Inequality in Health

Lecture I: Introduction

Dr Martin Karlsson
University of Duisburg-Essen
Winter semester 2022-23

Outline

RA's Wanted!

- At the Chair of Health Economics, we need **student assistants**.
- RA's work in **research projects**:
  - Data collection
  - Data digitisation
  - Data processing
  - Literature search
  - Proposal writing
  - Micro-management of academic events....
- We offer
  - Flexible **working conditions**
  - Personalised tasks
  - Friendly working environment
  - Possibility to **qualify** for theses and research
- Interested?
  - Send an email to Sekretariat.GOEK@ibes.uni-due.de.
  - Attach CV and transcript of records.

Introduction

Health Economics in Essen

- Chairs
  - **Martin Karlsson** (Health Economics)
  - **Jürgen Wasem** (Health Care Management)
  - **Katharina Blankart** (Health Care Management)
  - **Daniel Kühnle** (Health and Labour)
- CINCH Research Centre 2012–
- Leibniz Science Campus: Demographic Change 2016–

Other Activities

- Health Economics **Research Seminar**.
  - on Mondays (Time varies).
  - Full program: **Here**
  - Next time: **Yiqun Chen** (University of Illinois at Chicago), Oct 24.
- **Departmental seminar**
  - on Wednesdays 12.15.
  - Full program: **Here**
  - Next time: **Julia Schaumburg** (VU Amsterdam), Oct 26.

Background

- Health inequalities are at the center of the political debate.
- Despite enormous improvements in general health conditions, vast disparities between rich and poor persist, even in wealthy countries.
- There is also widespread agreement that inequalities in health are more problematic than other inequalities.
- In recent years economists made rapid progress in the measurement and analysis of health inequality.
- On this course we will cover economic analysis of health inequalities from every possible angle.

Road map

1. **Part I. Inequality: Measurement, Decomposition and Quantitative Analysis**
   - Income inequality: measurement
   - Health inequality: quantitative analysis
   - Decomposition of inequalities
   - Recent advances in the measurement of health inequality.
2. **Part II. Understanding the Gradient**
   - Health deficit accumulation
   - Early life conditions
   - Policy interventions affecting early life health
   - Education and health
   - Pandemics
   - The intergenerational transmission of health
   - Labour and Health.

Road map

1. **Part III. Distributive Justice and Health**
   - Inequality of opportunity in health.

Literature

- These lecture notes are available on **Moodle**: Inequality in Health WS 2022-23, pw: IiH2023!.
- In the **Syllabus**: **Reading list** of required and optional reading; **calendar**.
- Further informations, **FAQs**, **assignments** and news published there.

Evaluation

- Tutorials: practical exercises and literature seminars.
- Evaluation: **written exam** at the end of the term.
- For **doctoral** students **only**: **term paper**.

Measuring Health

Introduction

- One size does not fit all: health status indicators differ according to **age**.
- Mainly use health status indicator that allow **comparability** across populations.
- Preferred indicators: ease of measurement and calculation, sometimes adjusted for gender and other characteristics.

Table 1. Overview of commonly used health status indicators for different stages of life.

Life Stage	Indicator
Newborn	Apgar score Birthweight
Childhood	U5MR, Under-Five Mortality Rate H/A, Height-for-Age W/H, Weight-for-Height W/A, Weight-for-Age Mental Health, Well-being
Adulthood	BMI, Body Mass Index WHtR, Waist to Height Ratio Mortality, Cause of Death

Newborn's Health: The Apgar Score

- Conducted twice: 1 and 5 minutes after birth.
- Scores five factors on a 0-2 scale (0 is worst), for a total between 1 and 10:
  1. Appearance: skin color
  2. Pulse: heart rate
  3. Grimace: reflexes
  4. Activity: muscle tone
  5. Respiration: breathing rate and effort
- A score ≥ 7 at 5 minutes after birth is considered good.
- Not intended as a predictor of long-term health, but there is evidence that low APGAR scores at 5 minutes correlate with worse long-term health outcomes.

Figure 1. Virginia Apgar demonstrating Apgar score, 1959.

The Apgar Score II

SIGN	0	1	2	1 min	5 min
Heart Rate	Absent	Less Than 100	Over 100	2	2
Respiratory Effort	Absent	Slow, Irregular	Good Cry	1	2
Muscle Tone	Limp	Some Flexion	Active Motion	1	2
Reflex Irritability	No Response	Grimace	Cry	1	2
Color	Pale	Body Pink, Extr. Blue	All Pink	1	2
TOTAL SCORE				6	10

Figure 2. Apgar Score Card.

Newborns' Health: Birthweight

- **Average** birthweight for full-term babies: 2.5-4.2 kg.
- **Low** birthweight (<2.5 kg) or very low birthweight (<1.5 kg) associated with:
  - Increased mortality risk in the first year of life (60-80% of IMR in developing countries)
  - Developmental problems in childhood
  - Chronic diseases (obesity, cardiovascular diseases, diabetes) & adverse economic outcomes in adulthood.
- Low birthweight usually due to:
  - Preterm delivery
  - Unhealthy maternal behaviors (e.g. smoking)
  - Congenital anomalies.
- Excessively **high** birthweight also associated with chronic diseases (obesity, diabetes, some cancers) in adulthood.

Birtweight and Later Outcomes

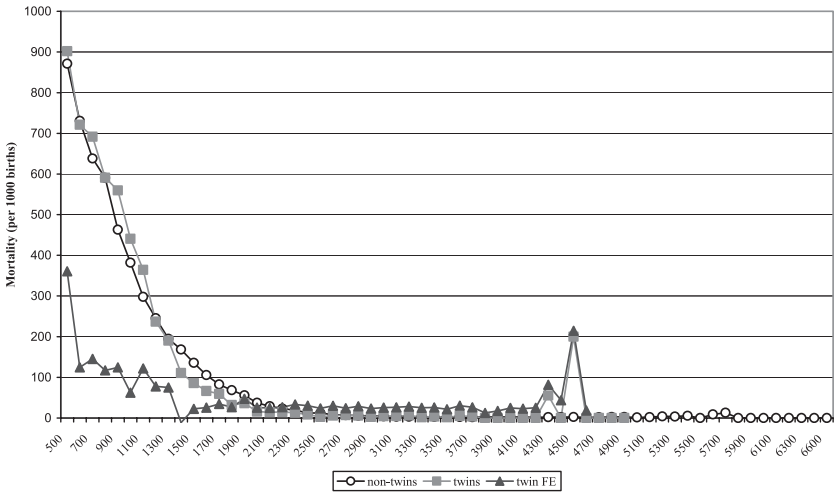


Figure 3. Average IMR (per 1,000) by birthweight, all individuals born in Norway 1967–97.

