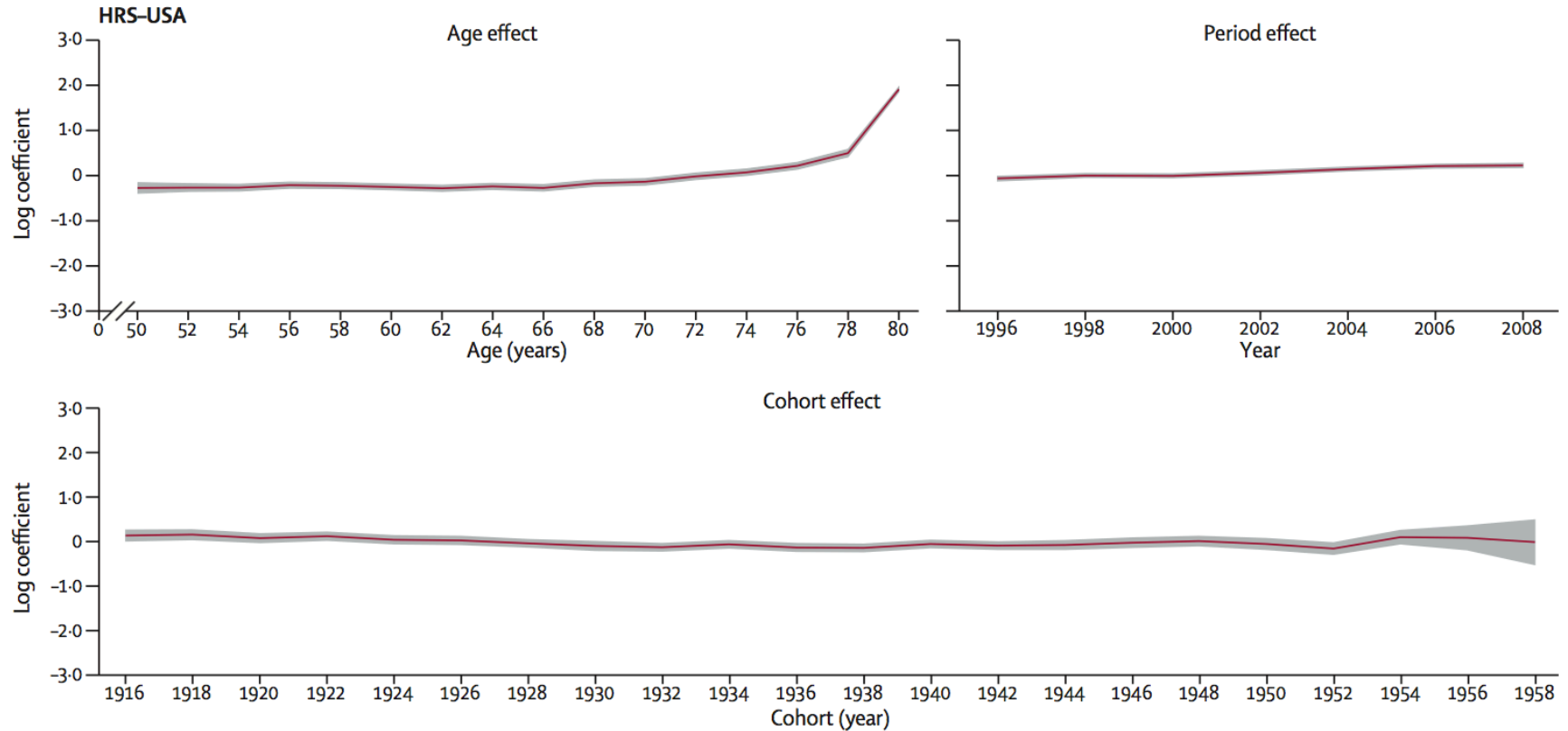
- Compression of morbidity
- Expansion of morbidity / failure of success
- Dynamic equilibrium

- No consensus

ADLs in HRS



IADLs in HRS



Contributors to DALYs Over Time

	1990 IHME GBD	2010 IHME GBD	Change 1990–2010 IHME GBD (%)	2004 WHO GBD (unweighted, no discount)	Change 2004 to 2030 (weighted and discounted; %)
General					
Population aged ≥60 years (millions)	487.5	754.9	..	658.7	..
All causes	434.8 (100%)	574.4 (100%)	+32.1%	450.9 (100%)	+55.2%
DALYs per 1000 population	891.9	760.9	..	684.5	..
GBD categories					
Communicable, maternal, perinatal, and nutritional conditions	45.2 (10.4%)	53.3 (9.3%)	+17.9%	38.6 (8.6%)	–18.7%
Non-communicable diseases	368.3 (84.7%)	488.6 (85.1%)	+32.7%	395.5 (87.7%)	+61.3%
Injuries	21.3 (4.9%)	32.6 (5.7%)	+53.1%	16.8 (3.7%)	+78.0%
Burdensome chronic non-communicable disease categories					
Cardiovascular diseases	137.3 (31.6%)	173.9 (30.3%)	+26.7%	157.4 (34.9%)	+40.6%
Cancer	64.4 (14.8%)	87.0 (15.1%)	+35.1%	65.3 (14.5%)	+69.2%
Chronic respiratory diseases	54.9 (12.6%)	54.3 (9.5%)	–1.1%	41.0 (9.1%)	+84.3%
Digestive diseases	15.8 (3.6%)	19.4 (3.4%)	+22.8%	15.2 (3.4%)	+15.8%
Mental and behavioural, and neurological disorders	22.2 (5.1%)	38.0 (6.6%)	+71.2%	31.0 (6.9%)	+79.5%
Sensory impairment	12.3 (2.8%)	18.0 (3.1%)	+46.3%	43.9 (9.7%)	+82.0%
Musculoskeletal	27.9 (6.4%)	43.3 (7.5%)	+55.2%	12.1 (2.7%)	+70.3%
Genitourinary diseases	9.4 (2.2%)	16.4 (2.9%)	+74.5%	7.5 (1.7%)	+61.1%
IHME=the Institute of Health Metrics and Evaluation. GBD=global burden of disease.					
Table: Numbers and proportion (%) of DALYs attributable to particular causes, for people aged 60 years and older in 1990 and 2010 (IHME GBD) and 2004 with projections to 2030 (WHO GBD)					

Next Week:

LECTURE: BIOLOGY OF AGING

HOMEWORK: READING, POSSIBLE

PRESENTATION TOPICS