L&S 39G

Health, Human Behavior, and Data

Prof. Ryan Edwards

Class 3

September 15, 2015

Today's agenda

- Some quick i>clicker questions about the readings
- Natalie and Eric on the readings
- More in depth on the readings
- Epidemiological transition & vaccinations
- Term papers
- Mortality and life expectancy
- *Next time: A fun game about mortality and life expectancy*

Sep 8	Bhattacharya chaps 1-2	Alastair & Catherine	Oct 27	Ashenfelter & Ziliak	
Sep 15	Cutler et al. and Wachter	Eric & Natalie	Nov 3	Ruhm	
Sep 22	Bhattacharya chap 3		Nov 10	Small & Rosenbaum	
Sep 29	Bhattacharya chap 4		Nov 17	Buckles & Hungerman	
Oct 6	Sutton and Bartholomew		Nov 24	Carpenter & Dobkin	
Oct 13	Aron-Dine et al.		Dec 1	Edwards & Mason	
Oct 20	Oster				

i>clicker question 3.1

The newspaper reports that life expectancy at age 20 is 60 years. If you're 20 years old today, to what age should you expect to live?

A. Younger than 80

B. 80

C. Older than 80

i>clicker question 3.2

Suppose you have several million dollars to spend on health in a developing country "Pinnerland." What do you do with the cash?

A. Embezzle it

B. Give it to residents of Pinnerland. Wealthier is healthier

C. Spend it on female education initiatives

D. Buy antibiotics and ship them to Pinner doctors

E. Buy food and distribute it to the Pinner people

i>clicker question 3.3

What explains the socioeconomic gradient in health between rich and poor people within a country?

A. Rich people can afford better nutrition

B. Rich people smoke less

C. Rich people are the doctors, poor people are the patients

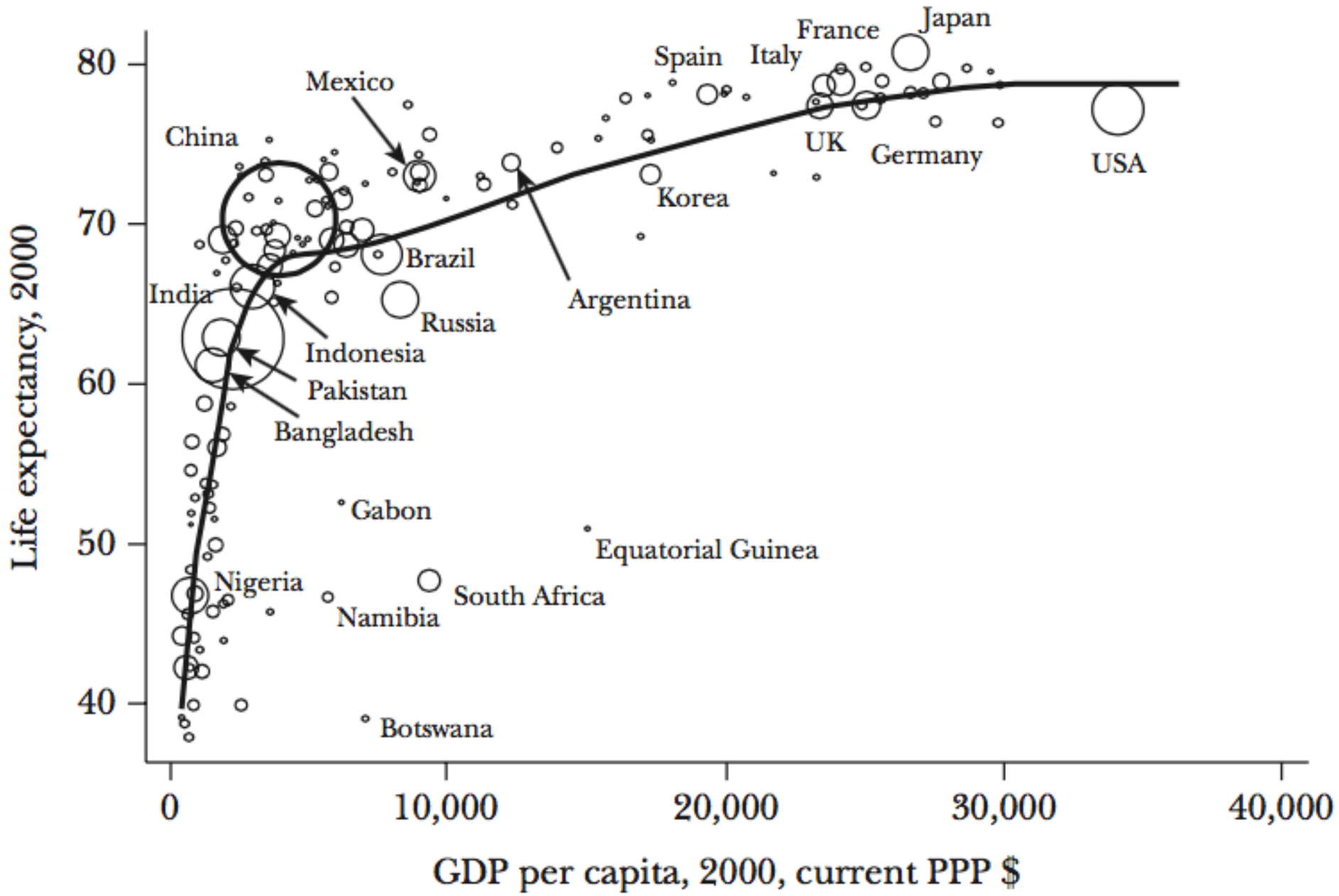
D. Rich vampires drink the blood of poor people