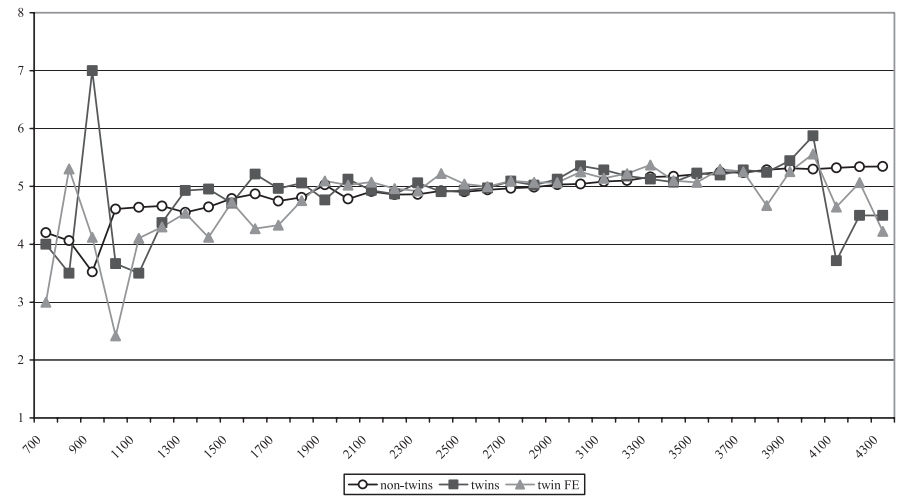


Figure 4. IQ at ages 18-20 by birthweight (males only), all males registered for mandatory military service born in Norway 1967–97.

Source: Black et al (2007).

Newborns' Health: Other Measurements

- Additional measurements taken to check babies' growth:
  1. **Head circumference** to monitor brain growth.
  2. **Length** to monitor the baby's growth, to be compared to growth charts that take into account the infant's age and gender.

Figure 5. Measuring recumbent length in a child below 2 years of age in Chad.

Child Health: Under-Five Mortality Rate

- **U5MR**: probability of dying between birth and age 5 per 1,000 live births.
- Captures 70%-80% of all deaths of children under 18.

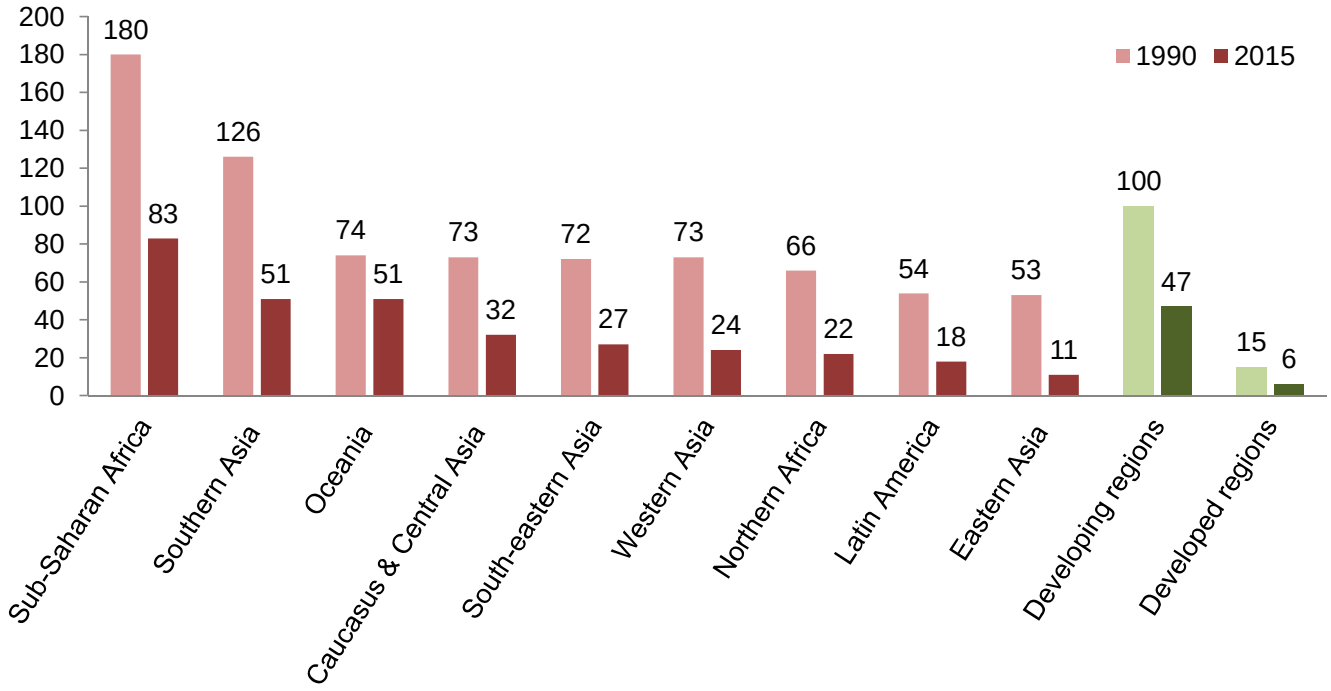


Figure 6. U5MR by Unite Nations region, 1990 and 2015 (deaths per 1,000 live births) Source: UN (2015).

Child Health: Anthropometric Indicators

- Anthropometric indicators: measure children's **nutritional status** (diet less claims).
- Common indicators for child nutritional status:
  - **Height-for-Age** (H/A) [*Stunting*]
  - **Weight-for-Height** (W/H) [*Wasting*]
  - **Weight-for-Age** (W/A). [*Underweight*]
- Useful to report H/A, W/H and W/A as $Z-$scores: $z = \frac{x-\mu}{\sigma}$.
- Conventional **cut-off threshold** given by $-2SD$, i.e. two SD below the median of reference (well-nourished children).
- Children with H/A, W/H and W/A $Z-$scores below the threshold are said to be *stunted*, *underweight* and *wasted*, respectively.

Height-for-Age

- HAZ (standardised H/A) identifies large departures of height w.r.t. median value of a reference population.
- **Stunting**: failure to gain sufficient height, given age and gender.
- Very low height-for-age score (HAZ $< -2SD$) $=$ stunting.
- Associated with **long-term** factors (chronic malnutrition, frequent illness): indicates *past* growth failure.

(a) Guatemala

(b) United States

Figure 7. Nine-year old children born to Guatemalan parents.

