# Revealing Human Progress

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# Outline

- ## Introduction
  - Quotes, poll questions, **The Big Reveal**
- ## Data and graphs (lots!)
  - Human progress, perception vs. reality
- ## **My Request (Take-Home Message)**
- ## Class examples
- ## Conclusion
  - Disclaimer, 2019-2020, more info, final quote

# Quote 1: Quantitative mindset

"How can we soundly appraise the state of the world?  The answer is to *count*. … A quantitative mindset, despite its nerdy aura, is in fact the morally enlightened one, because it treats every human life as having equal value rather than privileging the people who are closest to us or most photogenic."  – Steven Pinker

# Question A

- **In the last 20 years, the proportion of the world population living in extreme poverty has …?**
    - ❑ Almost doubled
    - ❑ Remained more or less the same
    - ❑ Almost halved

# Question B

- What percent of the world's 1-year-old children today have been vaccinated against some disease?
  - 20 percent
  - 50 percent
  - 80 percent

# Question C

- Worldwide, 30-year-old men have spent 10 years in school, on average. How many years have women of the same age spent in school, on average?
  - 9 years
  - 6 years
  - 3 years

# Quote 2: Most important change

"Over the past twenty years, the proportion of the global population living in extreme poverty has halved. This is absolutely revolutionary. I consider it to be the most important change that has happened in the world in my lifetime." – Hans Rosling

# Question A

- In the last 20 years, the proportion of the world population living in extreme poverty has …?
  - ☐ Almost doubled
  - ☐ Remained more or less the same
  - ☐ ***Almost halved***

# Question B

- What percent of the world's 1-year-old children today have been vaccinated against some disease?
    - ☐ 20 percent
    - ☐ 50 percent
    - ☐ ***80 percent***

# Question C

- Worldwide, 30-year-old men have spent 10 years in school, on average. How many years have women of the same age spent in school, on average?
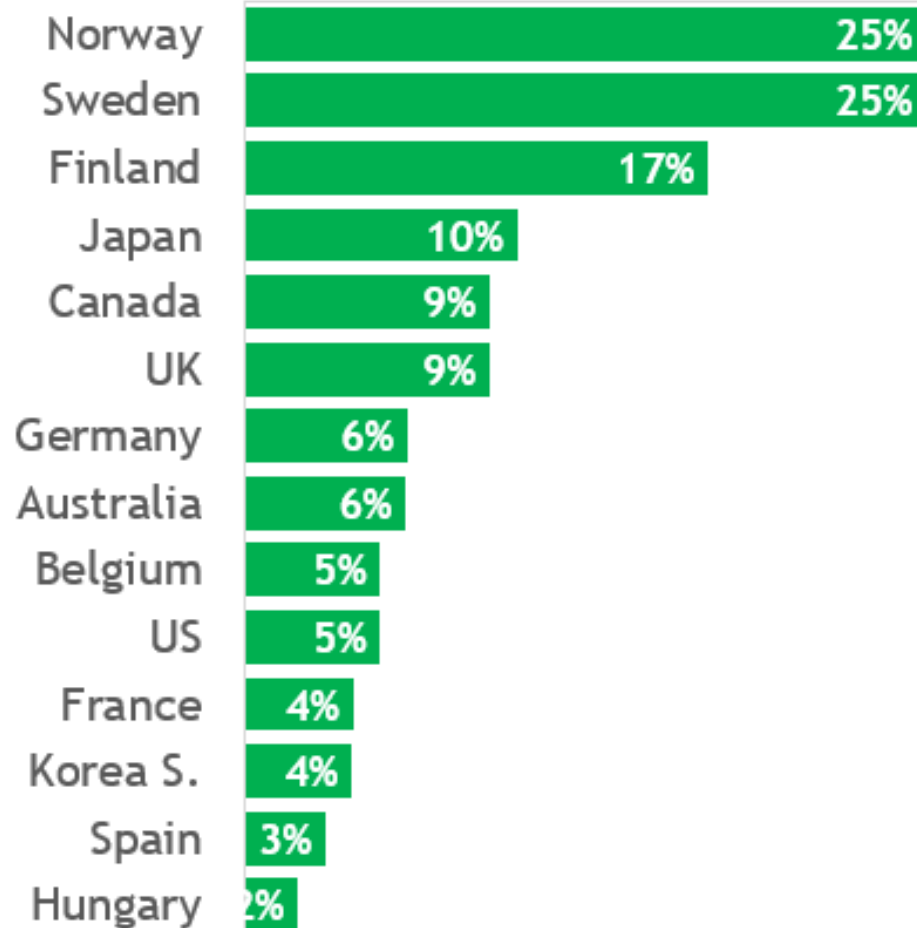  - *9 years*
  - 6 years
  - 3 years

# Quote 3: The big reveal!

"Here is a shocker: *The world has made spectacular progress in every single measure of human well-being.*

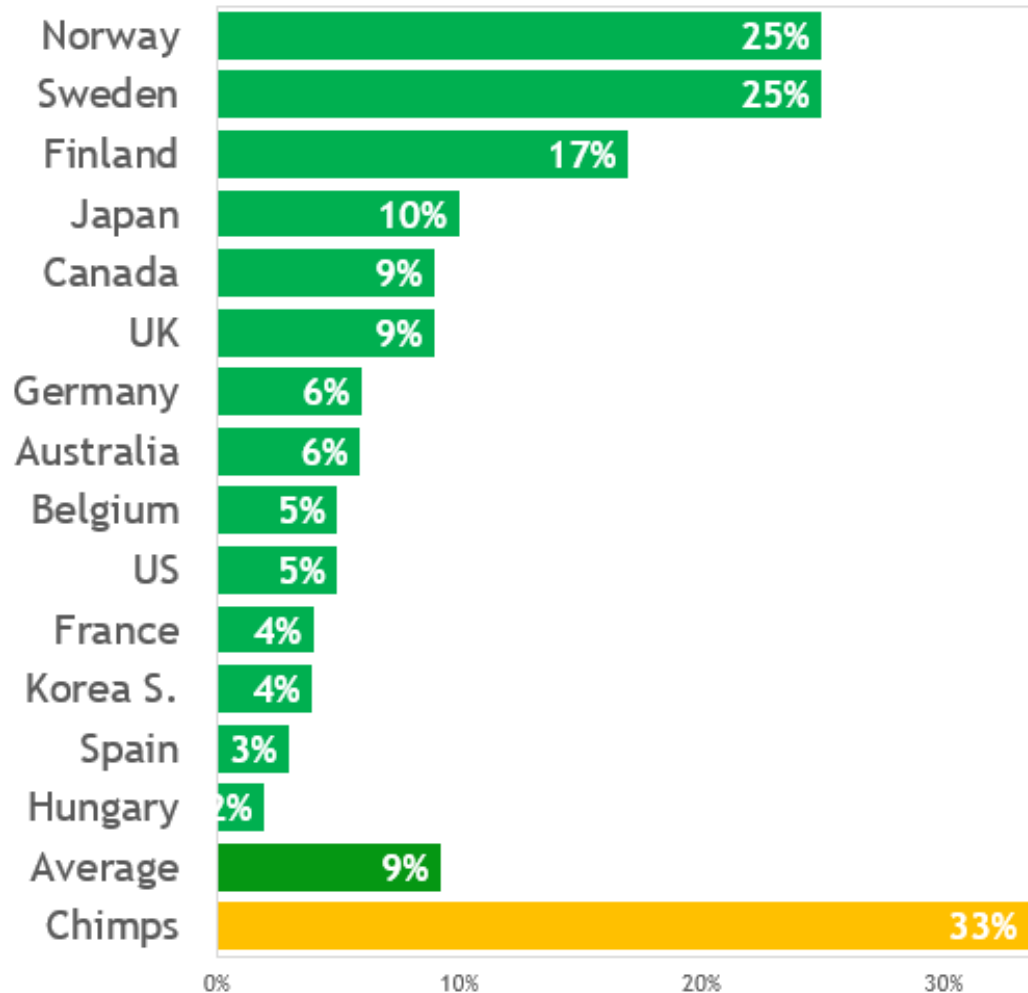Here is a second shocker: *Almost no one knows about it.*"  – Pinker
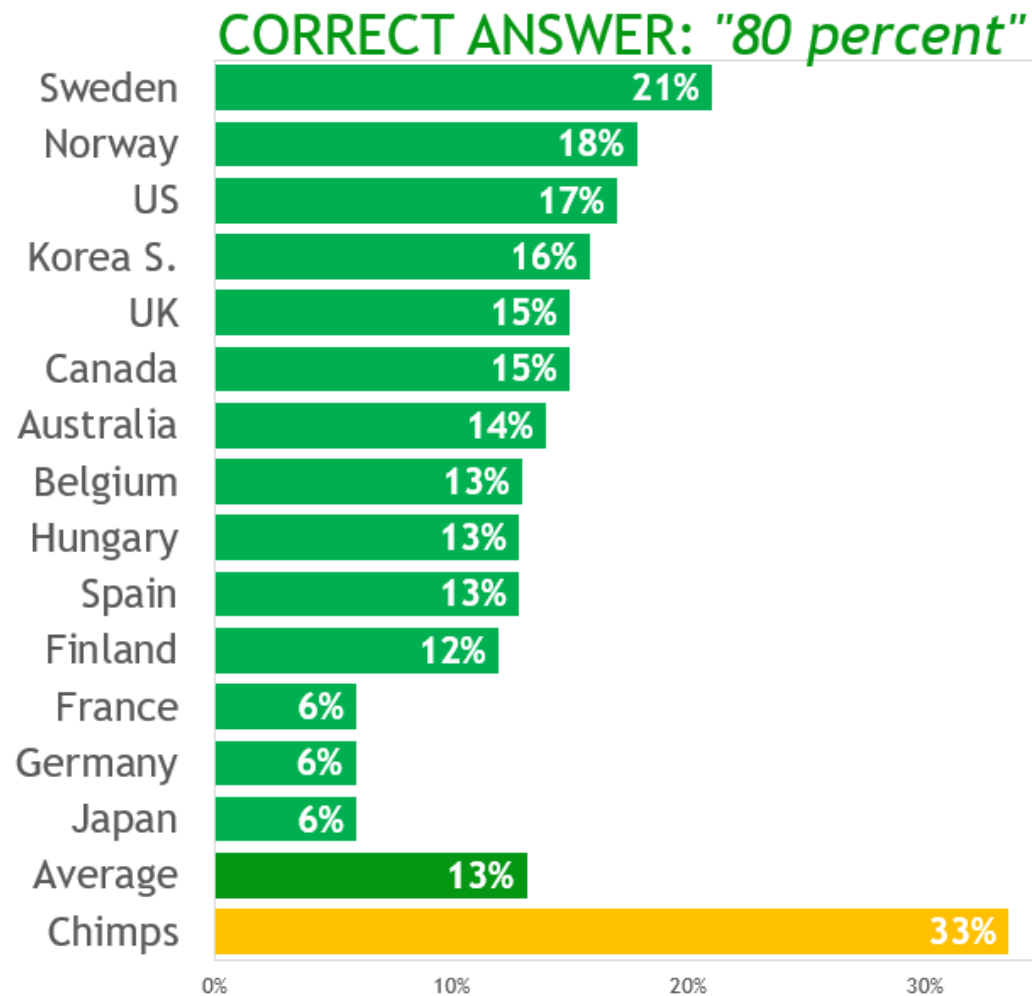
# Question A (poverty)

**CORRECT ANSWER:** *"Almost halved"*

| Country | Percent |
|---|---|
| Norway | 25% |
| Sweden | 25% |
| Finland | 17% |
| Japan | 10% |
| Canada | 9% |
| UK | 9% |
| Germany | 6% |
| Australia | 6% |
| Belgium | 5% |
| US | 5% |
| France | 4% |
| Korea S. | 4% |
| Spain | 3% |
| Hungary | 2% |

# Question A (poverty)



**CORRECT ANSWER:** *"Almost halved"*

| Country | Percentage |
|---------|-----------|
| Norway | 25% |
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| Germany | 6% |
| Australia | 6% |
| Belgium | 5% |
| US | 5% |
| France | 4% |
| Korea S. | 4% |
| Spain | 3% |
| Hungary | 2% |
| Average | 9% |
| Chimps | 33% |

# Question B (vaccinations)

**CORRECT ANSWER: "80 percent"**

| Country | Percent |
|---------|---------|
| Sweden | 21% |
| Norway | 18% |
| US | 17% |
| Korea S. | 16% |
| UK | 15% |
| Canada | 15% |
| Australia | 14% |
| Belgium | 13% |
| Hungary | 13% |
| Spain | 13% |
| Finland | 12% |
| France | 6% |
| Germany | 6% |
| Japan | 6% |
| Average | 13% |
| Chimps | 33% |

# Question C (schooling)



**CORRECT ANSWER: "9 years"**

| Country | Percent |
|---|---|
| Korea S. | 32% |
| Hungary | 32% |
| US | 26% |
| Australia | 25% |
| Germany | 25% |
| Japan | 21% |
| Canada | 20% |
| UK | 19% |
| Sweden | 18% |
| France | 18% |
| Spain | 13% |
| Belgium | 13% |
| Finland | 10% |
| Norway | 8% |
| Average | 20% |
| Chimps | 33% |