Readings this week

- Cutler, Lleras-Muney, and Deaton (2006) “The Determinants of Mortality”
  - Overview of historical human development since Enlightenment
  - Overview of health among developing countries today
  - A look at health and mortality *within* countries
  - Focus is on trying to understand why health improves
- Wachter (2014) *Essential Demographic Methods*
  - Fun, funny, lengthy look at some tools in demography, here with a focus on mortality

Figure 1

The Preston Curve: Life Expectancy versus GDP Per Capita



Source: Reproduced from Deaton (2003, Figure 1).
Note: Circles are proportional to population.

Historical mortality declines

- Stronger declines in mortality rates during infancy and youth, because of great progress against infectious disease. Why?
  - **Improved nutrition?**
    - More income buys more food and improves health
    - Also technologies improve crop yields, more food, improves health
    - McKeown: tuberculosis (“consumption”)
    - Fogel: big increases in caloric intake & height after mid-1800s
    - But was the timing right? What about the lack of a clear health gradient between well-fed aristocrats and poorly-fed commoners? And did diseases *cause poor nutritional absorption?*

- **Public health initiatives?**

    - There's something besides income that matters for health, because country X, with the same incomes today as country Y in the past, has better health

    - Macro and micro initiatives

        - Macro: quarantines, public works like piping/plumbing, chlorination, pasteurizing

        - Micro: boiling, washing hands, ventilating rooms

- A lot of this required the germ theory of disease, not accepted until 1880s

- Deaths from water and food-borne diseases like typhoid, cholera, dysentery, fell a lot because of water purification

- **Urbanization?**

    - At first, living in cities was *bad for health* because of the easier spread of infectious disease

- **Vaccination?**

    - Big vaccination didn't take off until the 20th century, but there were cruder technologies before that, like "variolation" — rubbing people with smallpox

    - In 1775, Washington ordered the entire Continental Army variolated

    - But except for TB, most diseases degraded quality rather than quantity of life … so this can't have been a huge source of improvement

- **Medical treatments?**

  - Huge for understanding gains against cardiovascular disease (heart attacks) after 1960

    - They say the rest of the gains are due to smoking cessation

  - Gains against infant mortality stemming from improved neonatal care especially for low birthweight

  - Cutler clearly thinks this is important, Fogel not so much: "The main thing that physicians do is to make life more bearable: reduce morbidity and tell people how to take care of themselves." (*Escape from Hunger and Premature Death*, 2004)

- **Early life conditions**

  - “Fetal origins” or “womb with a view” hypothesis of Barker (1990):

    - Nutritionally deprived fetuses get biologically reprogrammed to sustain themselves through their reproductive years