Weight-for-Height

- WHZ (standardised W/H) proxies **current** nutritional status.
- **Wasting**: failure to achieve sufficient weight for height.
- Very low weight-for-height score (WHZ $< -2SD$) = wasting.
- Does not give indication about the **cause** of malnutrition (starvation, epidemic diseases, chronic conditions).

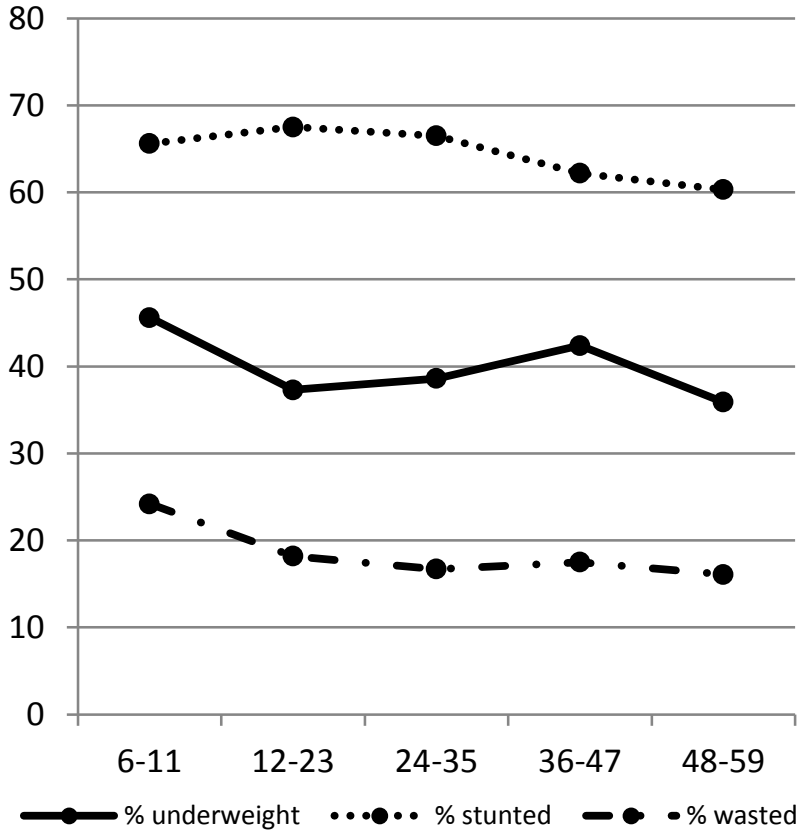


Figure 8. Share of children by malnutrition status and age, Pakistan, 2010. Source: Arif et al. (2012).

Adolescent Mental Health

- Mental disorders often appear at ages 12-19, persist over the life cycle.
- PHQ-9: **self-report questionnaire**, used as a **screening tool** to evaluate whether evaluation by a healthcare provider for **depression** is needed.
- **Nine dimensions** (anxiety, food disorders etc) that are based on the corresponding mental health disorders from DSM-IV.
- This mental health measure Φ uses dimension-reducing aggregation.
- $\Phi = \sum_{c=1}^{9} \mu_c$ where
  - μ_c for all nine measures of mental health $\mu_c \in \{0, .., 3\}$
  - Φ defines the (unweighted) aggregate count $\Phi \in \{0, .., 27\}$
  - $\Phi >= 20$ indication for major depressive disorder.

Adult Health: The Body Mass Index (BMI)

- The Body Mass Index (**BMI**) is a widely used indicator for measuring **adults**' health status.
- It measures departures from "regular" weight (both directions: overweight and thinness).
- $BMI = \frac{w}{h^2}$ where
  - w weight in kilos
  - h height in meters.
- Primarily used to identify **chronic nutrition deficiencies** or **obesity**.
- Particularly relevant in areas where adults may be as vulnerable to malnutrition as children.

Adult Health: Waist-to-Height Ratio (WtHR)

- **Waist-to-height ratio** (**WtHR**) seems a more accurate predictor of **mortality** than BMI (Mayhew et al, 2014).
- $WHtR = \frac{c}{h}$ where
  - c waist circumference in meters
  - h height in meters.
- WtHR measures the distribution of body fat and is positively correlated with the risk of cardiovascular disease.
- Indicative critical value: 0.5.
- Can also be used to predict health risks in children older than 5.

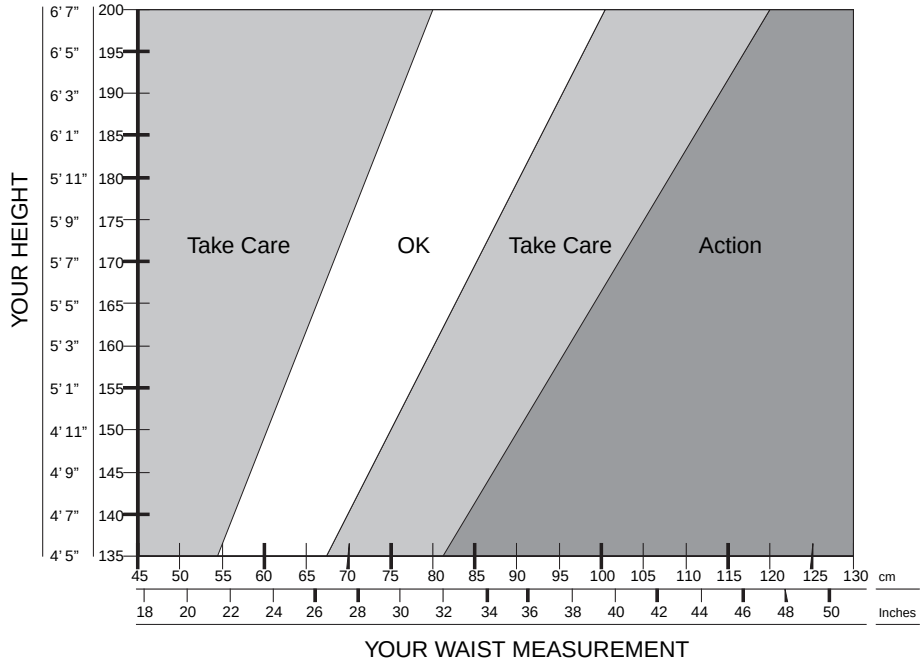


Figure 9. Boundary values of WtHR proposed by WHO (2005).

Adult Health: Mortality

- Vital statistics: source of **mortality data**.
- Mortality: measured as a **binary variable** for death at a certain age.
- Mortality Rate $= \frac{m}{N}$ where
  - m No. deaths occurring within a time interval
  - N population size.
- **Excess mortality**: Deviation of total deaths deviation from what was expected.
- High mortality reflects the

- **Death causes** can be used to construct cause-specific mortality rate.