# Worse than ignorance



Share of humans with different scores

**80%** scored worse than chimps

**10%** scored better than chimps

Number of correct answers

Sources: Novus and Ipsos MORI. See: gapm.io/gms17m
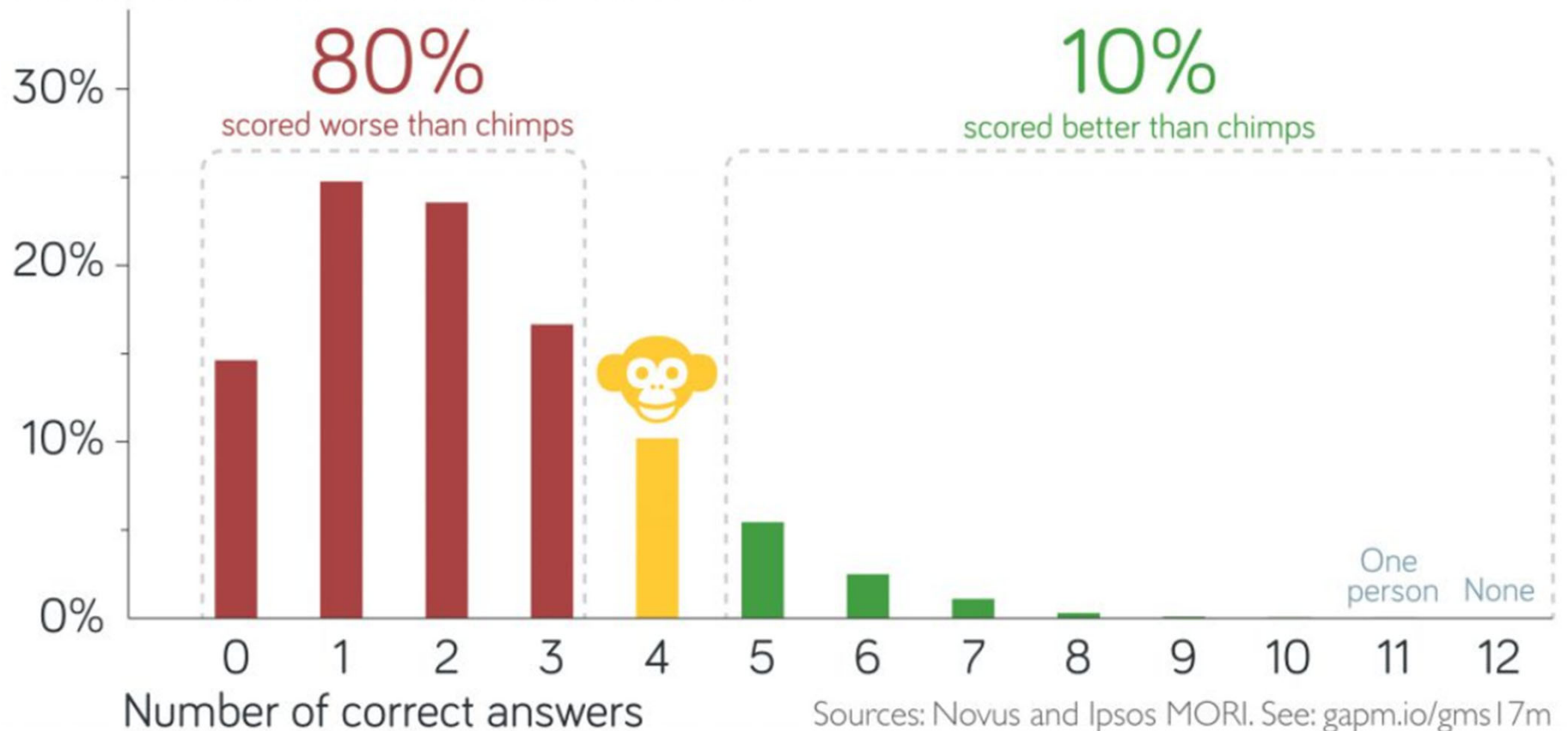
# Inspirations for this talk
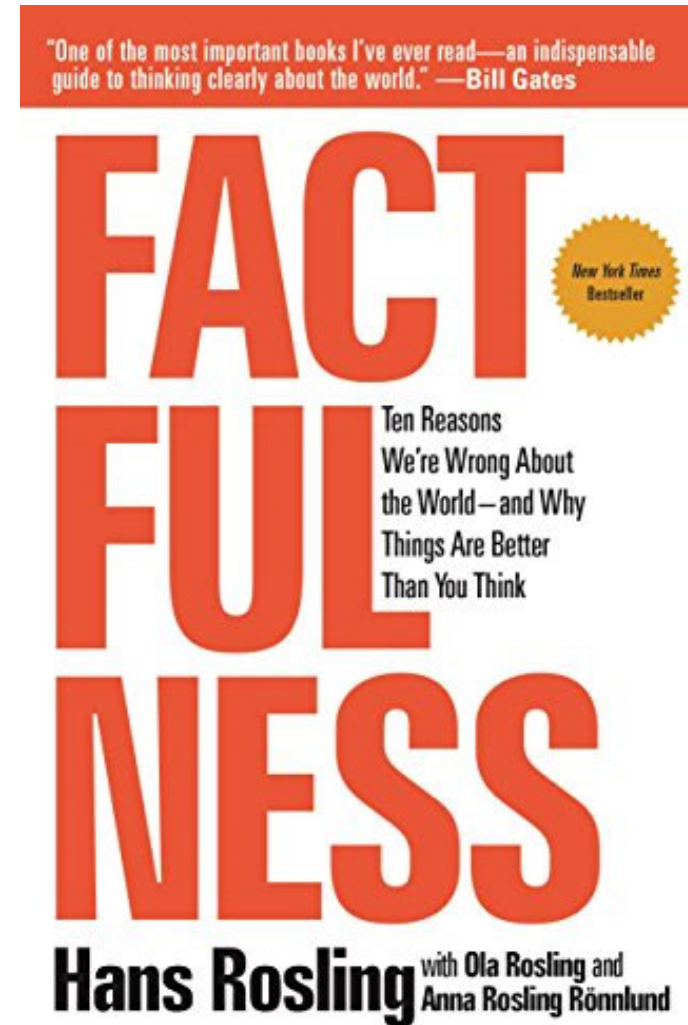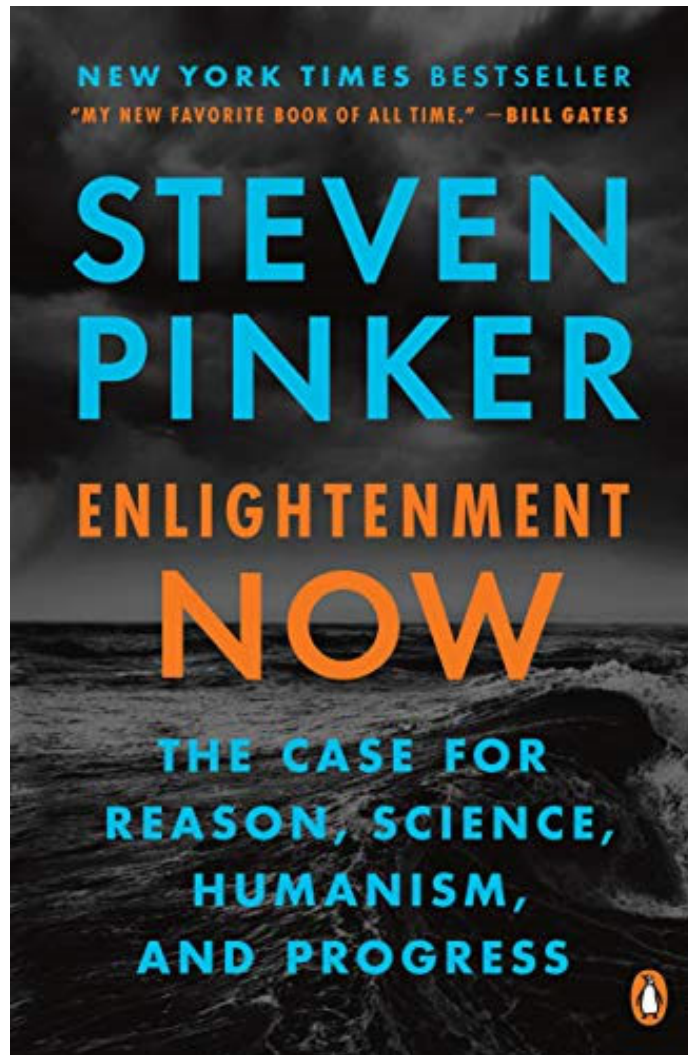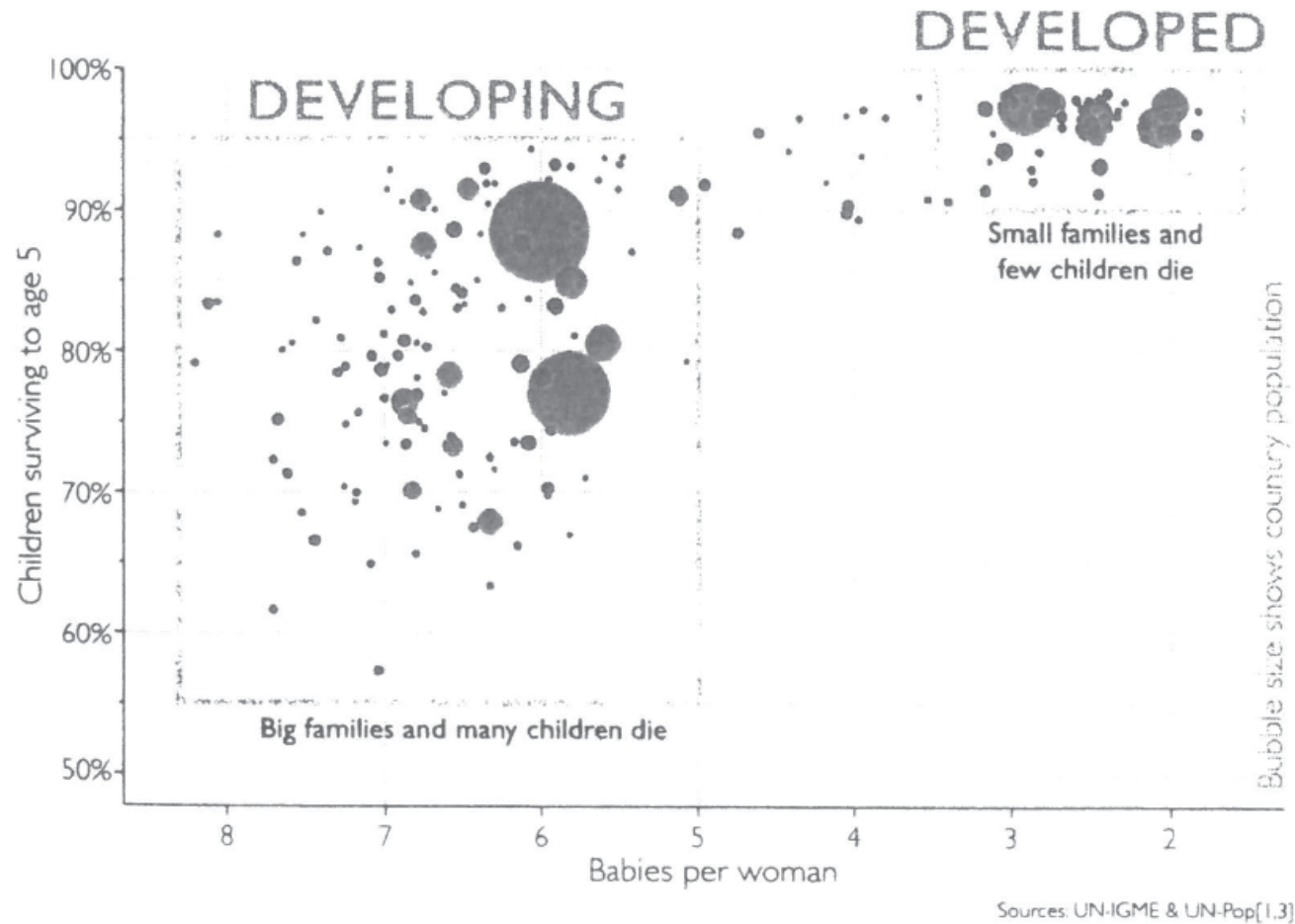
# Gap instinct (Rosling)