  - Supported by robust independent correlation between birthweight and adult height

  - Mixed evidence of poor health in adulthood for surviving fetuses during famines and trauma

  - Doblhammer and Vaupel (2001) find month-of-birth effects that show improved longevity after age 50 for kids born during the autumnal harvest

  - Cutler et al. think these effects in any event are likely to be small compared to those of cardiovascular risk factors in adulthood, but they also effectively “shrug” and suggest wait-and-see

Summary of historical mortality declines

1. From mid-1700s to mid-1800s

   Improved incomes may have improved nutrition and thus health

2. From late 1800s to 1930s

   Public health era, when urbanization raised disease prevalence at first, then cleaner water and healthy practices improved health

3. From the 1930s

   The “Era of Big Medicine” starting with vaccination and antibiotics, continuing with intensive personal interventions

Table 1

The Worldwide Structure of Mortality in 2002

	Treatments/Prevention	*World*	*Low-income countries*	*High-income countries*
Deaths per 100,000		916	1,113	846
Percent of total deaths by age				
Children (0–4)		18.4%	30.2%	0.9%
Elderly (60+)		50.8	34.2	75.7
Percentage of deaths from chronic diseases				
Cancer	Partially preventable and treatable	12.4	6.3	26.2
Cardiovascular disease	Partially preventable and treatable	29.3	21.5	38.1
Numbers of deaths, millions				
Respiratory infections*	Antibiotics	3.96	2.90	0.34
HIV/AIDS	Anti-retroviral therapy	2.78	2.14	0.02
Perinatal deaths*	Pre- and post-natal care	2.46	1.83	0.03
Diarrheal diseases*	Oral rehydration therapy	1.80	1.54	—
Tuberculosis	Preventable with public health; usually treatable	1.57	1.09	0.01
Malaria*	Partially preventable; treatable	1.27	1.24	—
DPT/Polio/Measles*	Vaccinations	1.12	1.07	—

Source: Based on WHO data and subject to large margins of error, particularly for adult mortality in low-income countries, most of which lack complete vital registration systems.

Notes: DPT stands for diphtheria, pertussis (whooping cough) and tetanus. An asterisk (*) indicates that the disease is most commonly fatal in children, except respiratory disease in high-income countries. — indicates less than 10,000 deaths. "Low-income" and "high-income" are World Bank designations of countries; these can be thought of as corresponding to below $5,000 PPP and above $10,000 PPP in Figure 1. Perinatal deaths are deaths in the first seven days of life and are primarily associated with low birth weight.

Challenges in the developing world

- Much debate over how to improve health
- “Wealthier is Healthier,” Pritchett and Summers (1996)
- Cutler et al. say “income can only buy so much if the disease burden is overwhelming” (p. 111)
- Health delivery systems are not in good shape, with doctor absenteeism, incentives to overtreat, ineffective care
- Women’s education (and empowerment) continues to lag but is arguably critical, especially for children’s health
- Even if income raises health, reduced mortality may increase population growth *and thus reduce income* unless things adjust

Health inequalities within countries

- Whitehall studies of British civil servants: strong effects of rank on cardiovascular mortality and all-cause, but less for cancer

- In the U.S. and in other advanced economies, a strong gradient in mortality at all ages across race, education, income, wealth, almost always favoring the more well off

- Why?

Causes of the gradient

- **Health care?**
  - Least well off have worse care, but they're also sicker to beging with
  - Universal health care doesn't seem to change thing much, but it should if health care were an important cause of the gradient
    - Introduction of Medicare had unclear impacts on U.S. mortality, no clear improvement vs. the UK
    - Britain's class gradient in health survived the introduction of the National Health Service in WWII
- **Resources?** (Income to buy food)
  - Access to cheap food now appears to be a real problem (obesity)

- **Health behaviors?**

  - There are big gradients in smoking, drinking, exercise, preventive behaviors like mammograms, adherence to doctors' suggestions

  - But gradients in mortality persist even after controlling for these observed behaviors

  - Worse, behavior by different groups differs even though information and prices seem to be the same

    (We'll see the Grossman (1972) model next time)

- **Income and income inequality?**

  - Cutler et al. refer to a literature that says *psychosocial stress*, from low status and control, is bad for health

    - In humans, this would look like civil servants; in apes, this would look like anyone other than the alpha male
    - There are biological channels of this badness: stress, cortisol, inflammation, wear-and-tear

  - But health and *income* <u>probably cause each other</u>

  - Economists like *education* causing health because it represents knowledge and protective "human capital" but it too can be reverse-caused by health

Conclusions of Cutler et al.