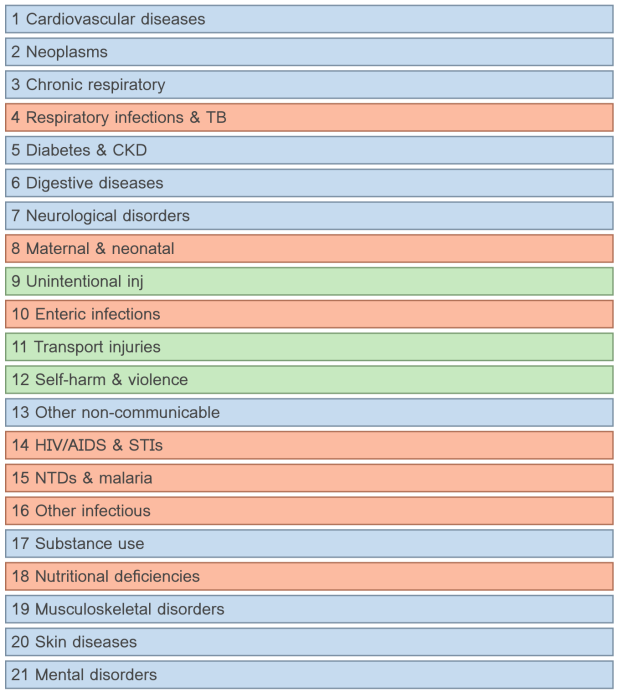


Figure 10. Ranked global mortality rate by cause. Source: IHME (2019).

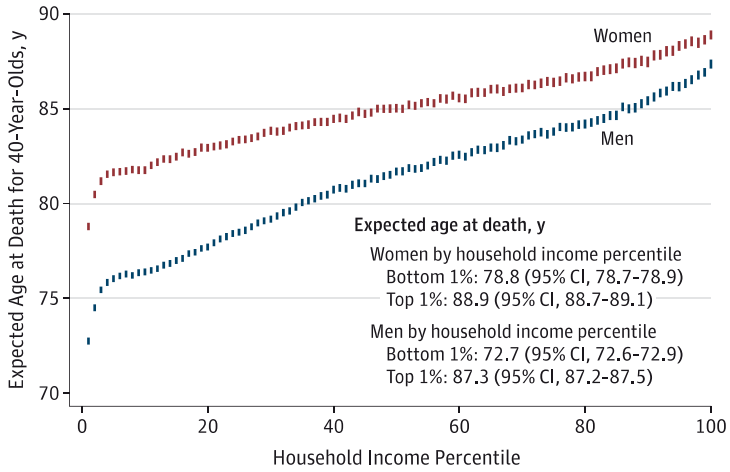
Gradients in Health

Introduction

- **Health outcomes** differ widely with respect to socioeconomic status (SES) both **within** and **across** countries.
- Particularly in less developed countries we observe a **social gradient** in **health**: inequalities in health are related to inequalities in income.
- The social gradient is empirically detected also for other **measures** of socioeconomic status, like:
  - Education
  - Occupational status
  - Area of residence
  - Ethnicity.
- It **persists** over the life cycle and, in general, the same mechanisms apply in rich and poor countries.

Income Gradient in Health

- Expected age at death for 40-year-olds by **household income percentile**.
- Huge **differences between** top and bottom **percentiles** both for women (10.1 years) and men (14.6 years).
- **Gender differences decline** at higher income percentiles.



Mean household income in thousands, $[a]					
Women	24	45	71	112	1.9 million
Men	26	50	77	119	2.0 million

Figure 11. Adjusted Life Expectancy for 40-Year-Olds by Household Income Percentile, 2001-2014. Source: Chetty et al. (2017).

Income Gradient over Time

- Within a country SES gradients can change over time.

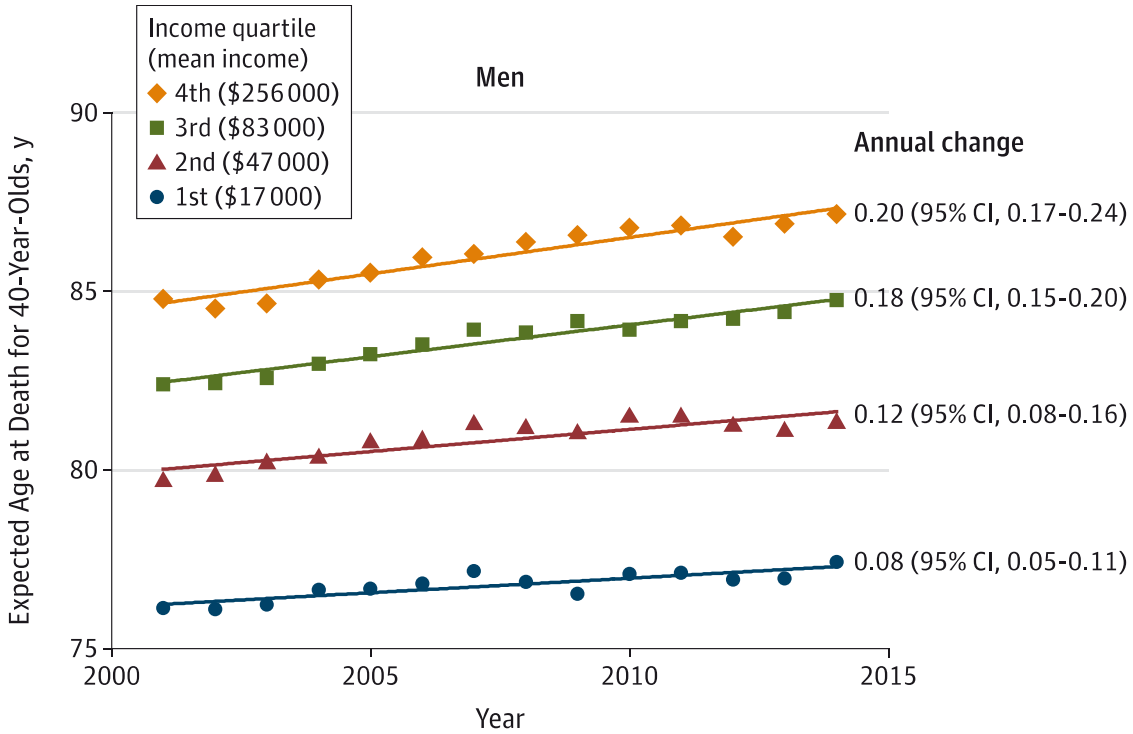


Figure 12. Life Expectancy by Income Quartile by Year. Source: Chetty et al. (2017).

Education Gradient in Health

- **Education** is another often used proxy for socioeconomic status.
- Better educated individuals generally have better health outcomes.