# Gap instinct (Rosling)



DEVELOPING

DEVELOPED

Small families and
few children die

1965

Big families and many children die

Children surviving to age 5

Babies per woman

Bubble size shows country population

Sources: UN-IGME & UN-Pop[1,3]
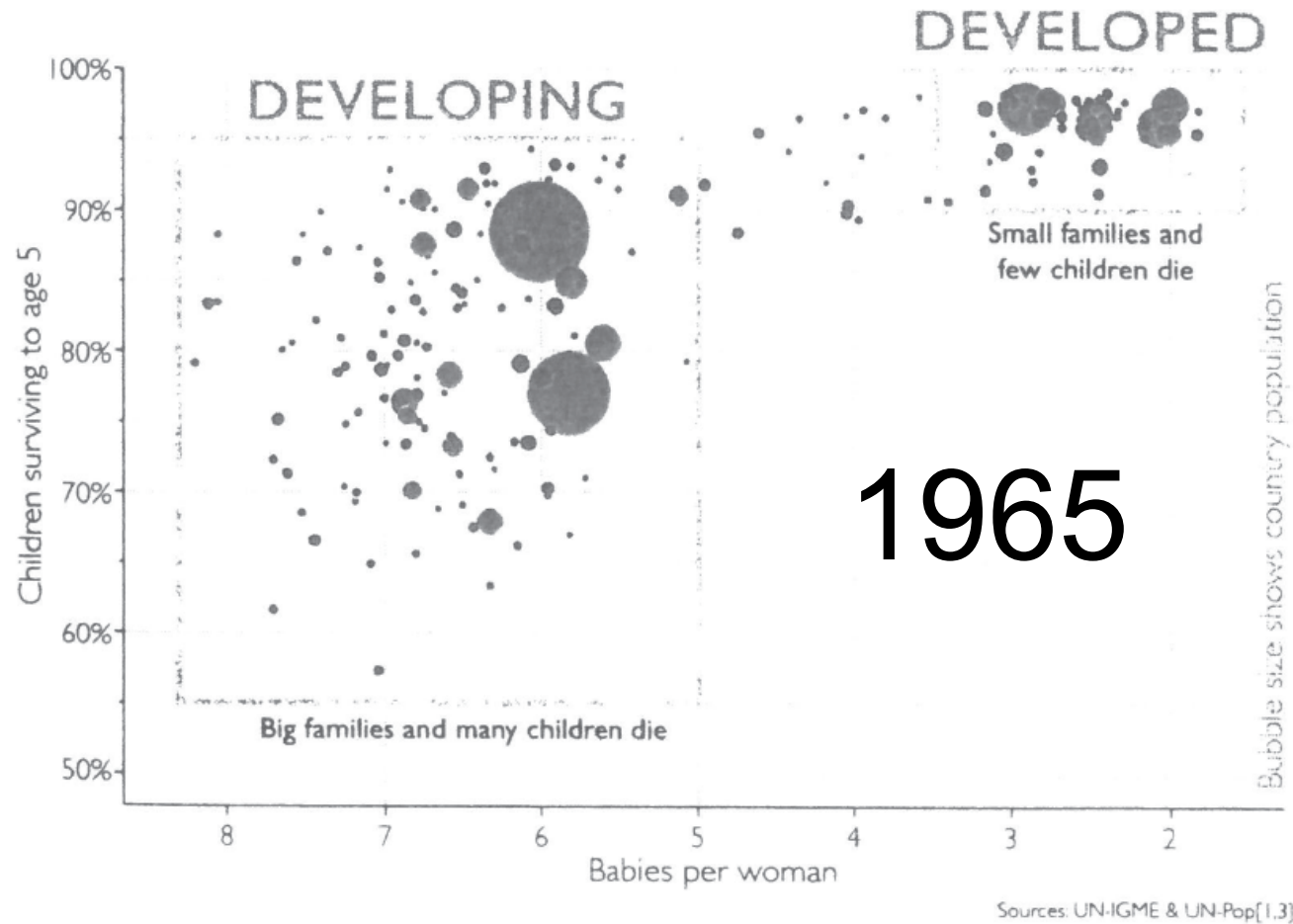
# Gap instinct (Rosling)
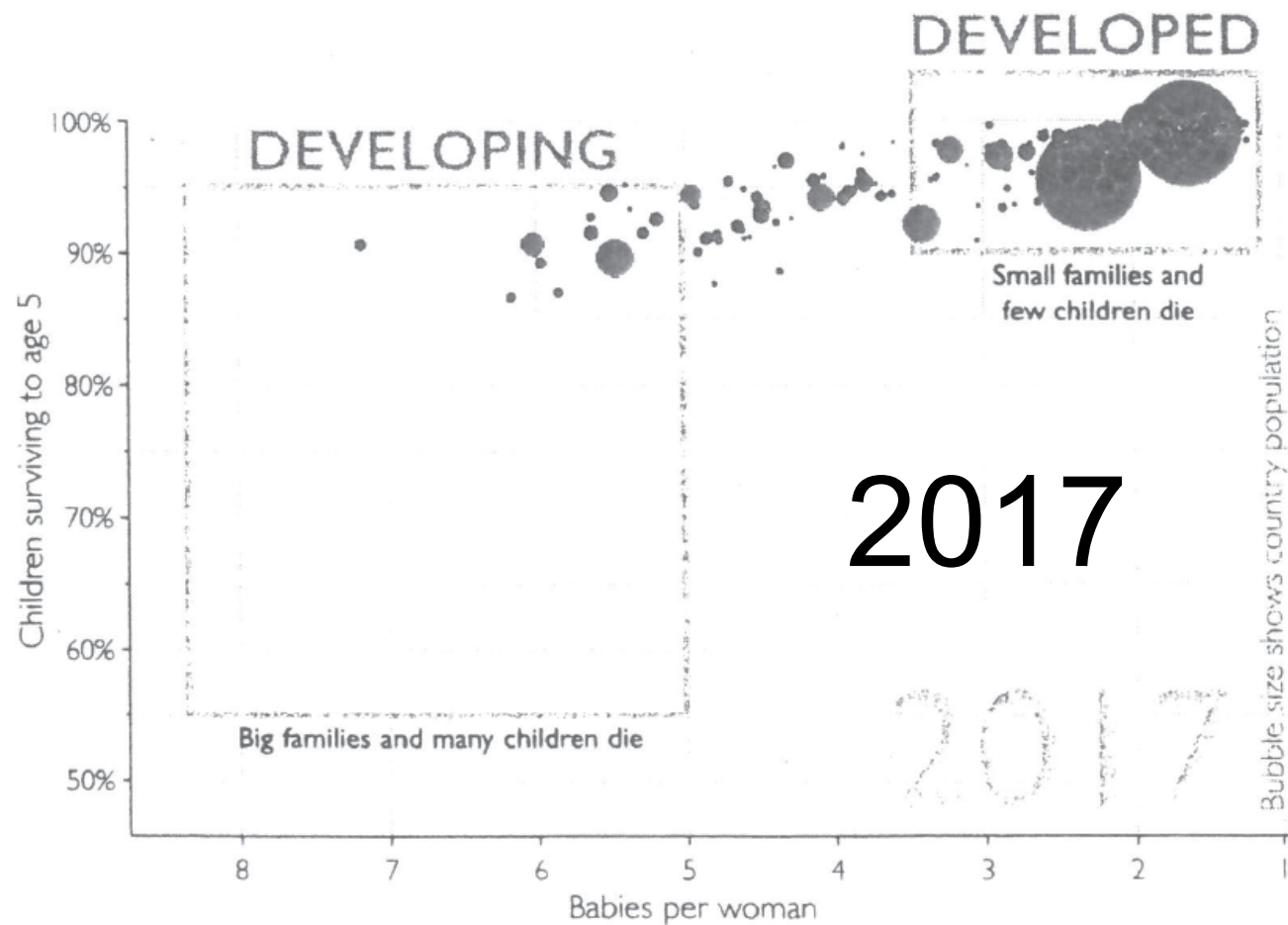
# Perception: World is getting worse



Thinking generally about the world, all things considered, do you think the world is getting better or worse, or neither getting better nor worse? 18235 adults in the following countries. Results ordered by net score (% getting better minus % getting worse)

| | Getting better | Neither | Getting worse |
|---|---|---|---|
| China* | 41 | 16 | 33 |
| Indonesia* | 23 | 28 | 42 |
| Saudi Arabia | 16 | 15 | 55 |
| UAE | 10 | 23 | 60 |
| Denmark | 8 | 30 | 57 |
| Norway | 8 | 25 | 61 |
| Germany | 4 | 31 | 59 |
| Sweden | 10 | 20 | 66 |
| Thailand* | 11 | 17 | 69 |
| Singapore | 4 | 29 | 62 |
| Finland | 8 | 20 | 67 |
| US | 6 | 23 | 65 |
| GB | 4 | 25 | 65 |
| Malaysia* | 6 | 23 | 68 |
| Hong Kong* | 8 | 17 | 71 |
| Australia | 3 | 25 | 70 |
| France | 3 | 11 | 81 |
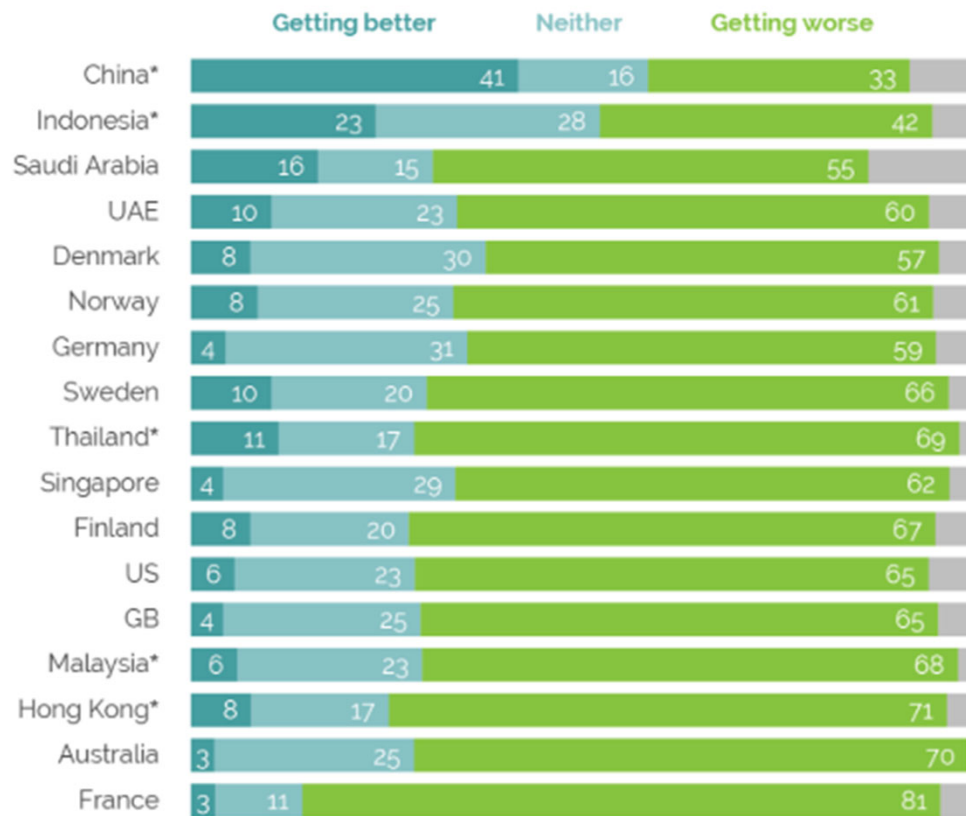
*Weighted to be representative of online population

YouGov | yougov.com

November – December 2015

# Crime rate: Perception vs. actual

U.S. Violent Crime Rate^ and Americans' Perceptions of Crime Rate
vs. Year Ago

■ % More crime in the U.S.    ■ Violent crime victimization rate
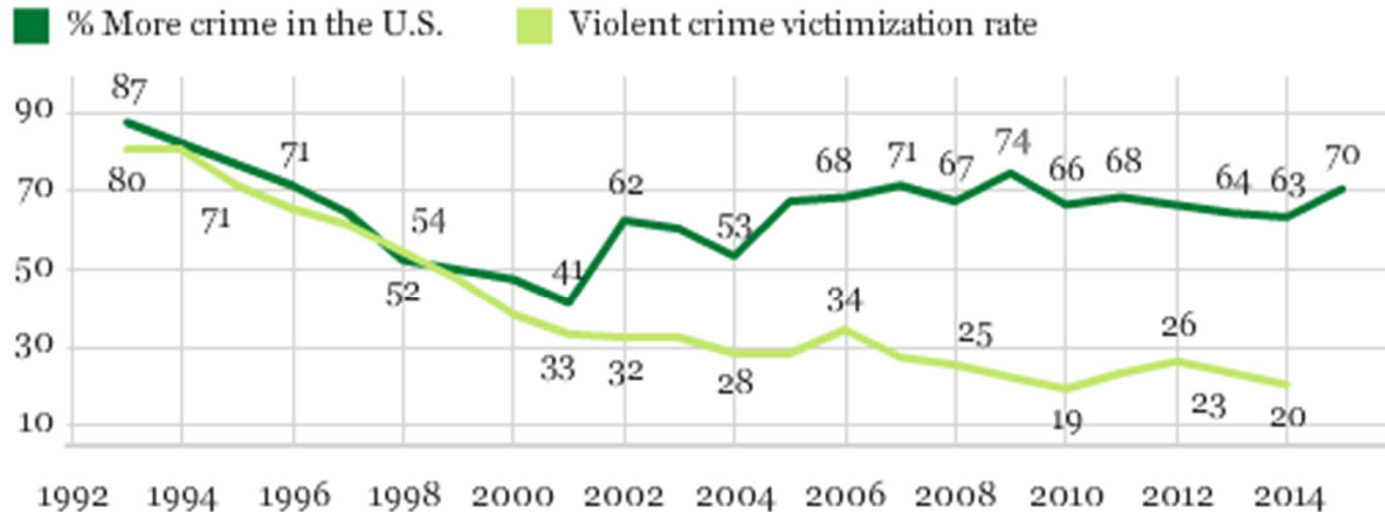


^ Violent crime rate is number of victimizations per 1,000 persons that occurred during the
year. Source: Bureau of Justice Statistics, National Crime Victimization Survey, 1993-2014
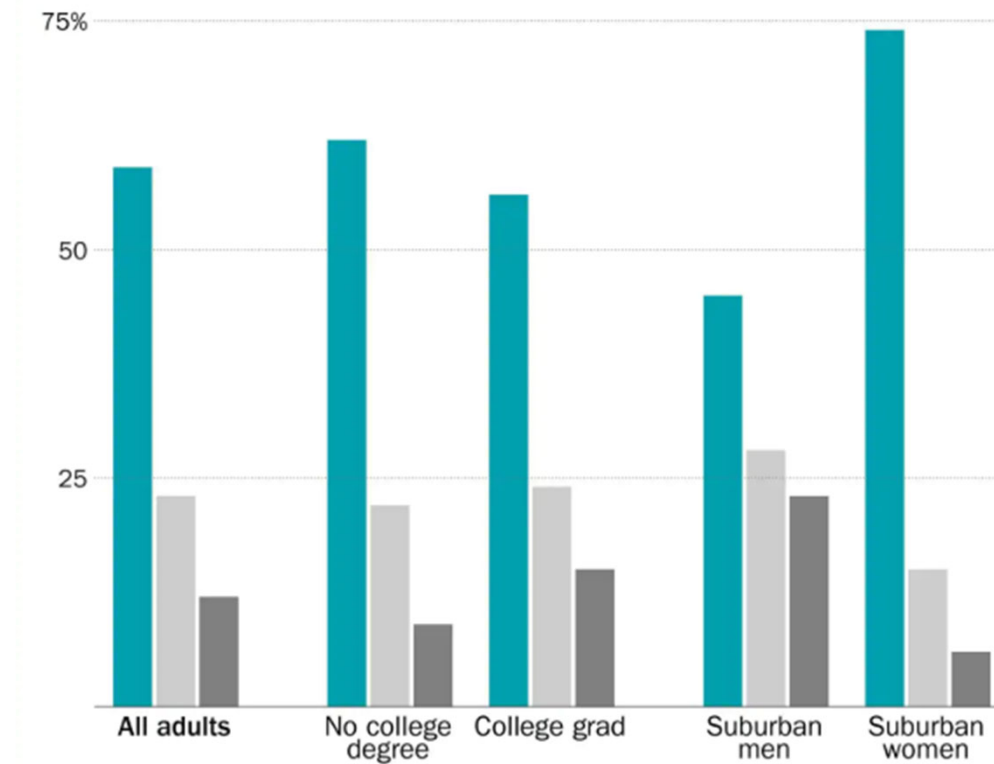
GALLUP

# Gun murder rate: perception

**Compared to 25 years ago, how has the per capita gun murder rate in the U.S. changed?**

NPR-PBS NewsHour-Marist poll, Feb. 2019

■ HIGHER　　□ ABOUT THE SAME　　■ LOWER



(Philip Bump/The Washington Post)