- There's no consensus on many issues!
- Knowledge and technology probably have played key roles, at the dawn of the transition and still now
- Economists tend to downplay the role of income
- Markets for developing health technology seem like they're functioning well
- But this may imply the rich will benefit the most at first

Epidemiological transition

Term paper “topics” due next time, Sep 22

- Guidelines:
  - Must be data-focused, not a book report nor a philosophical or theoretical piece
  - “Topics” consist of three sentences:
    1. This is the question I am asking & why
    2. These are the data I will analyze
    3. This is what I think I find (and what it will mean)

The data source can be a statistical brief

- Let’s discuss some examples. Can you “use” these? Sure, if you like them & you **adapt them** *& do your own work*

Note:

Many of these examples focus on socioeconomic well-being more broadly and *not on health*

I'd like your topic in L&S 39G to focus on health

But if your soul is burning to do something else, we can discuss it

Term paper topic example 1

1. **Question:** How have the socioeconomic characteristics of my home town or county changed between 2000 and 2010, and what does that mean for quality of life?

2. **Data:** The Census Bureau measures individuals' characteristics at the county level in the decennial census (2000 and before) and in the annual American Community Survey (started 2001).

3. **Answer:** I expect to find that average household income had barely increased because of the recession, even though educational attainment has risen a little, and it is because unemployment rates were still higher in 2010 than in 2000.

Term paper topic example 2

1. **Question:** Is the reason why whites use disproportionately more mental health services than non-whites because they have higher incomes and can better afford those services?

2. **Data:** The National Institutes of Mental Health collects data on users and providers of psychiatric services, and the California Health Interview Survey also measures characteristics of users.

3. **Answer:** I think I will find that people with higher income use more mental health services. (*But I'm actually wrong.)*

Term paper topic example 3

1. **Question:** Does the level of school funding explain differences in academic performance across school districts, or are other factors important?

2. **Data:** The state department of education supplies data on achievement tests like the SAT for different cities, and the Census Bureau provides local-area income and education statistics.

3. **Answer:** I think I will find that schools can have the same funding level and still differ a lot in academic performance. (*And I'm right.*)

Term paper topic example 4

1. **Question:** Are countries poor because they have low life expectancy, or the reverse, or have trends in income and in life expectancy diverged?

2. **Data:** The World Bank's *World Development Indicators* includes country-level data on income, life expectancy, and other variables.

3. **Answer:** I think I will find that income and life expectancy tend to move together, suggesting that one probably causes the other. (*But I'm actually wrong.)*

Term paper topic example 5

1. **Question:** Have baseball players always earned more than workers with comparable education, by how much, and how has that changed?

2. **Data:** The 1940 Census is online and searchable (be careful!), and I can find Joe DiMaggio at 241 Central Park West, his education, and his earnings

3. **Answer:** Baseball players have always been more rewarded in the labor market than their education alone would imply, but the trends also depend on whether the subject is a superstar, the average major leaguer, or the average player

How do you get an idea?

- Talk to people: me, friends, parents, etc.
- Read the newspaper
- Heck, read “US Weekly” or IGN.com or ESPN or something, anything you find interesting
- Identify a topic that
  - —Is interesting to you
  - —You can answer with data
  - —Has something to do with people, not just dollars or other statistics

Kim Kardashian is like half Armenian

Don’t procrastinate

- Starting early will help you in two ways

  — You’ll get done sooner with less stress

  — You’ll have more time to identify a project *that you can actually pull off*

    - Don’t bite off more than you can chew!