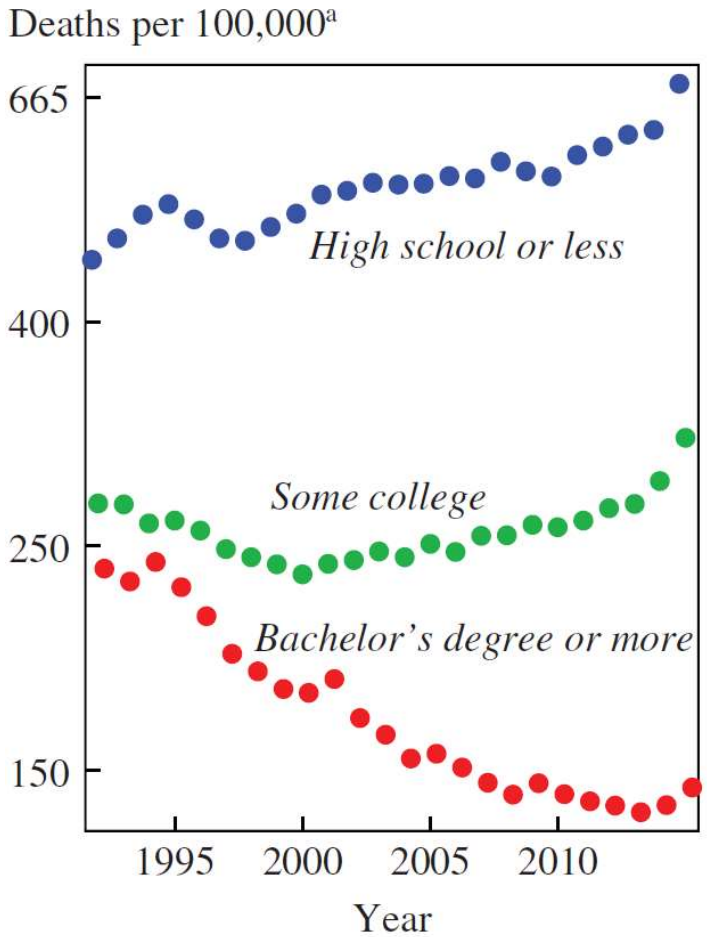


Figure 13. All-Cause Mortality for White Non-Hispanics Age 30-64, 1992-2015. Source: Case and Deaton (2017).

Lifestyle Gradient in Health

- Unhealthy behaviors like smoking, alcohol consumption, or inappropriate nutrition account for a large proportion of deaths, especially in developed countries.
- E.g. obesity correlates with several diseases such as diabetes, cancer, and cardiovascular disease.

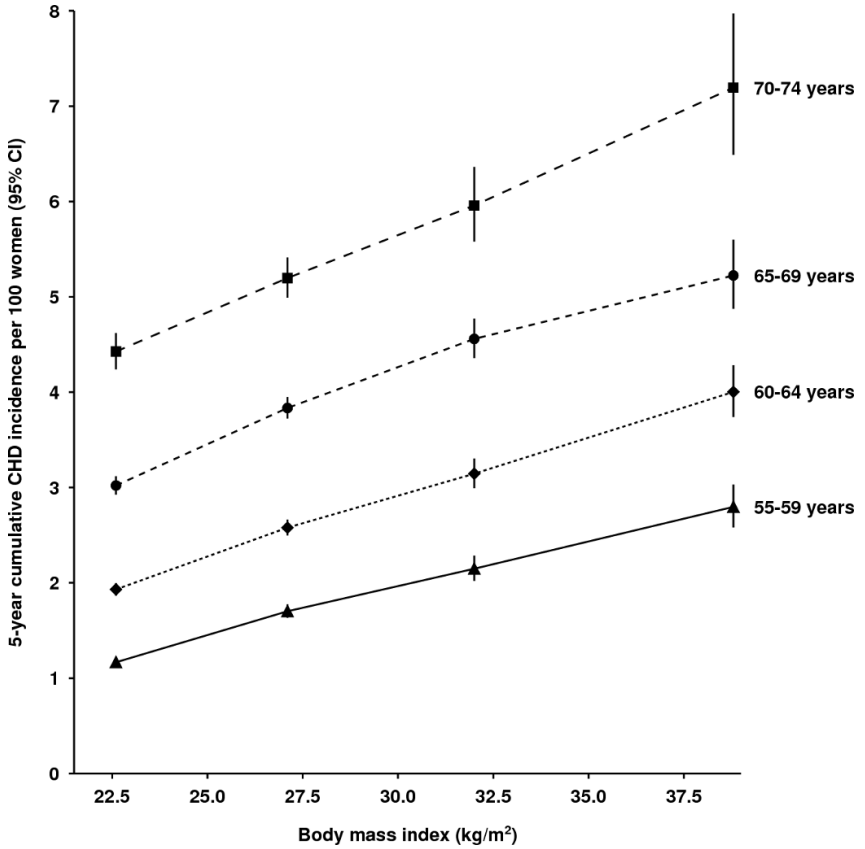


Figure 14. 5-years cumulative incidence of coronary heart disease w.r.t. BMI for British women, by age group. Canoy et al. (2013).

Family Background and Health

- Several diseases can be transmitted from parents to their children but also SES characteristics are intergenerationally related.
- Adverse behavior during pregnancy, e.g. smoking, might affect children's health and economic outcomes later in life.