# Gun murder rate: actual



**Firearm murders per year as a function of population**
Census Bureau, FBI Uniform Crime Reporting data

7.5 FIREARM HOMICIDES PER 100,000 PEOPLE

1994

5.0

2.5

1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
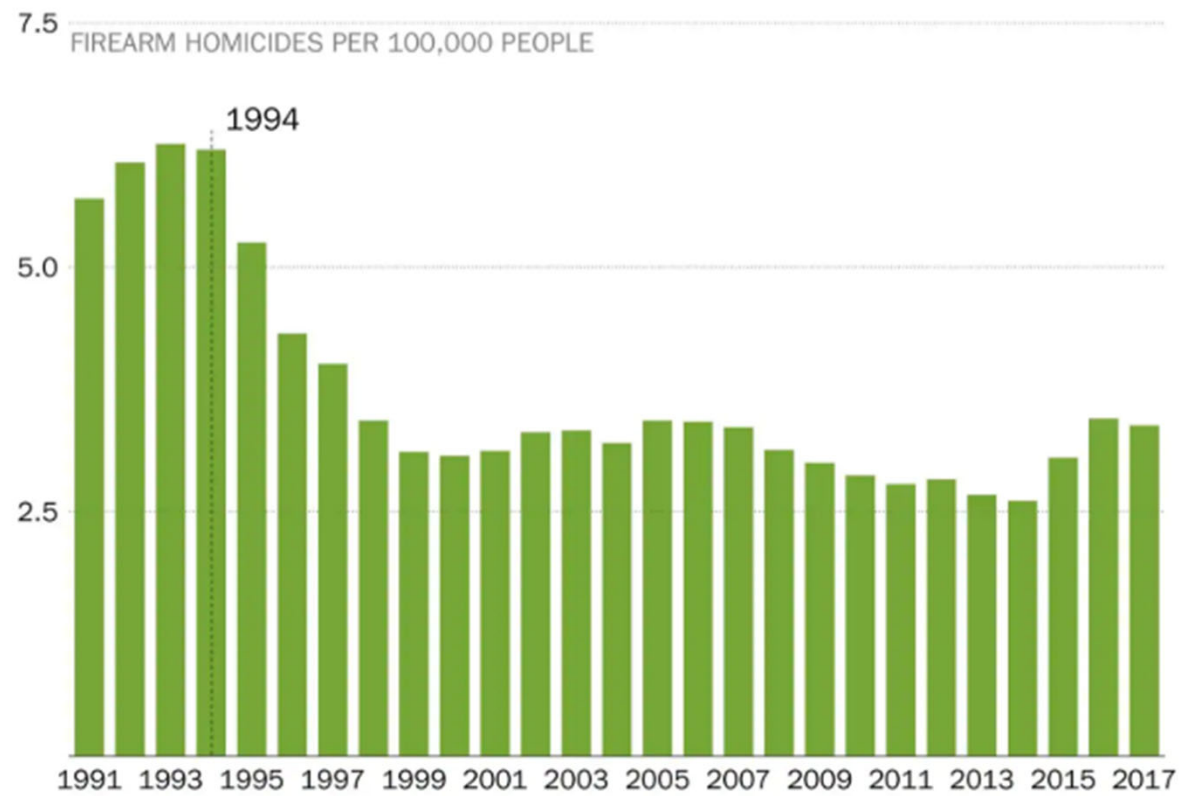
(Philip Bump/The Washington Post)

# Perceived happiness of others



In every country people think that others are less happy than they themselves say

People were asked the following question "When asked in a survey, what percentage of people do you think said that, taking all things together, they are very happy or rather happy?". The average answer is plotted on the y-axis against the actual answer on the x-axis.

# Smallpox: eradicated

Global number of reported smallpox cases
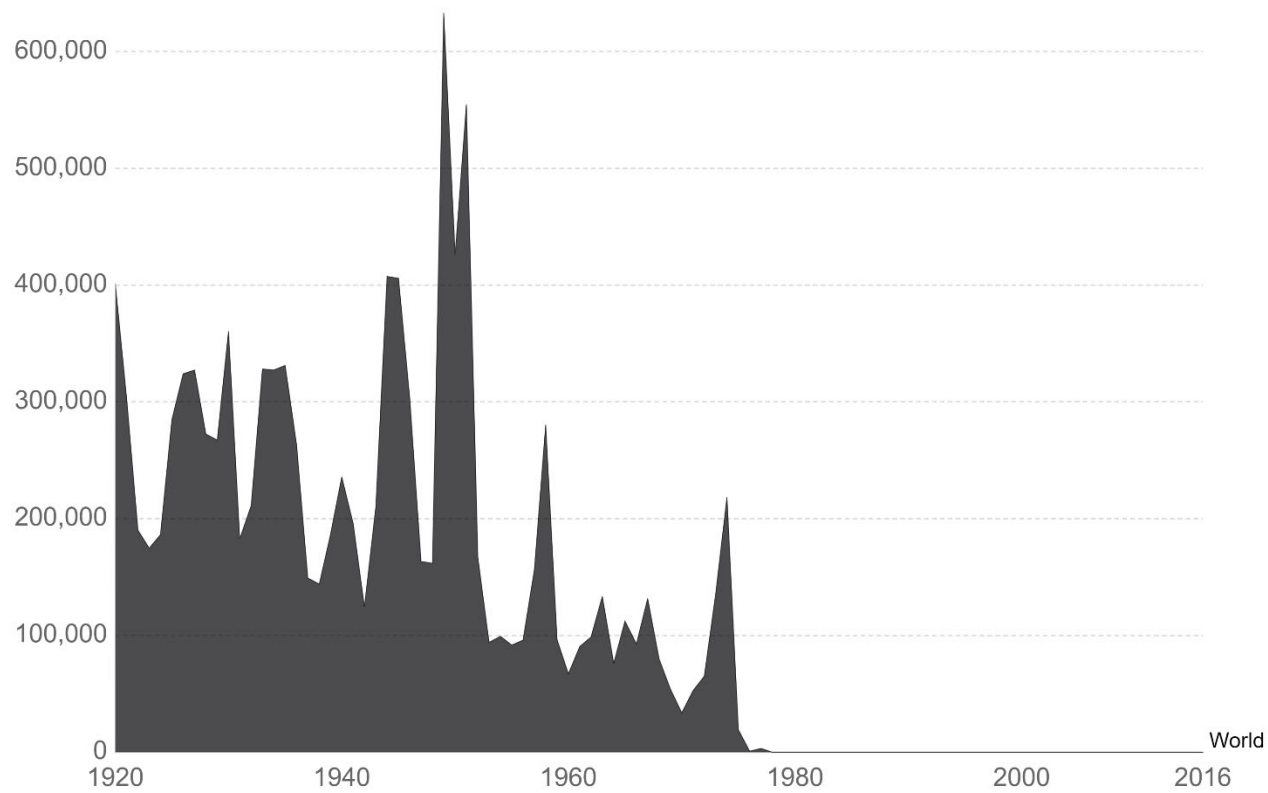
Source: World Health Organization (2011)

# Measles cases, U.S.

Reported cases and deaths of measles in the USA (1921-2015)
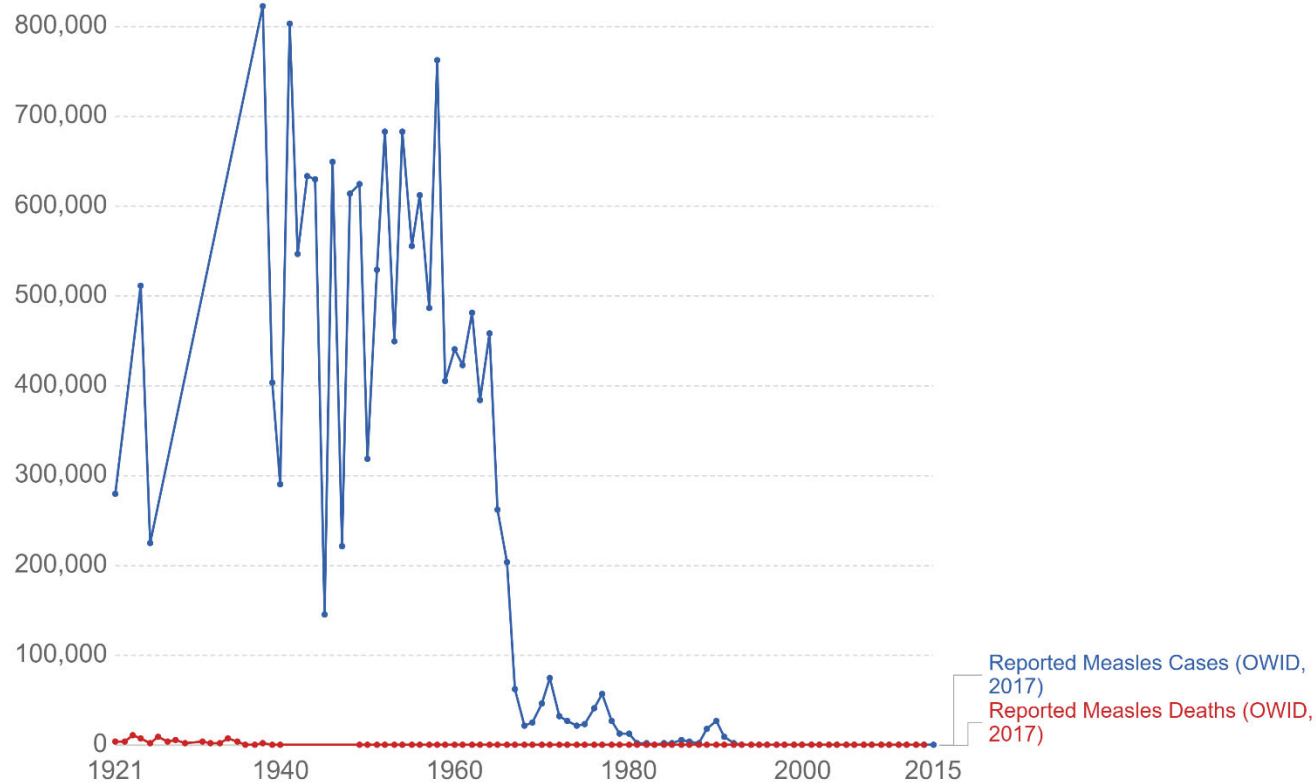


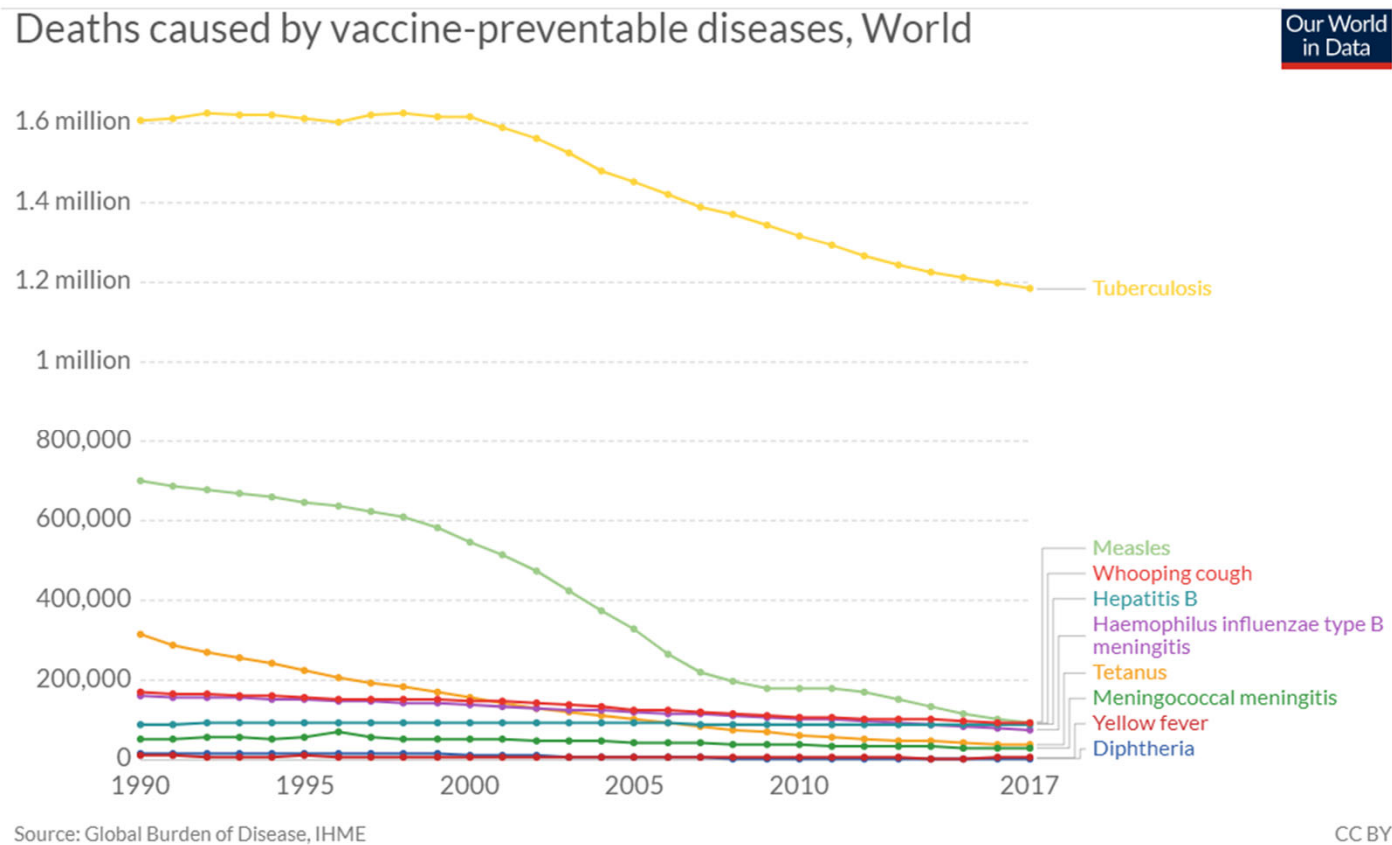Source: Our World in Data (2017)