    - Just get it done. It doesn’t have to be a work of art

Methods

- Use any method you want
- Simple histograms, which will be discussed in Stat/ CS 94, are fine

- Use any program you want
- MS Excel is fine, Python is fine, literally anything

- The tools may vary, but your desired output is the same: figures or charts and/or tables

Wikipedia

- Use it to jumpstart your knowledge
- Never
- Ever
- Ever
- Ever cite it as a source. Never.
- It doesn’t cite itself. It’s not a source, it’s practically anonymous cloud opinions

Back to course material:

Mortality: measures, trends

Mortality is a good measure of bad health, Length of life is a good measure of good health

- Health is multidimensional
  - Physical health:
    Functional abilities/disabilities, health conditions,
  - Mental health:
    Happiness, satisfaction, subjective well-being

- Especially for *population health,* or for historical studies, or studies in developing countries, life expectancy or mortality is commonly used

- Health economists and others also like what are called Quality-Adjusted Life Years (QALYs), which adjust for disability

Measuring mortality

- A reasonable measure is the Crude Death Rate (CDR), the number of deaths per population
  - In Germany and Italy, it's about 10 per 1000
  - In India, it's lower, around 8 per 1000
  - In the Philippines, it's even lower, at 5 per 1000
- But are Germans and Italians **less healthy** than Indians and Filipinos?
- Nope, in fact, there are proportionally more Germans and Italians who have survived to old age — but now they're dying!
- What is wrong with the measure? Why does it suggest that health is better in India or the Philippines than in Germany or Italy?

Other measures of mortality

- By birth **cohort**:
  - You could follow all individuals born in 1990 from birth until death and measure their life spans
- The average age at death in a birth cohort = the average length of life in a birth cohort = = “cohort life expectancy”
- A good, intuitive measure
- But also **impractical**, because we won’t know it until whole cohort is dead, say after 110 years
- We want measures that tell us about mortality *right now*, and about population growth *right now*

Period life expectancy

- Imagine a birth cohort that somehow lived their entire lives, experiencing each age, during a single calendar year
- How long would they have lived, on average?
- To answer this, you first calculate age-specific death rates in this year for each age: 0, 1, 2, 3, …, 38, …110+
- Using these, then calculate how many out of a 100,000 births would die at age 0, at age 1, at age 38, at age 110+
- Then calculate the average age at death for this cohort
- This is the **period life expectancy** at birth, or $\mathbf{e_0}$, and it depends only on the conditions during a period of time
- This is the number that is used most often and that you see in the newspaper etc.
- Characteristics: it doesn't depend on *age structure*, and it measures a *good*, not a bad like mortality