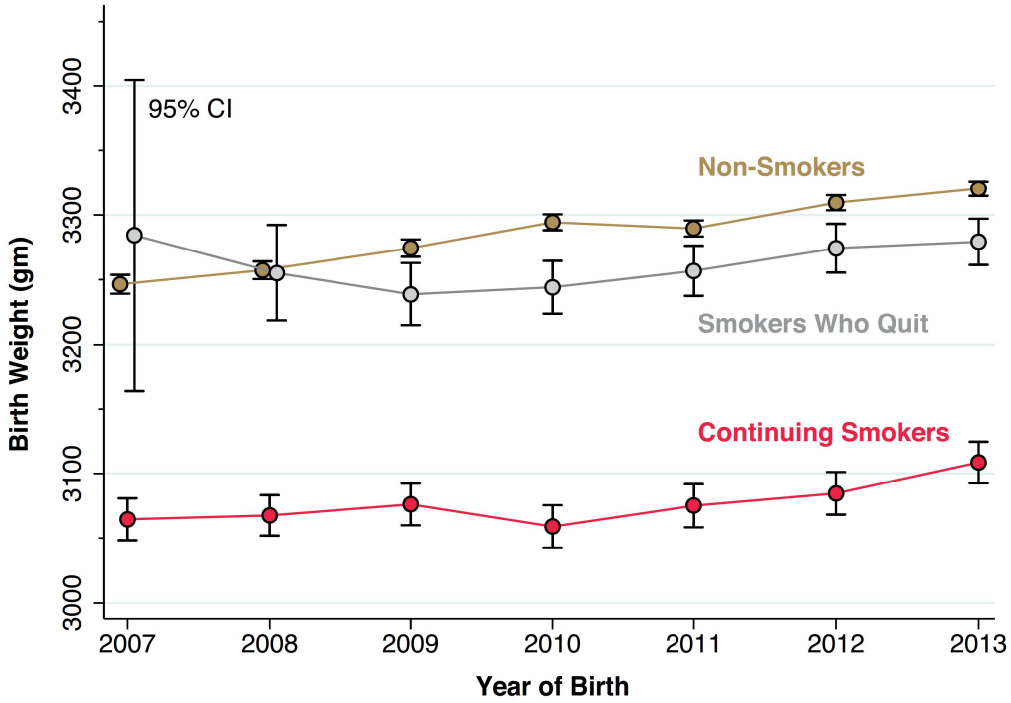


Figure 15. Annual mean birth weight among pregnant women in Uruguay, 2007-2013. Harris et al. (2015).

Trends in Health Inequality

Introduction

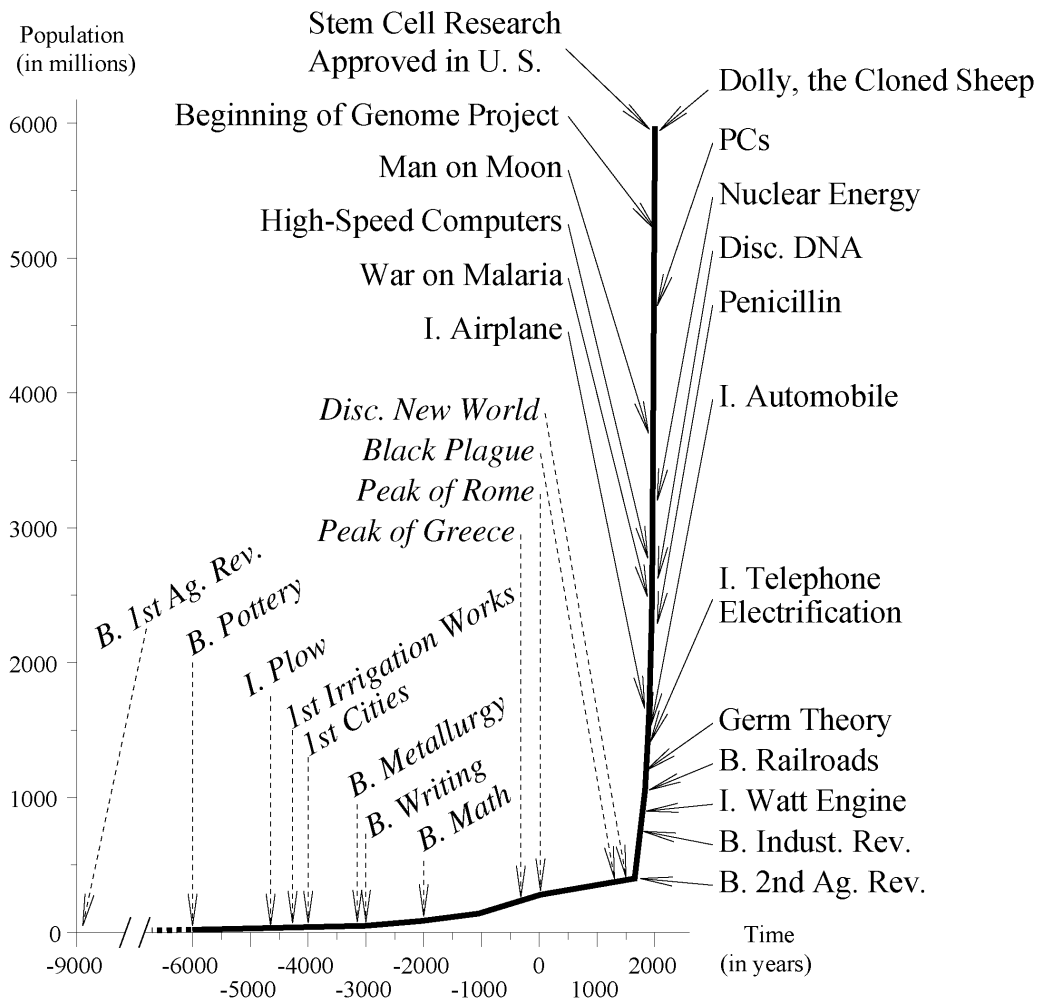


Figure 16. The growth of world population and some major events in the history of technology. Source: Fogel (2004).

Table 2. Life expectancy at birth in some countries, 1725-2010.

Country	1725	1750	1800	1850	1900	1950	1990	2010
England/UK	32	37	36	40	48	69	76	80
France		26	33	42	46	67	77	81
U.S.	50	51	56	43	48	68	76	78
Egypt						42	60	73
India					27	39	59	63
China						41	70	73
Japan						61	79	83

- **Living standards** increased exceptionally over the last 200 years.
- Coupled with a rapid **mortality decline**.
- *Is there a relationship between income and health?*