OurWorldInData.org/vaccination/ • CC BY

# Vaccine-preventable deaths



Deaths caused by vaccine-preventable diseases, World

Source: Global Burden of Disease, IHME

CC BY

# Child deaths



Global number of child deaths per year – by cause of death

Shown is the number of children younger than 5 years who died in a year. The height of the bar shows the total number of deaths with colored sections showing the number of children who died of diseases that are wholly or partially preventable by vaccines.
The number of child deaths for which there are vaccines available declined from 5.5 million deaths in 1990 to 1.8 million deaths 27 years later.
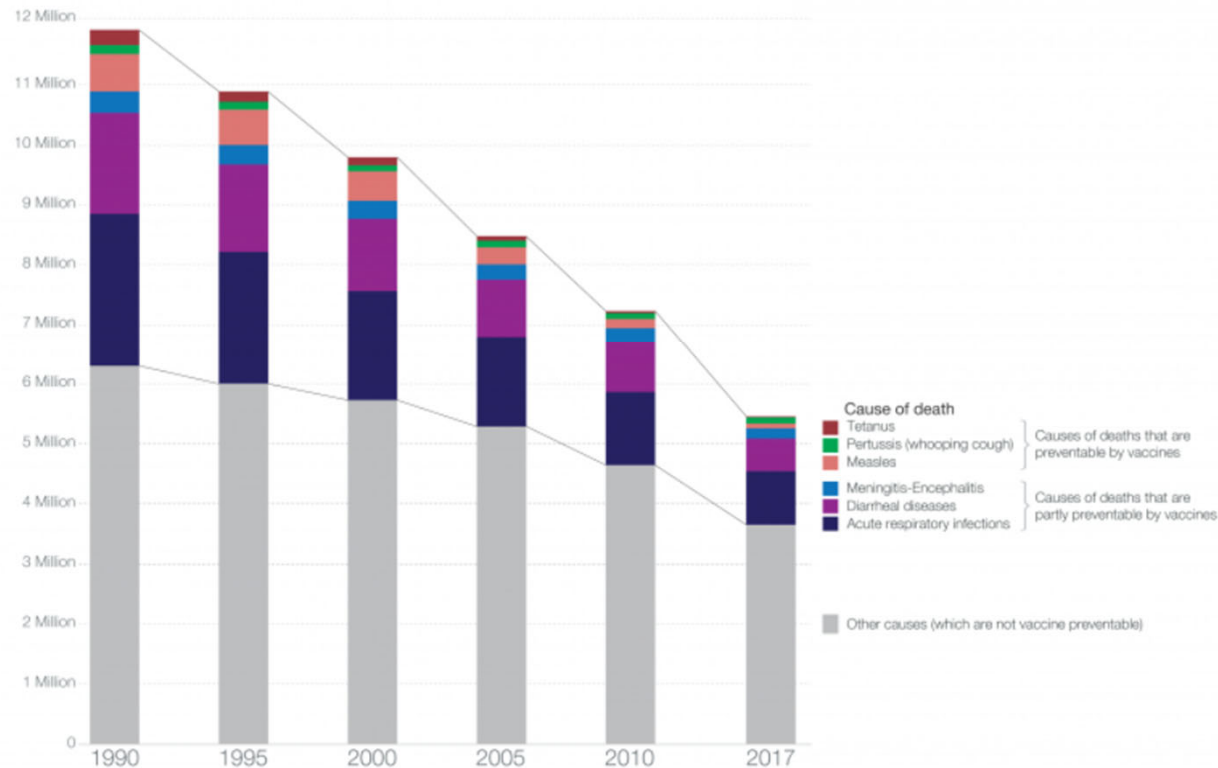
Data source: based on data from the *Institute for Health Metrics and Evaluation* (IHME)
The data visualization is available at OurWorldInData.org. There you find research and more visualizations on global development.

Licensed under CC-BY-SA by the authors.

# Motor vehicle injuries, deaths, U.S.



Motor vehicle road injuries deaths
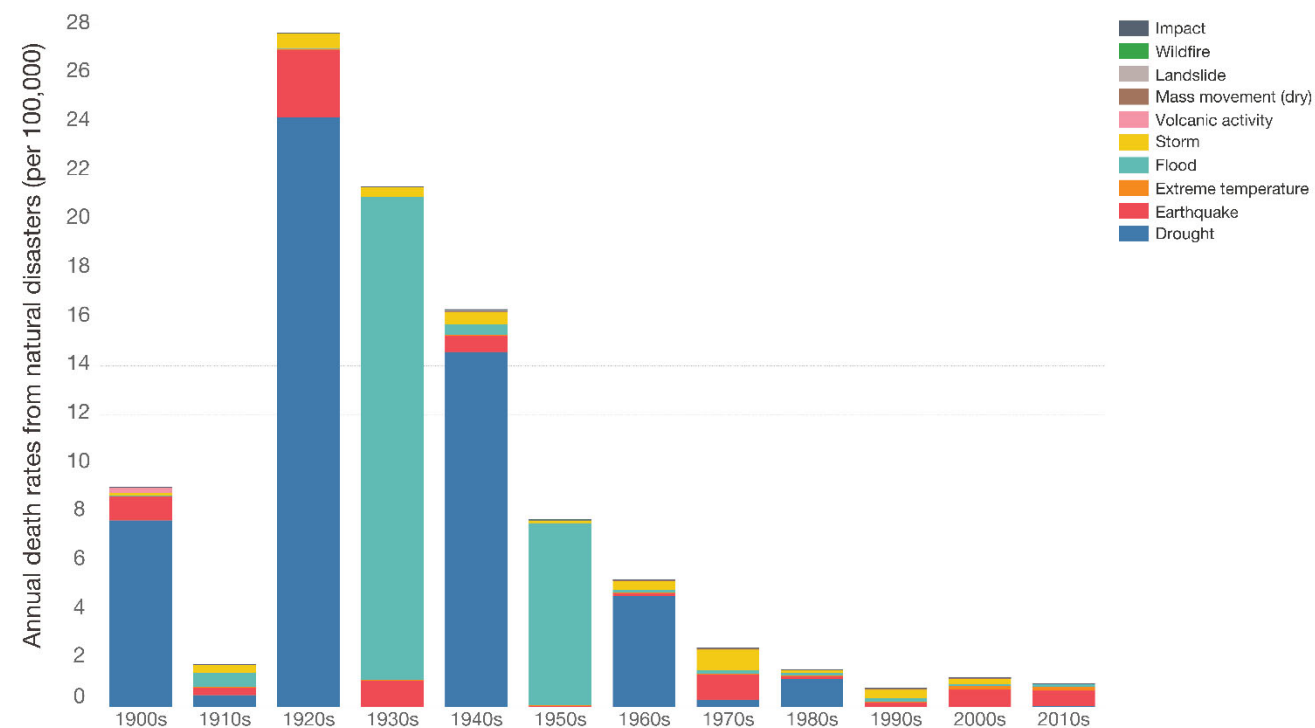per 100,000 people

HumanProgress
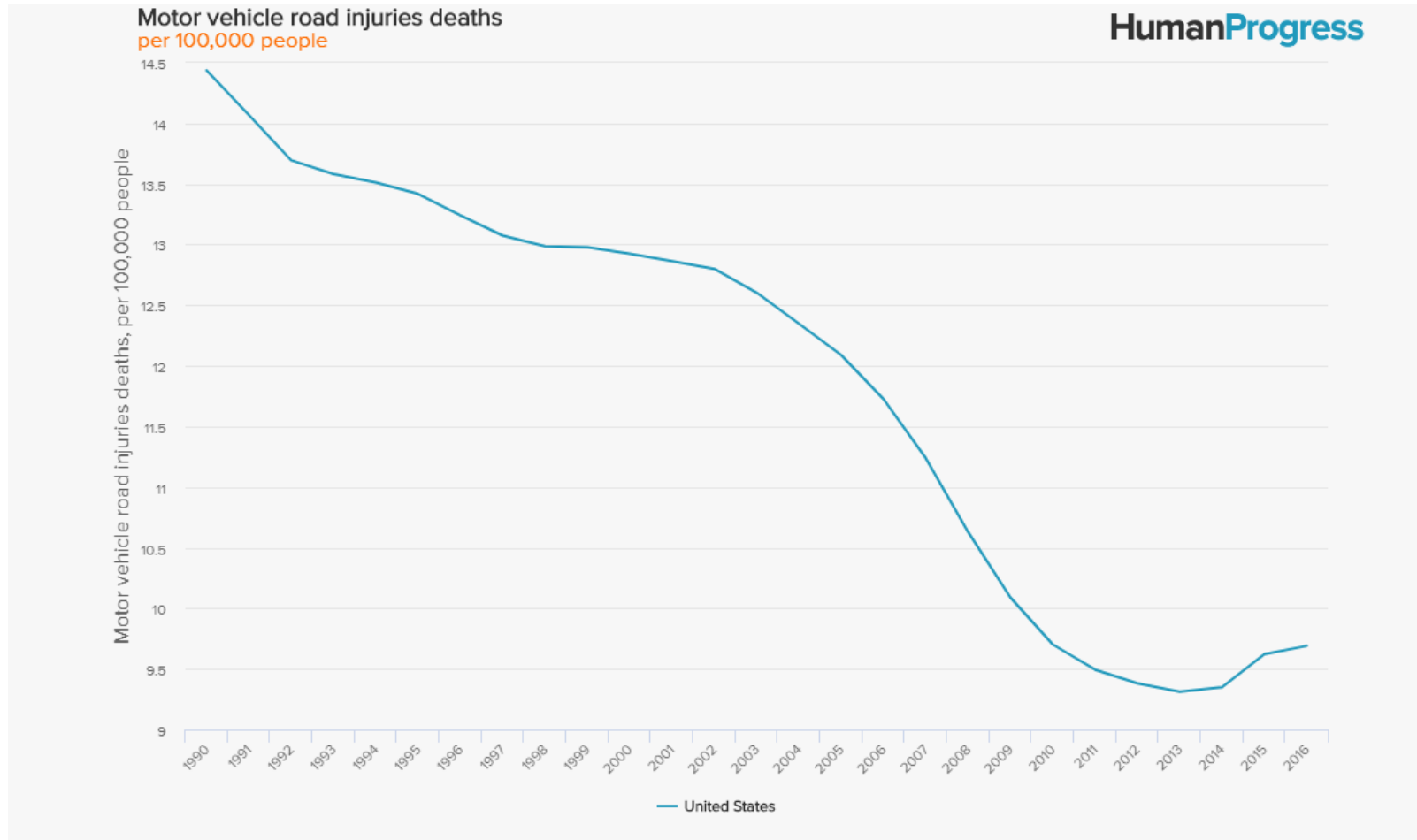
# Natural disaster deaths

## Global annual death rate from natural disasters, by decade 

Global death rate measured as the number of deaths per 100,000 of the world population.
This is given as the annual average per decade (by decade 1900s to 2000s; and then six years from 2010-2015).



Source: EMDAT (2017): OFDA/CRED International Disaster Database, Université catholique de Louvain – Brussels – Belgium.
The data visualization is available at OurWorldInData.org. There you find research and more visualizations on this topic.    Licensed under CC-BY-SA by the authors Hannah Ritchie and Max Roser.