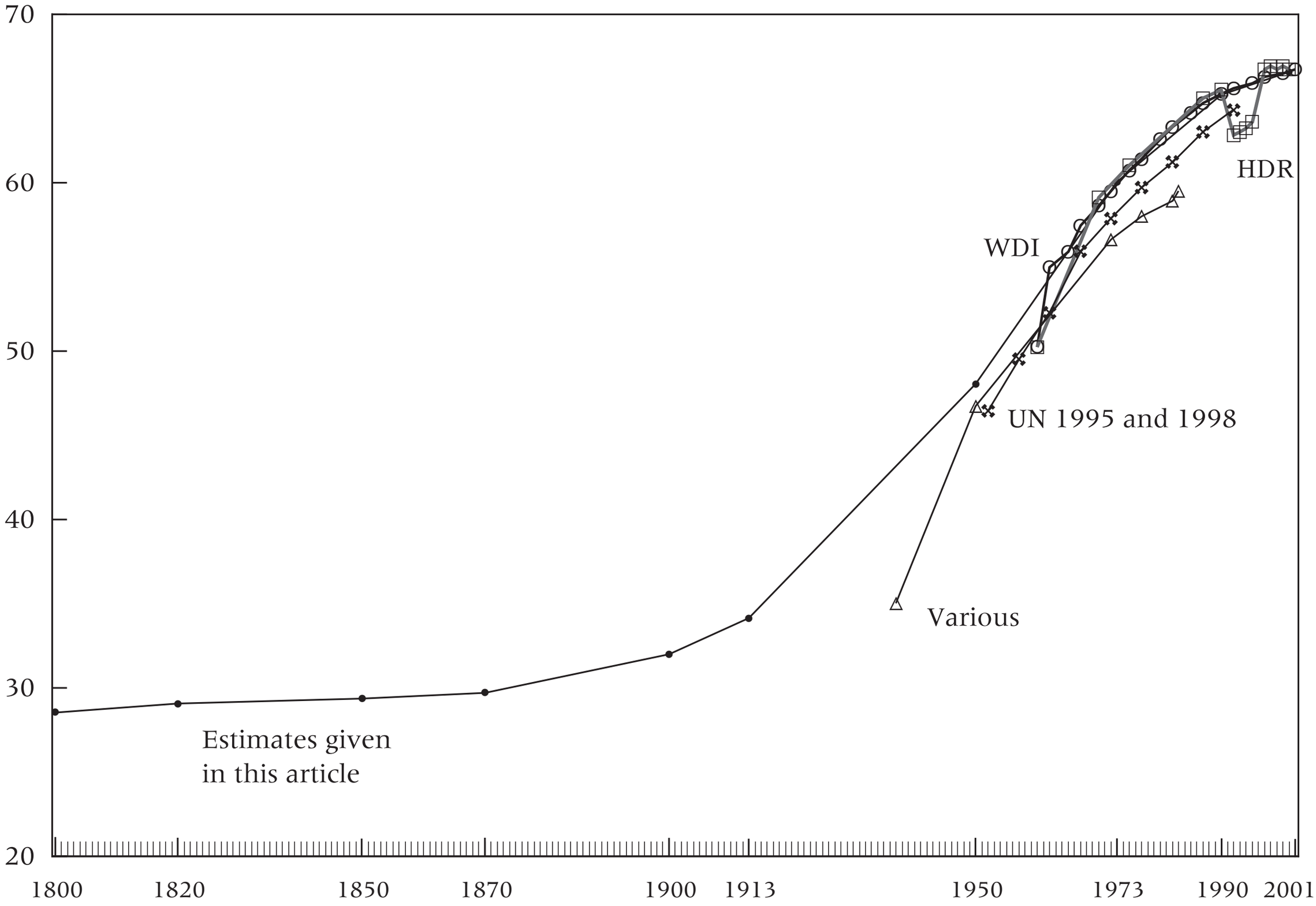
Trends in life expectancy, e_0, better match our priors about population health

Country	CDR (deaths per 1000 pop)	e_0 (years of life)
Germany	10	79
Italy	10	80
India	8	63
Philippines	5	70

Interpreting life expectancy

- In the newspaper, you'll almost always read about **period life expectancy <u>at birth</u>**, or "e_0"
- It measures the average length of life given being born alive
- In historical periods and in developing countries, what do you think is true about the **probability of survival** when you're **newborn**?
- It's very low. In the U.S. in 1900, 12% of females and 15% of males had died by their first birthday
- During historical periods and in developing countries, the average length of life from birth is **quite low**, maybe 40 years
- This **doesn't mean** the typical adult would die at age 40; the most common or modal age at death past infancy was around 72
- Your expected length of life is *higher* than e_0 because you've survived

FIGURE 1 World life expectancy estimates compared, 1800–2001



Source: J. C. Riley, Pop and Dev Review, v.31, n.3 (Sept 2005), p.541)