Income-Health Association in the Very Long Run

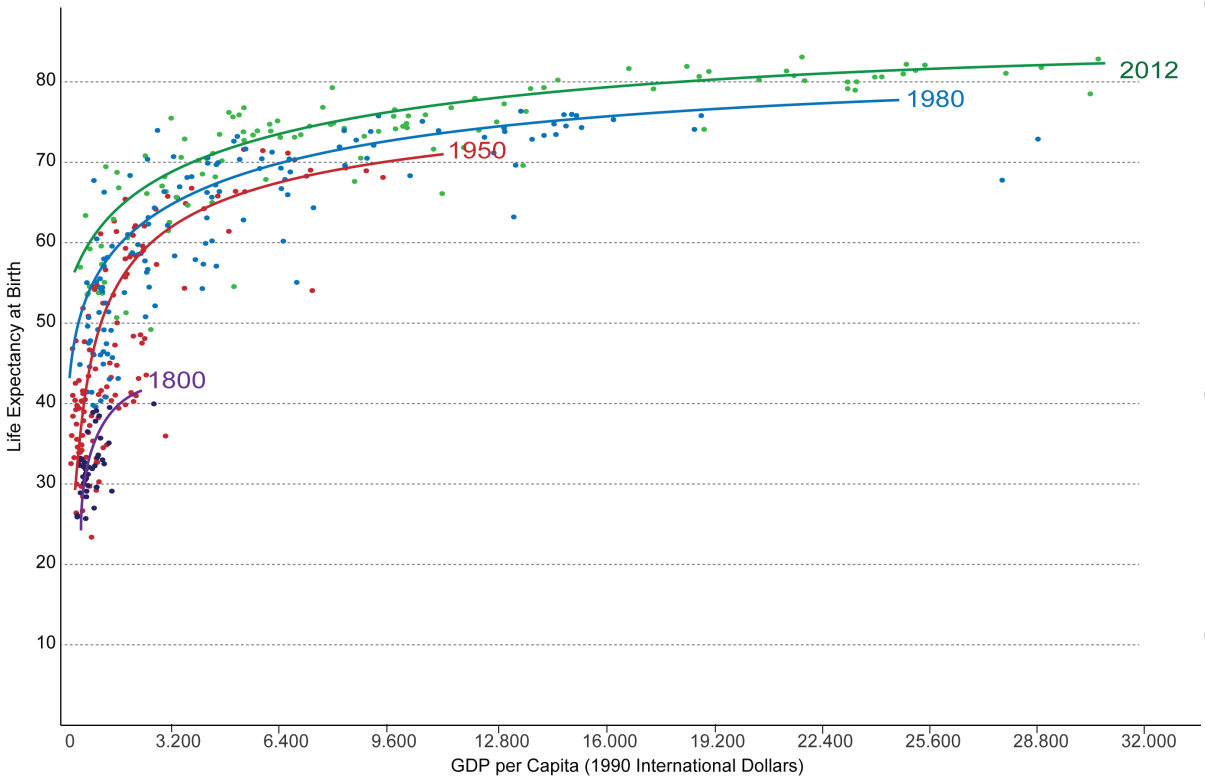


Figure 17. The Preston Curve: Life Expectancy versus GDP Per Capita from 1800 to 2012.

- The **Preston curve**: **cross-sectional** association between life expectancy and income per capita.
- Association stronger for countries with **low** levels of income.
- But we cannot infer that income and health are *causally* related. *Why?*

Improved Income, Improved Health

- In past decades most countries experienced enormous **health improvements** coupled with improved **economic conditions**.
- **Over time**:
  - Life expectancy increased,
  - Child mortality decreased,
  - Health generally improved.

  ...in **all social classes**.
- Even when health and living standards improve, **inequalities in health** may **persist**.

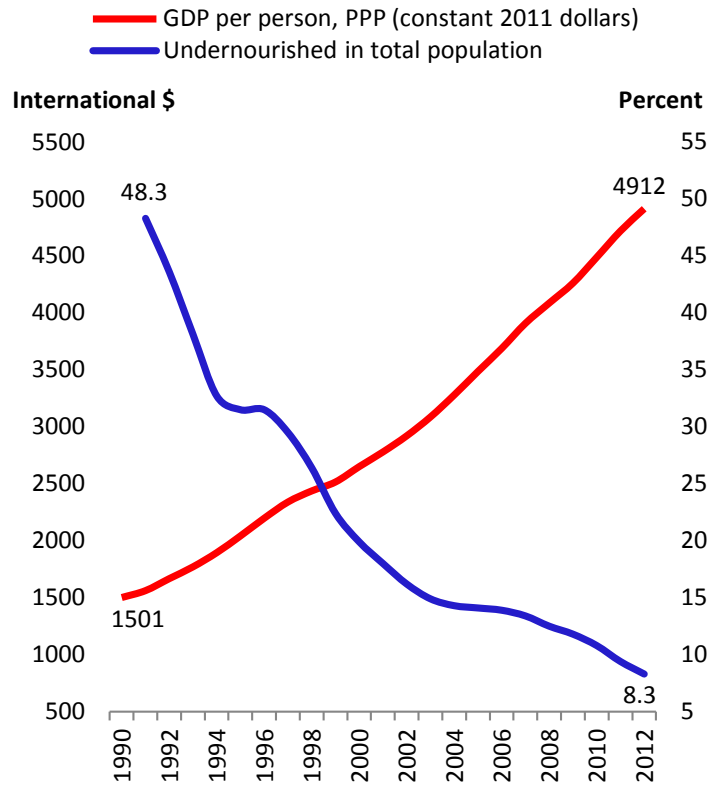


Figure 18. Undernourishment and economic growth in Vietnam, 1990-2012. Source: WHO (2014).

Income Inequality

- After WWII and until the 1970s developed countries experienced large increases in income.
- Such economic improvements were largely **shared** among population groups.
- From the 70s onward income gains disproportionately concentrated towards **top** of income distribution.
- **Widening** of the income gap.

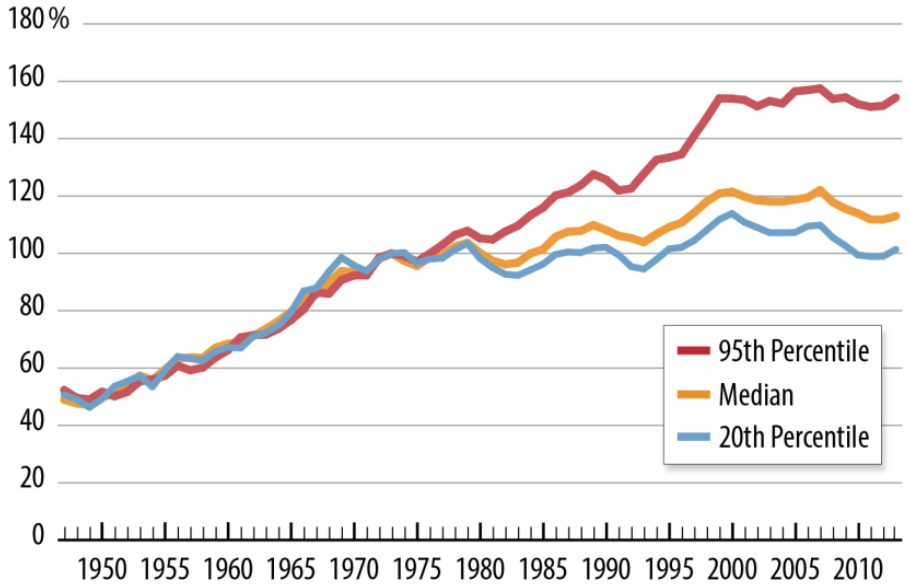


Figure 19. Real family income in the U.S. as percentage of 1973 level, by some income percentiles, 1947-2013. Source: Stone et al (2015).