# Extreme poverty



Share of the population living in extreme poverty, by world region

Extreme poverty is defined as living with per capita household consumption below 1.90 international dollars per day (in 2011 PPP prices). International dollars are adjusted for inflation and for price differences across countries.
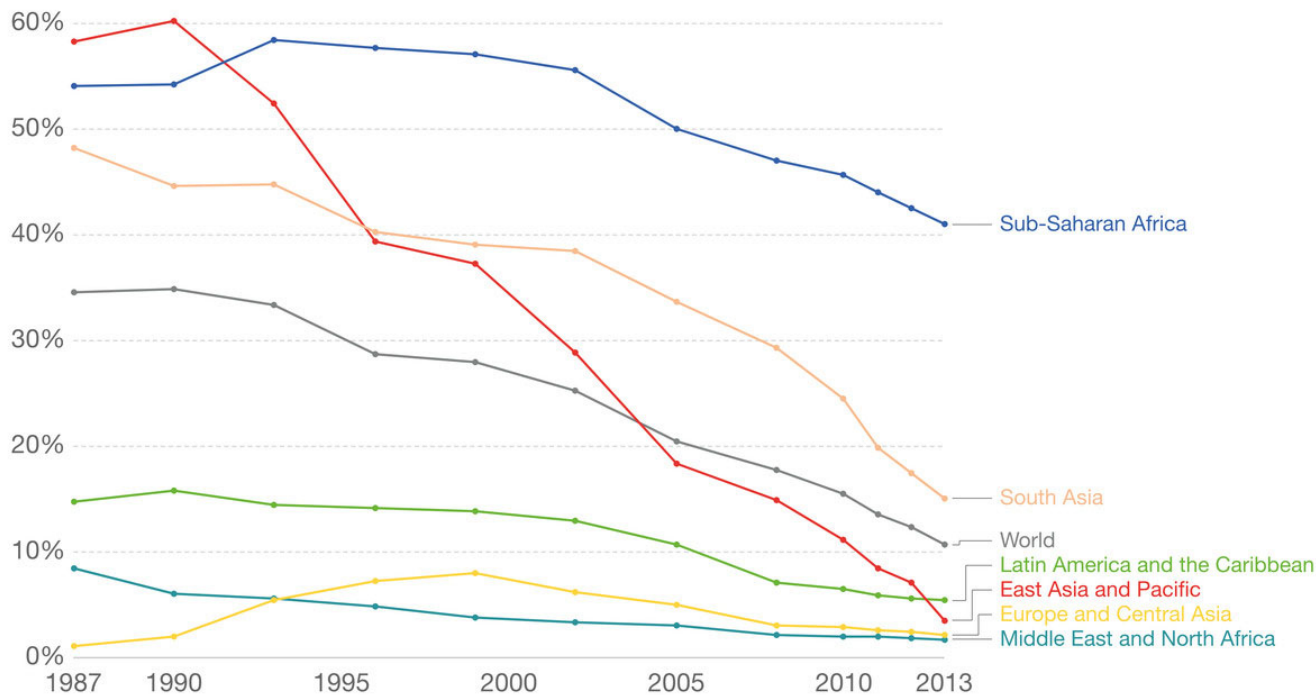
Source: Share of the population living in extreme poverty by world region - PovcalNet World Bank
Note: Consumption per capita is the preferred welfare indicator for the World Bank's analysis of global poverty. However, for about 25% of the countries, estimates correspond to income, rather than consumption.
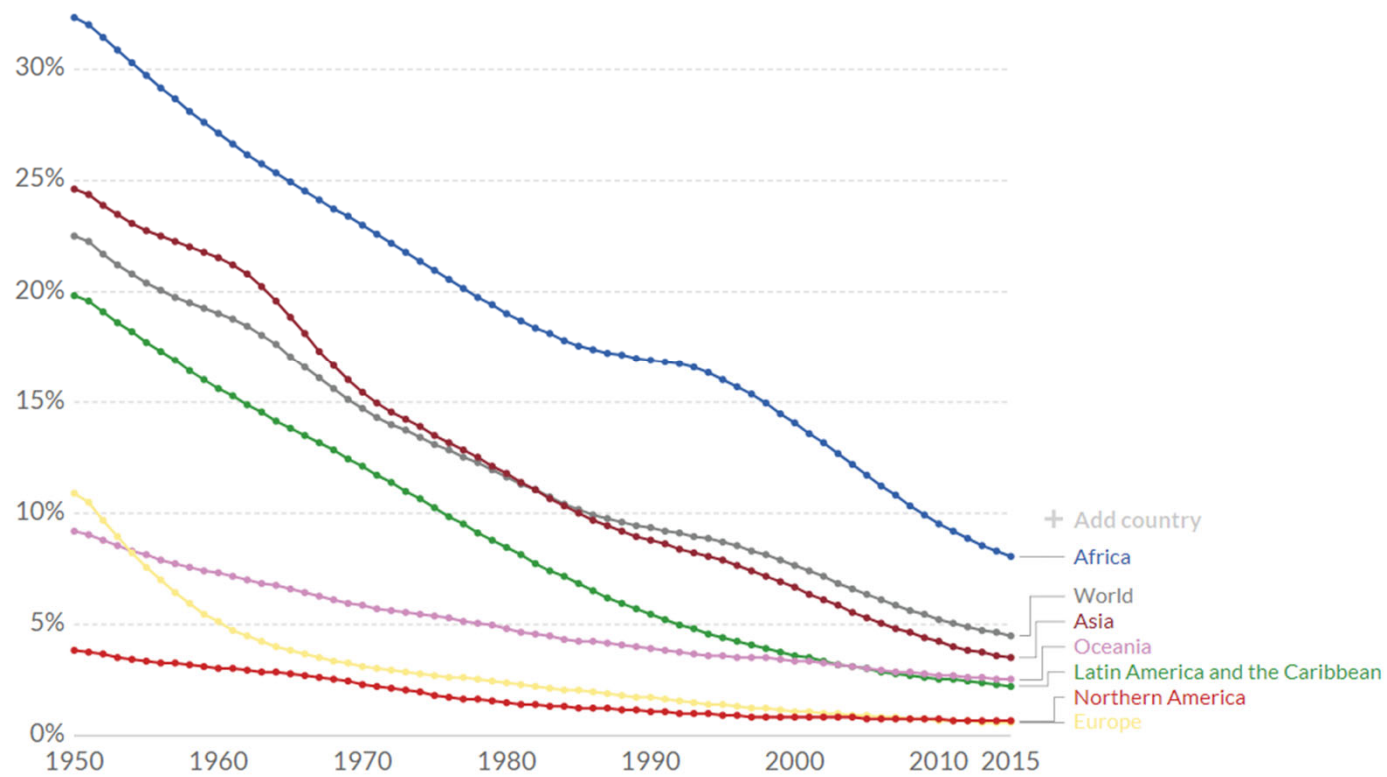OurWorldInData.org/extreme-poverty/ • CC BY-SA

# Child mortality



**Child mortality**
Share of children, born alive, dying before they are five years old.

Our World in Data

| | |
|---|---|
| Africa | |
| World | |
| Asia | |
| Oceania | |
| Latin America and the Caribbean | |
| Northern America | |
| Europe | |

Source: UN Population Division (2017 Revision)

CC BY

# Agricultural land use

# Crop yields

Average corn yields in the United States, 1866-2014
Average corn (maize) yields in the United States, measured in tonnes per hectare.
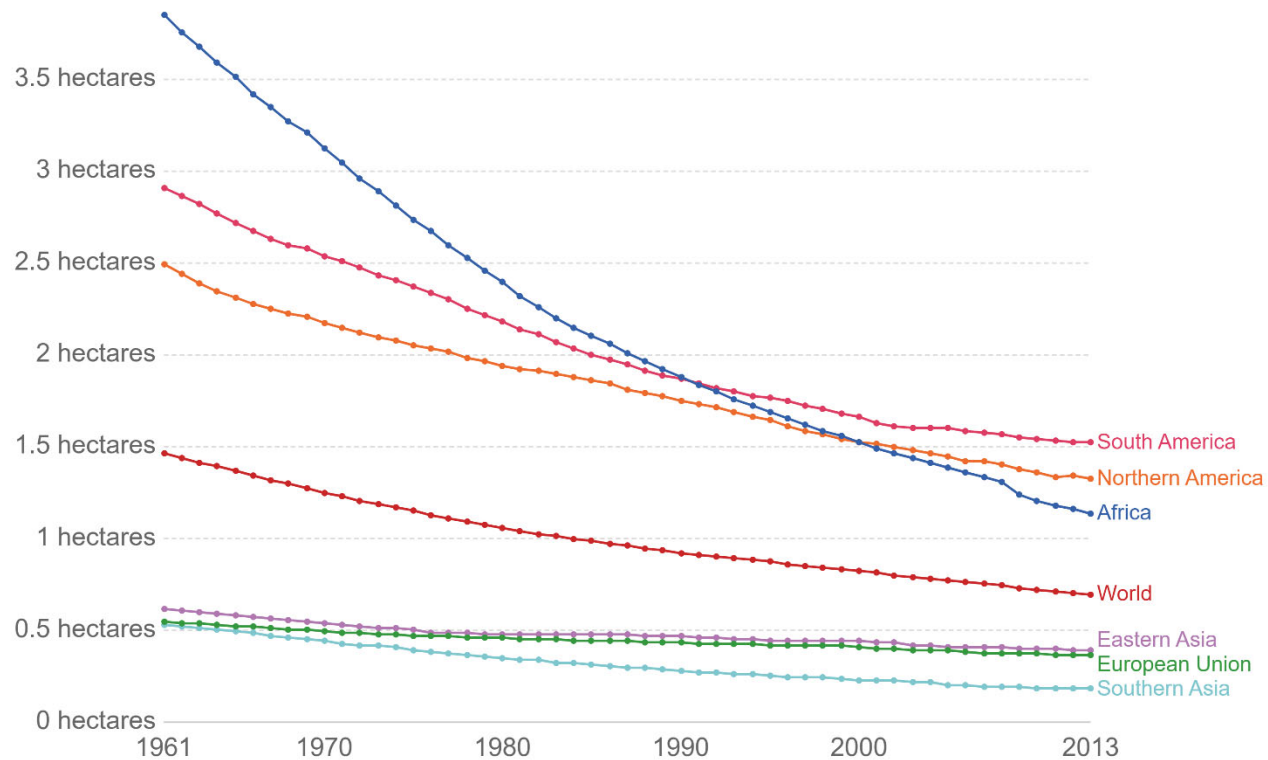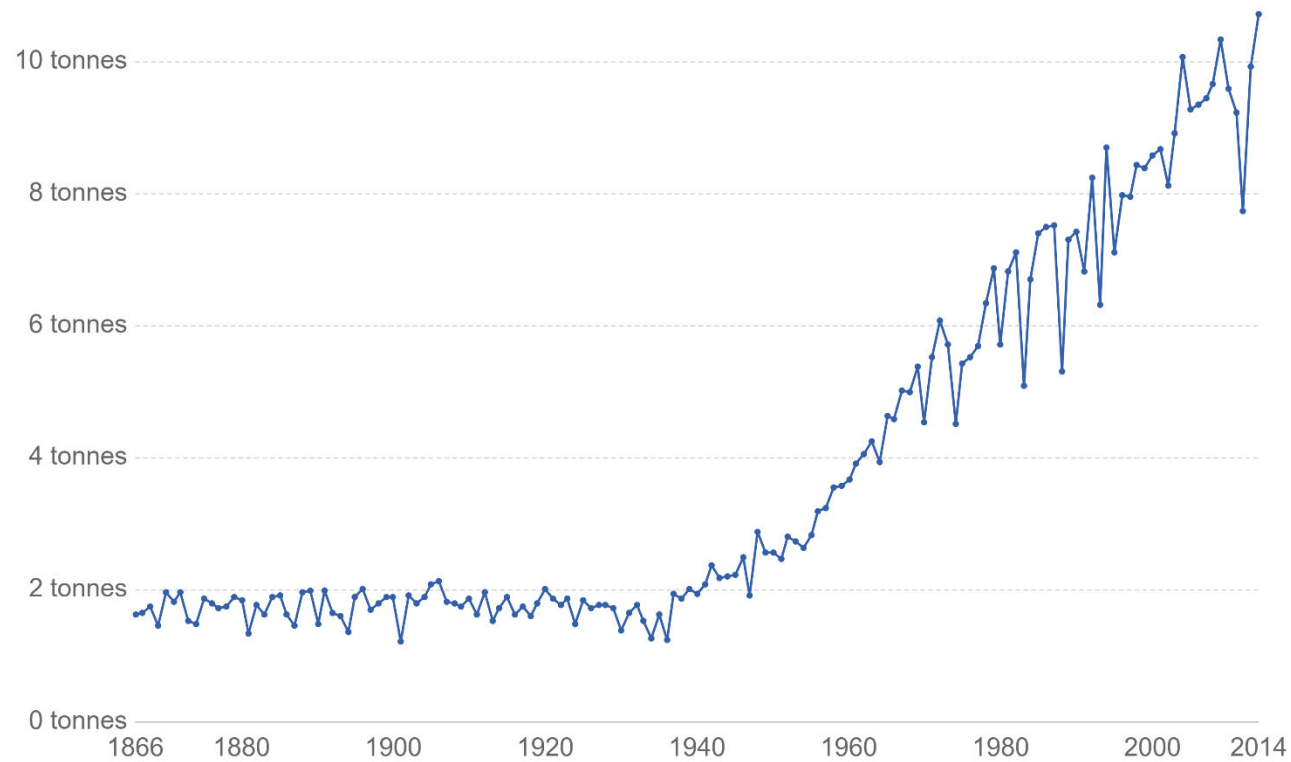
Source: United States Department of Agriculture (USDA) & UN Food and Agricultural Organization (FAO)
OurWorldInData.org/yields-and-land-use-in-agriculture/ • CC BY