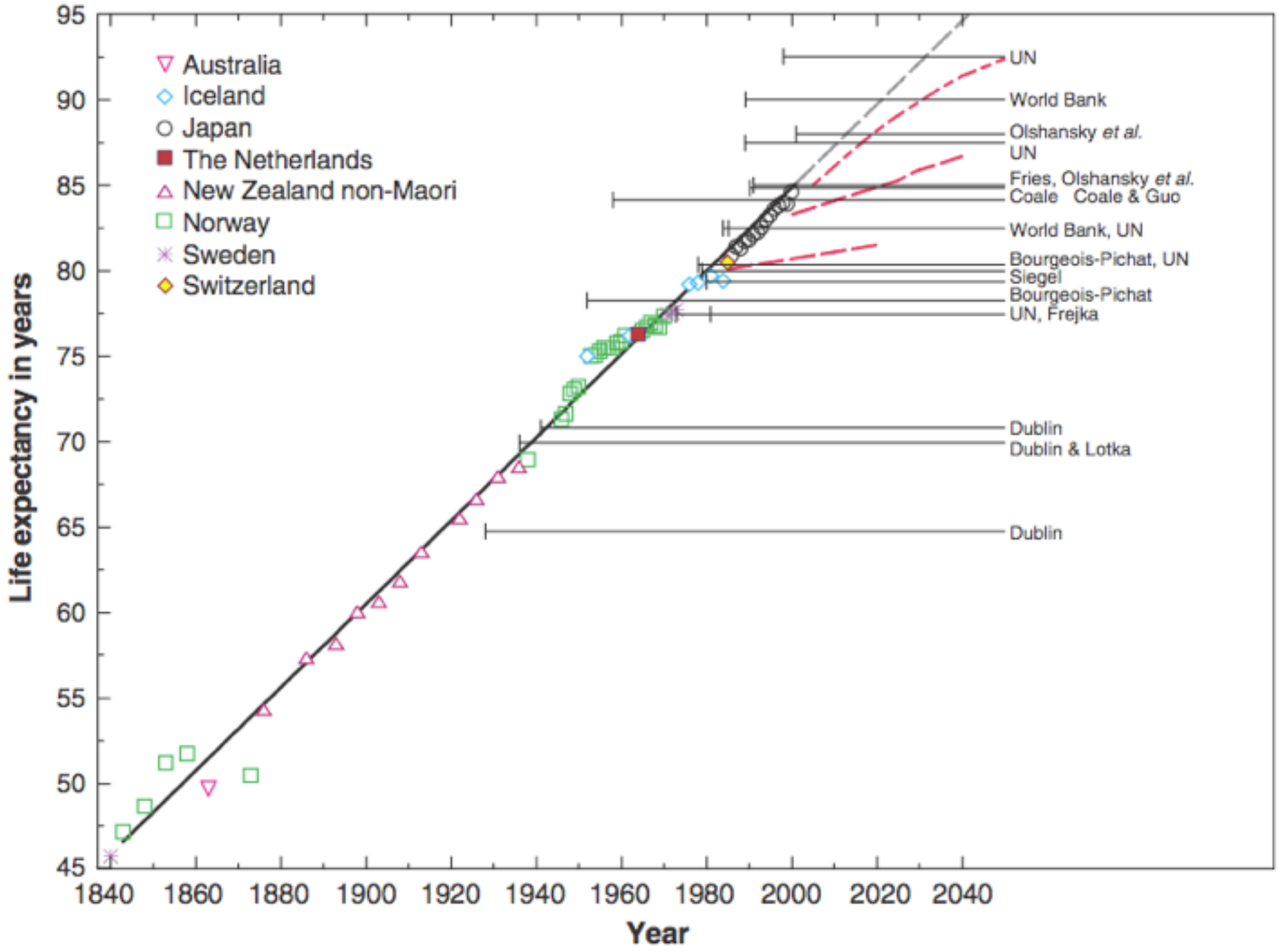


Fig. 1. Record female life expectancy from 1840 to the present [suppl. table 2 (*1*)]. The linear-regression trend is depicted by a bold black line (slope = 0.243) and the extrapolated trend by a dashed gray line. The horizontal black lines show asserted ceilings on life expectancy, with a short vertical line indicating the year of publication (suppl. table 1). The dashed red lines denote projections of female life expectancy in Japan published by the United Nations in 1986, 1999, and 2001 (*1*): It is encouraging that the U.N. altered its projection so radically between 1999 and 2001.