Health and Perceived Health Inequality

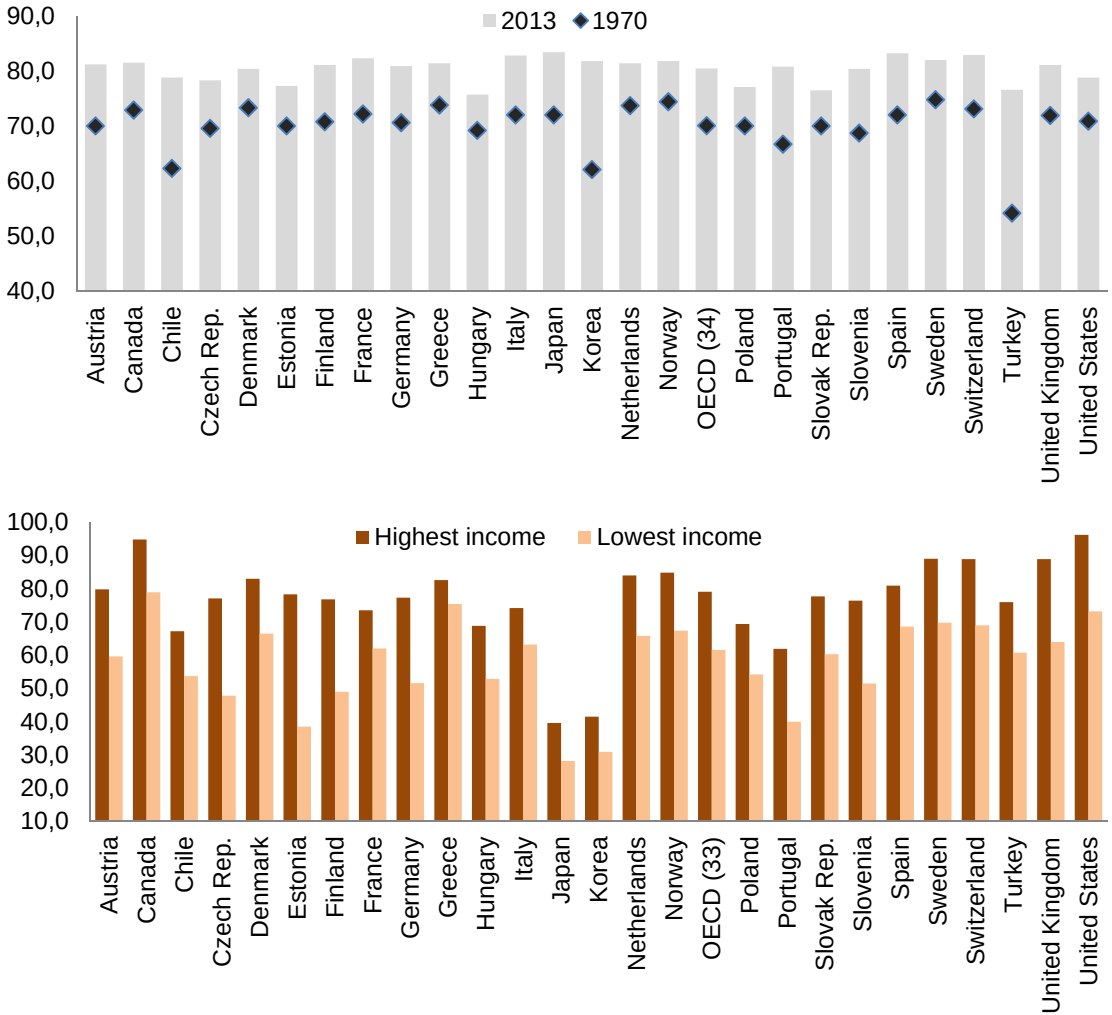


Figure 20. Life expectancy (in years) in 1970 and 2013 and perceived health status by income level in 2013 (% of population aged 15+ reporting to be in good or very good health). Source: OECD data.

Health Inequalities between Ethnicities

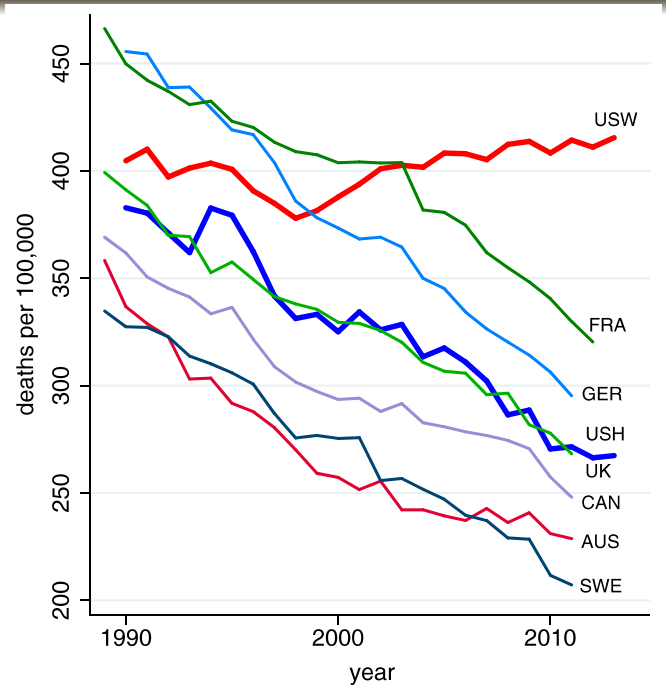


Figure 21. All-cause mortality, ages 45-54 for US White non-Hispanics (USW), US Hispanics (USH), and six comparison countries. Source: Case and Deaton (2015).

Table 3. Changes in mortality rates 2013-1999, ages 45-54 (2013 mortality rates). Source: Case and Deaton (2015).

	All-cause mortality	Poisonings	Intentional self-harm	Chronic liver cirrhosis
White non-Hispanics	33.9 (415.4)	22.2 (30.1)	9.5 (25.5)	5.3 (21.1)
Black non-Hispanics	-214.8 (581.9)	3.7 (21.8)	0.9 (6.6)	-9.5 (13.5)
Hispanics	-63.6 (269.6)	4.3 (14.4)	0.2 (7.3)	-3.5 (23.1)

Summary and Conclusions

Summary and Conclusions

- We introduced some basic **health indicators** used to assess population's health in different stages of life (newborns; children; adults).
- We observe large inequalities in health in **developing** as well as in **developed** countries.
- Inequalities in health are strictly interrelated to individuals' socioeconomic status, measured for instance by income, educational attainment, area of residence etc. We talk about a **socioeconomic gradient** in health.
- Inequalities are persistent over **time** and may become larger even if the overall conditions of a country improve (e.g. increased income).