# Vaccine rates



Global vaccine coverage: Share of vaccinated 1-year-olds

Legend:
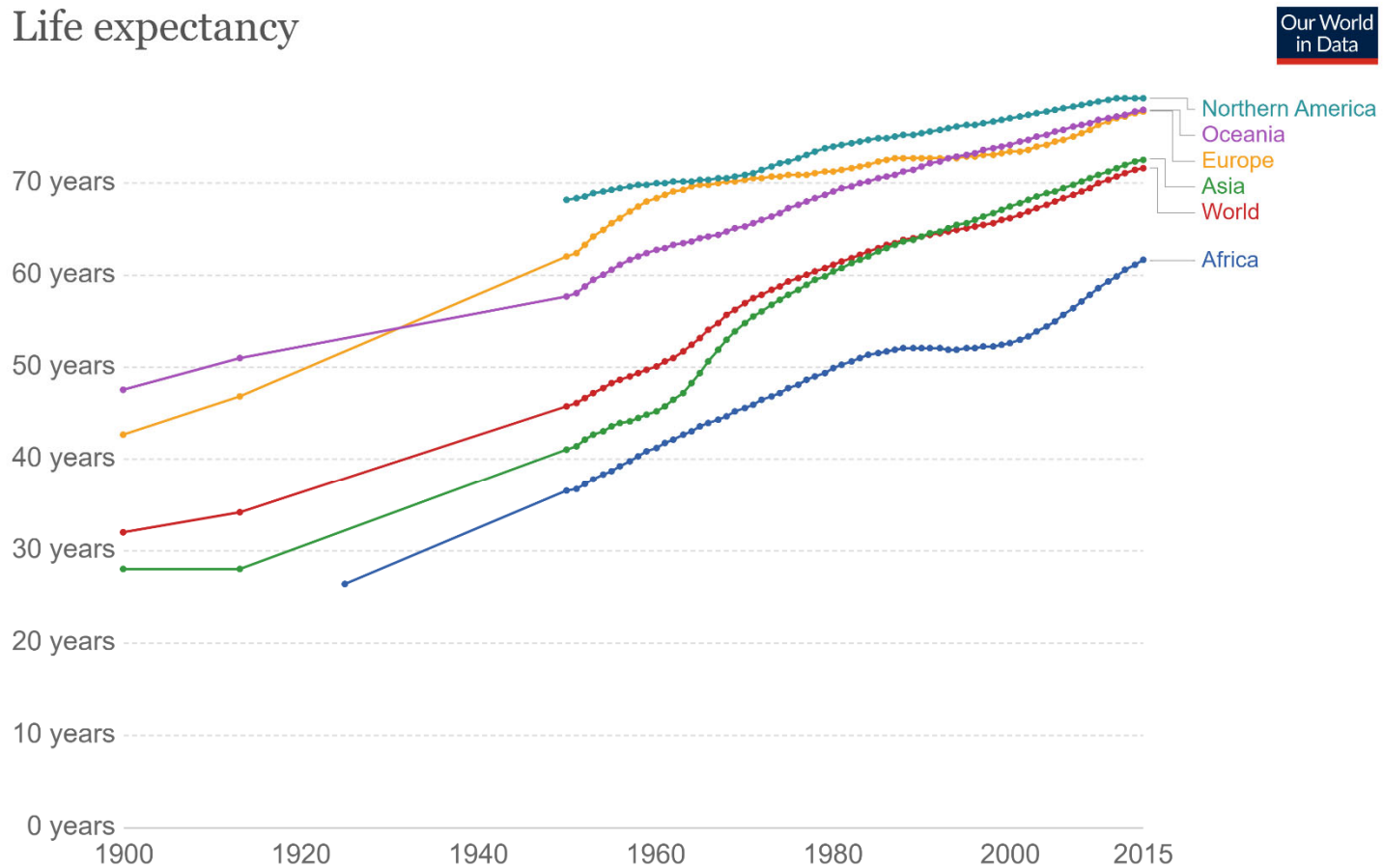- Diphtheria, pertussis and tetanus
- Polio
- Measles
- Hepatitis B3
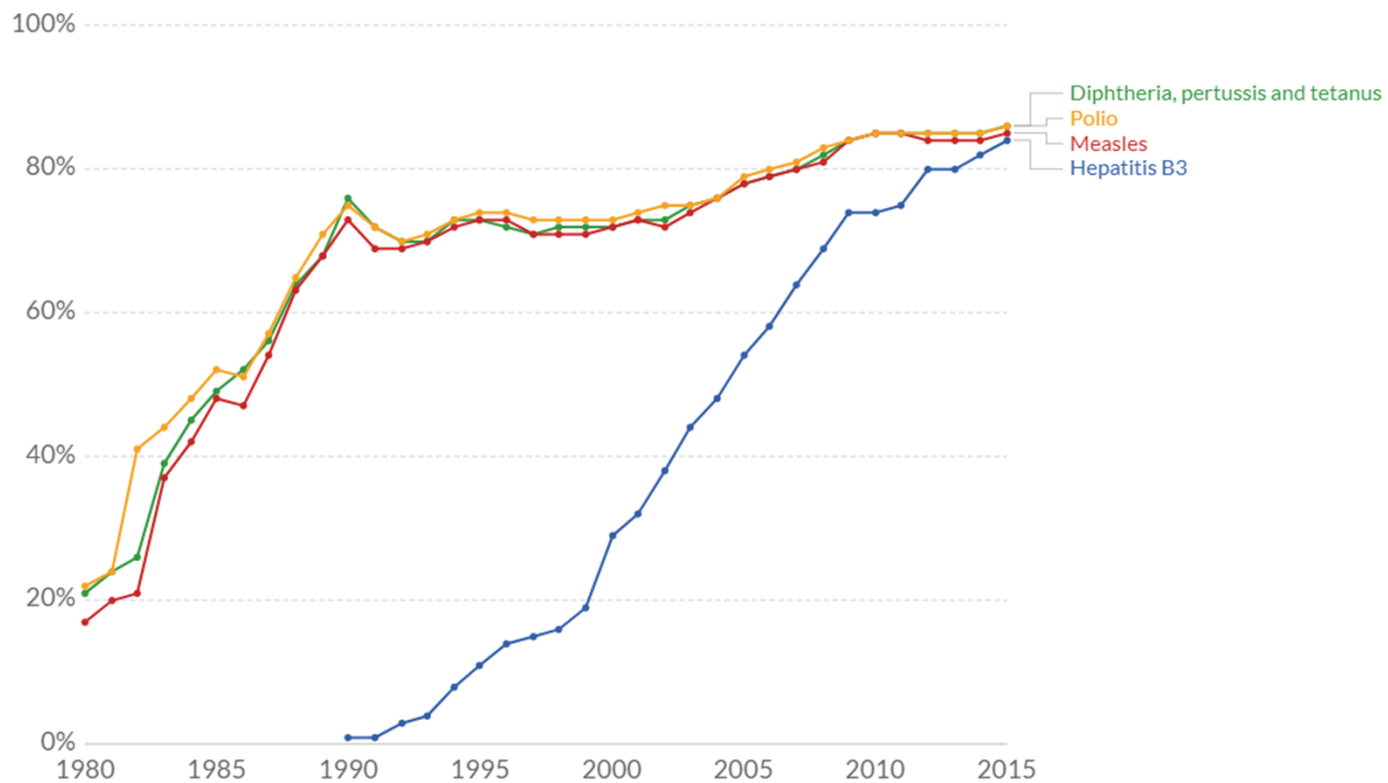
Source: WHO (2017) and UN Population Division (2017)

CC BY

# Life expectancy



Life expectancy

Our World in Data

70 years

60 years

50 years

40 years

30 years

20 years

10 years

0 years

1900    1920    1940    1960    1980    2000    2015

Northern America
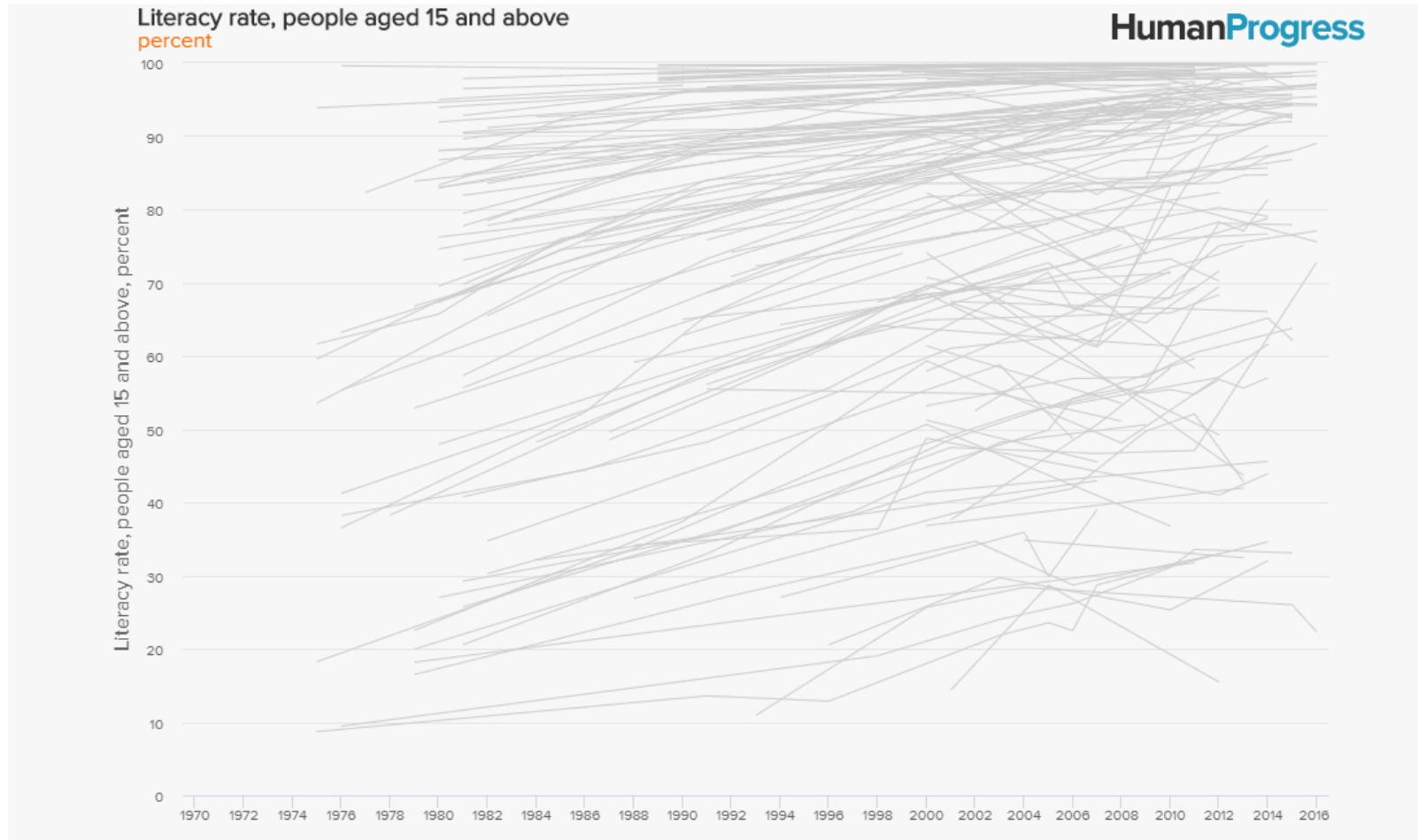Oceania
Europe
Asia
World

Africa

Source: Riley (2005), Clio Infra (2015), and UN Population Division (2019)        OurWorldInData.org/life-expectancy • CC BY
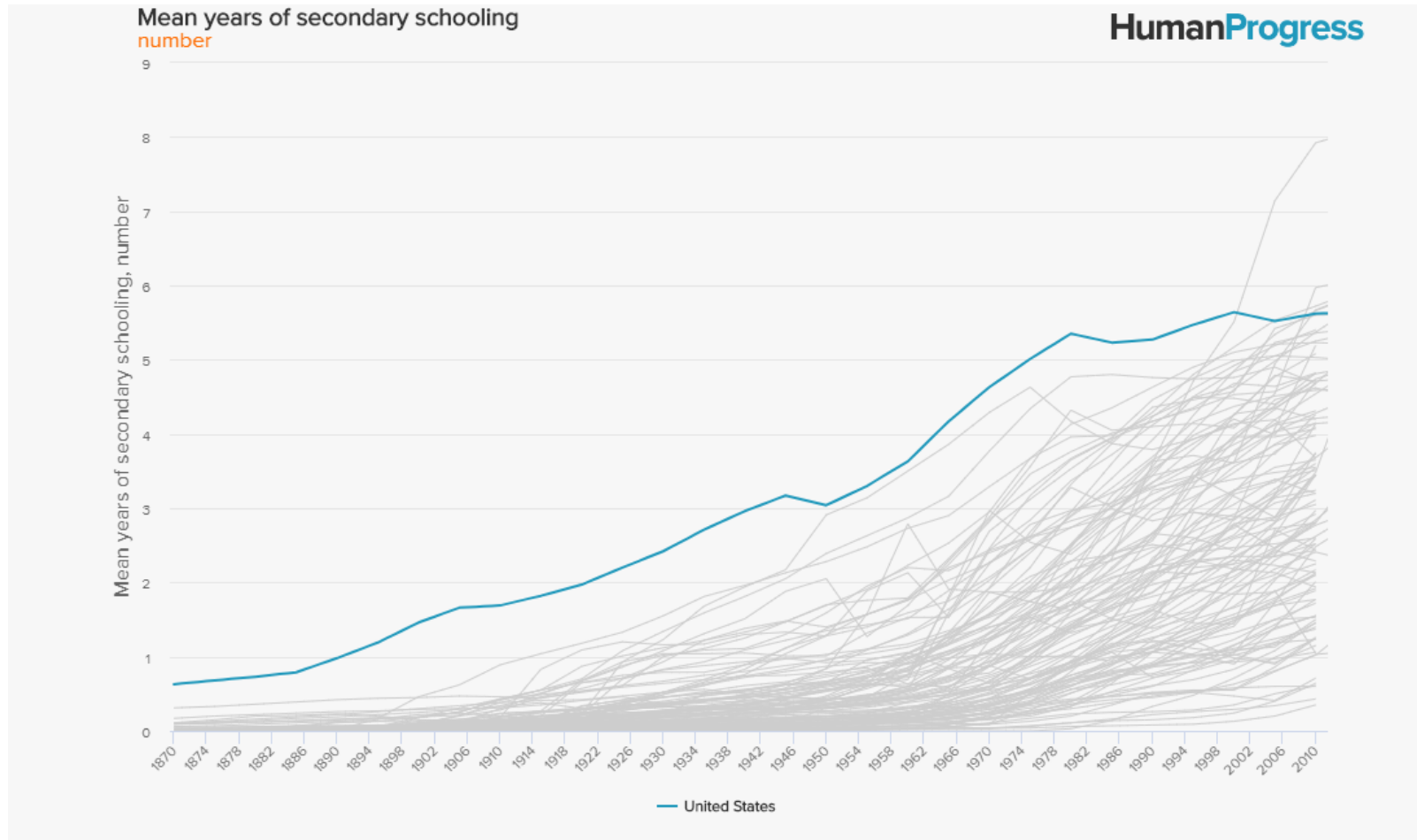Note: Shown is period life expectancy at birth, the average number of years a newborn would live if the pattern of mortality in the given year
were to stay the same throughout its life.

# Literacy



Literacy rate, people aged 15 and above
percent

HumanProgress

# Secondary schooling



Mean years of secondary schooling
number

HumanProgress

— United States

# Democracy vs. autocracy

## Numbers of autocracies and democracies

Shown is the number of a given political regime in the world over time. Democracies are defined as the combination of both liberal and elected democracies; autocracies are the sum of closed and elected autocracies.