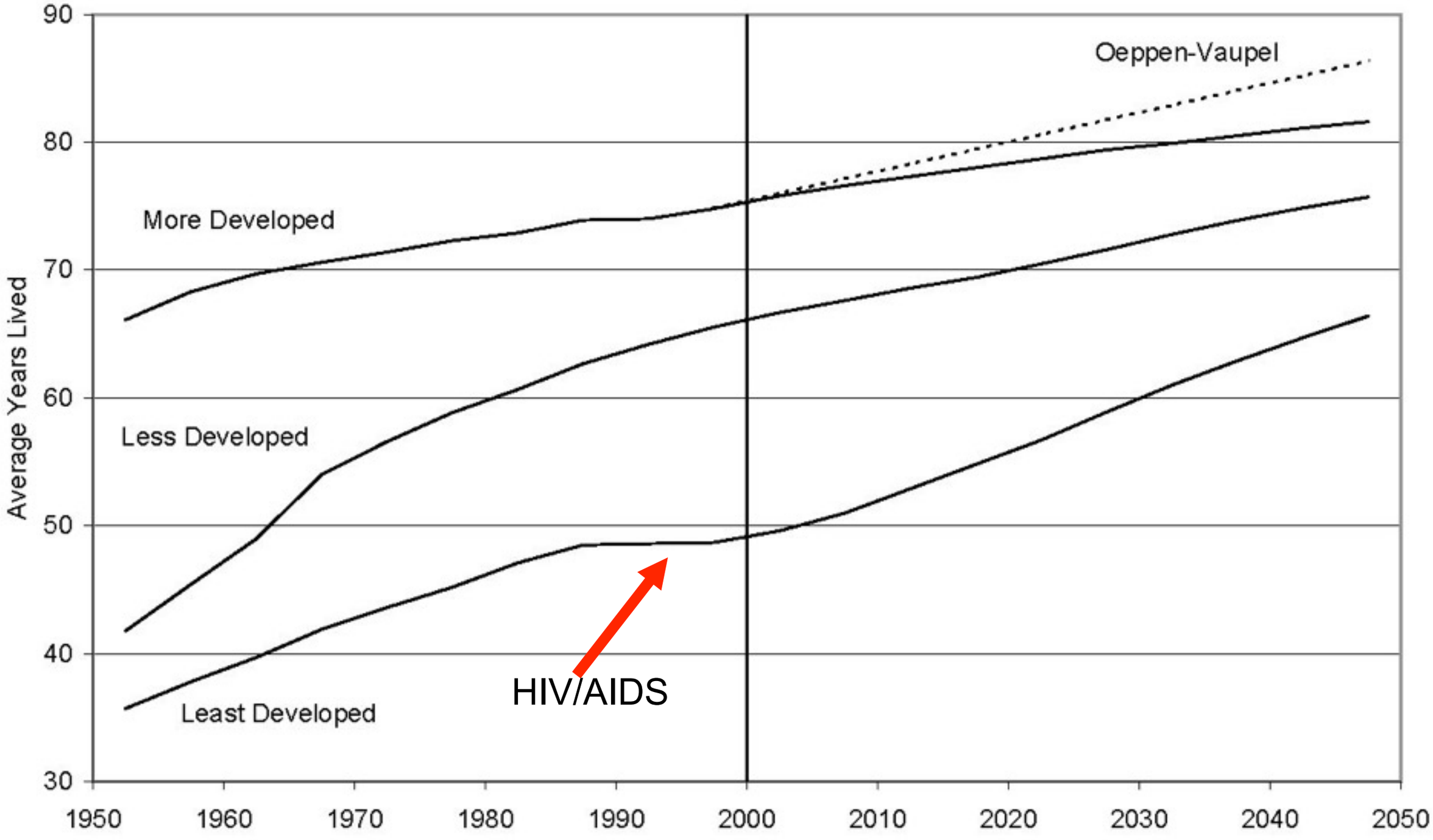
Source; Oeppen and Vaupel, *Science* 2002

Estimates of Life Expectancy Before the Beginning of the Health Transition

	Region of World					
Time	**Africa**	**Americas**	**Asia**	**Europe**	**Former USSR**	**Oceania**
Earliest Health transition	1920s	1820s	1870s	1770s	1890s	1860s
Life expectancy before transition	26	35	28	34	29	23 (indigenous) 46(European)

Source: J. C. Riley, *Pop and Dev Review*, v.31, n.3 (Sept 2005), p.538)

Past and Projected Life Expectancy at Birth, by Major Development Groups: 1950-2050



Source: Ronald Lee (2003) “The Demographic Transition: Three Centuries of Fundamental Change”, *Journal of Economic Perspectives*. v. 17, n. 4 (Fall), pp. 167-190. United Nations data, 2002 Revision.

Mortality and life expectancy

- 1/m = e