Our World in Data

Democracies

Autocracies

120

100

80

60

40

20

0

1900    1920    1940    1960    1980    2000    2018
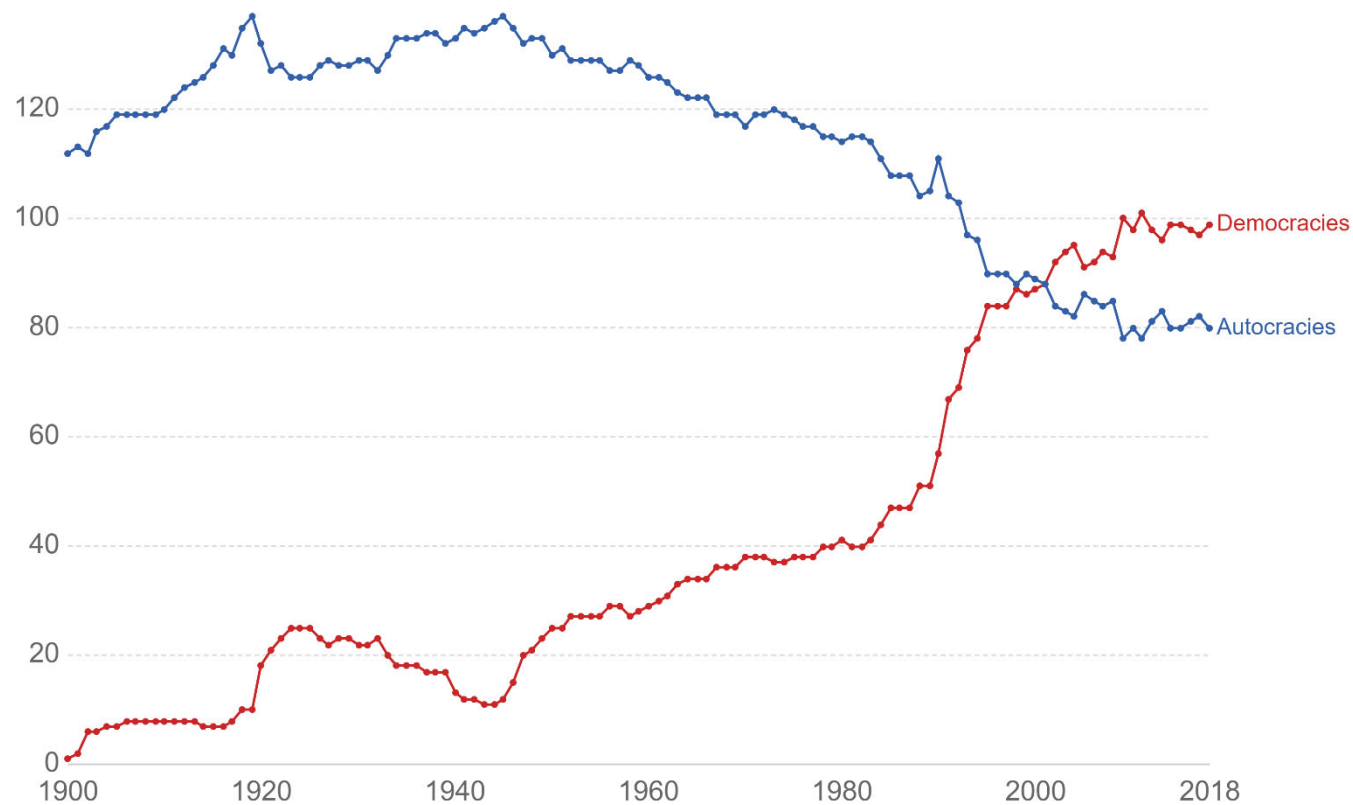
Source: Varieties of Democracy Project (2019, version 9)

CC BY

# Inter-racial marriage, U.S.

**Dramatic dive in share of nonblacks who would oppose a relative marrying a black person**

*% saying they would be very or somewhat opposed to a close relative marrying someone who is ____ among U.S. adults who are not that race or ethnicity*
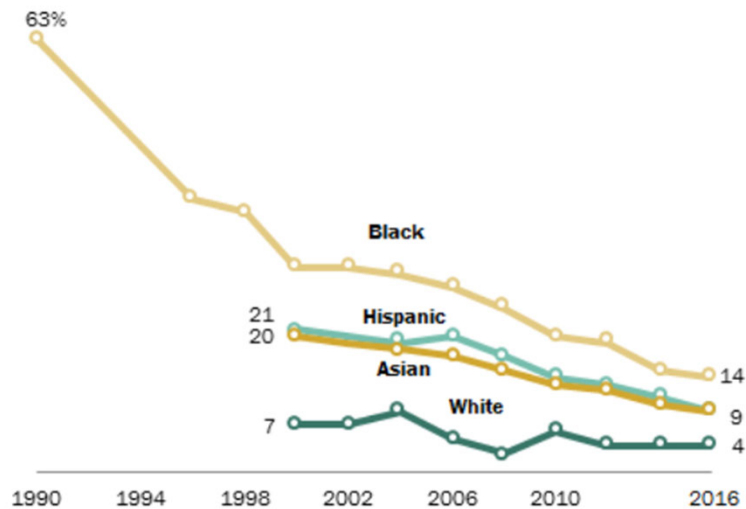


Note: Due to changes in question wording, the universe of nonblacks prior to 2000 includes anyone who reported a race other than black; in 2000 and later, the universe of nonblacks includes those who did not identify as single-race, non-Hispanic blacks (and so may include Hispanic blacks and multiracial blacks).
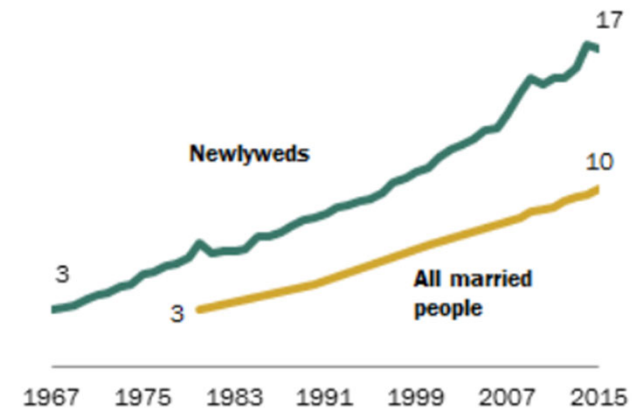Source: Pew Research Center analysis of General Social Survey.
"Intermarriage in the U.S. 50 Years After Loving v. Virginia"

**PEW RESEARCH CENTER**

**Since 1967, a steady rise in intermarriage in the U.S.**

*% who are intermarried among ...*



Note: Data prior to 1980 are estimates. See Methodology for more details. For "all married people," 1980, 1990, 2000, and 2008-2015 data points are shown.
Source: Pew Research Center analysis of 2008-2015 American Community Survey and 1980, 1990 and 2000 decennial censuses (IPUMS).
"Intermarriage in the U.S. 50 Years After Loving v. Virginia"

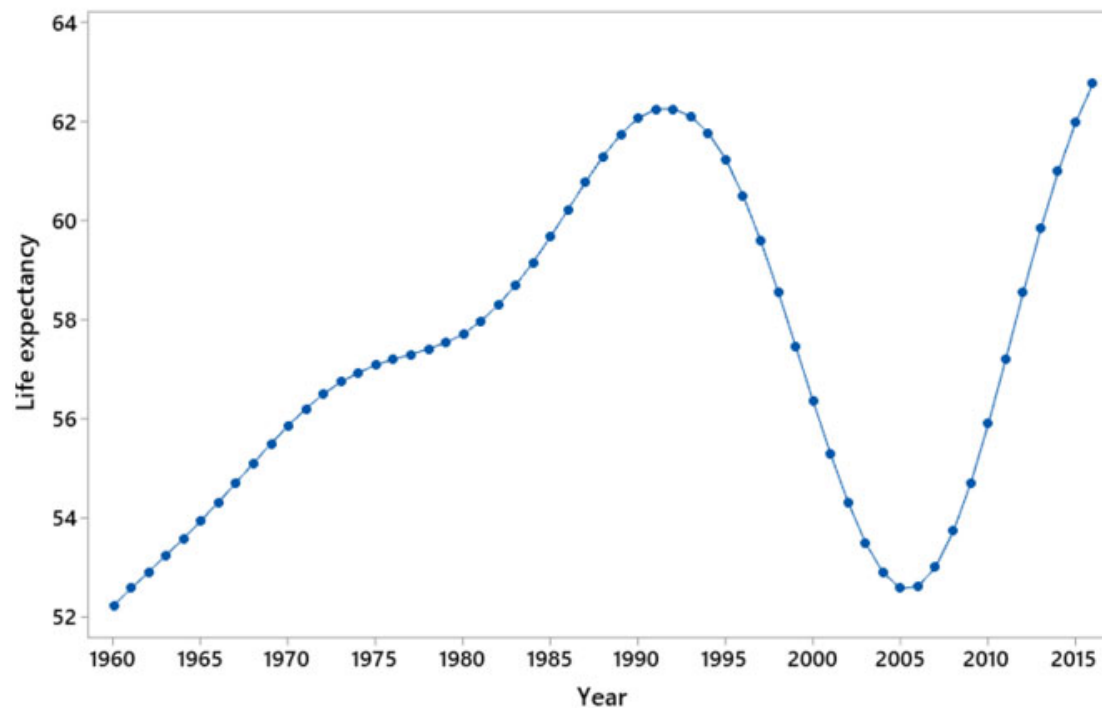**PEW RESEARCH CENTER**

# My request (Take-home message)

Use data, examples, activities, and assignments that make students aware of human progress.

# Example 1: Life expectancy

- Describe what this graph reveals.
- Make an educated guess for the country.

# Example 1: Life expectancy



Life expectancy in South Africa (1960-2016)
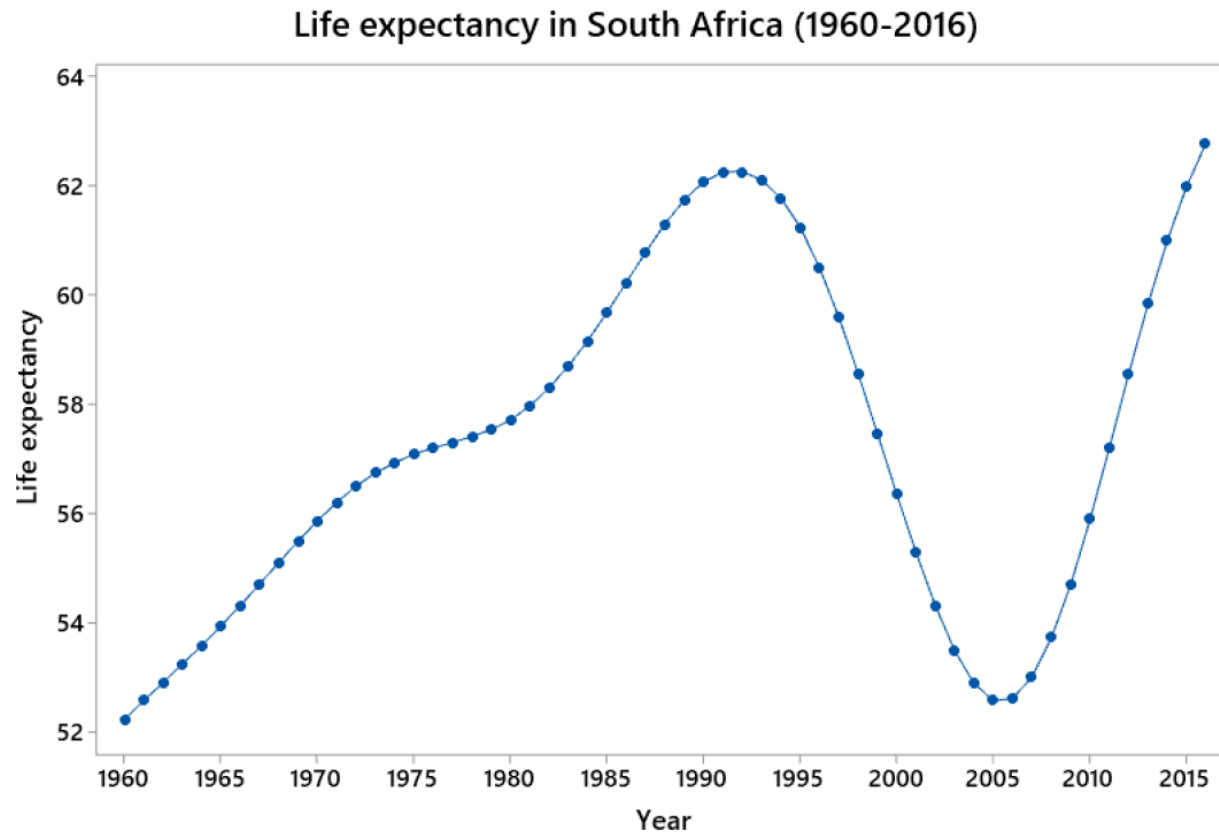
- Explain what happened in the 1990s.

# Example 2: $CO_2$ emissions

- Energy-related $CO_2$ emissions (in millions of metric tons) in the U.S. from 1990-2005



- Source: https://www.eia.gov/environment/emissions/carbon/
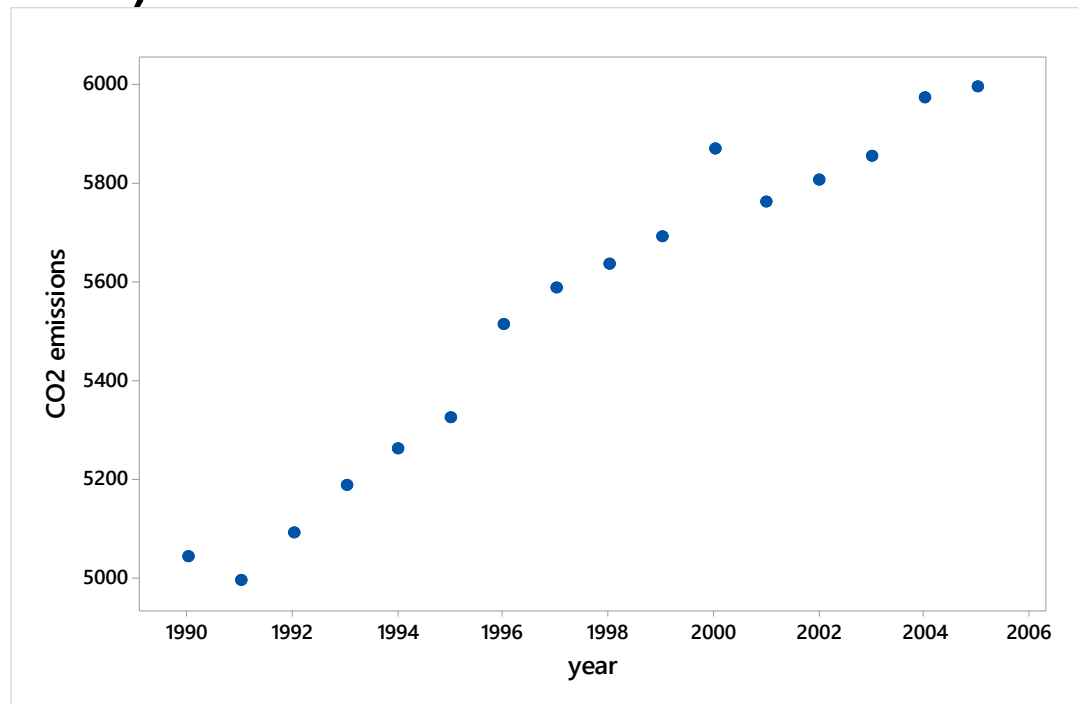
# Example 2: $CO_2$ emissions

- Use a least squares line to predict $CO_2$ emissions for the year 2016.

Predicted $CO_2$ emissions in year 2016

$$= -134{,}931 + 70.32 \times 2016 \approx 6834 \text{ mmt}$$

Actual $CO_2$ emissions in year 2016: 5170 mmt

- Determine percentage error of the prediction

$(6834 - 5170) / 5170 \times 100\% \approx 32.2\%$

# Example 2: $CO_2$ emissions

■ **What went wrong?? Extrapolation!**
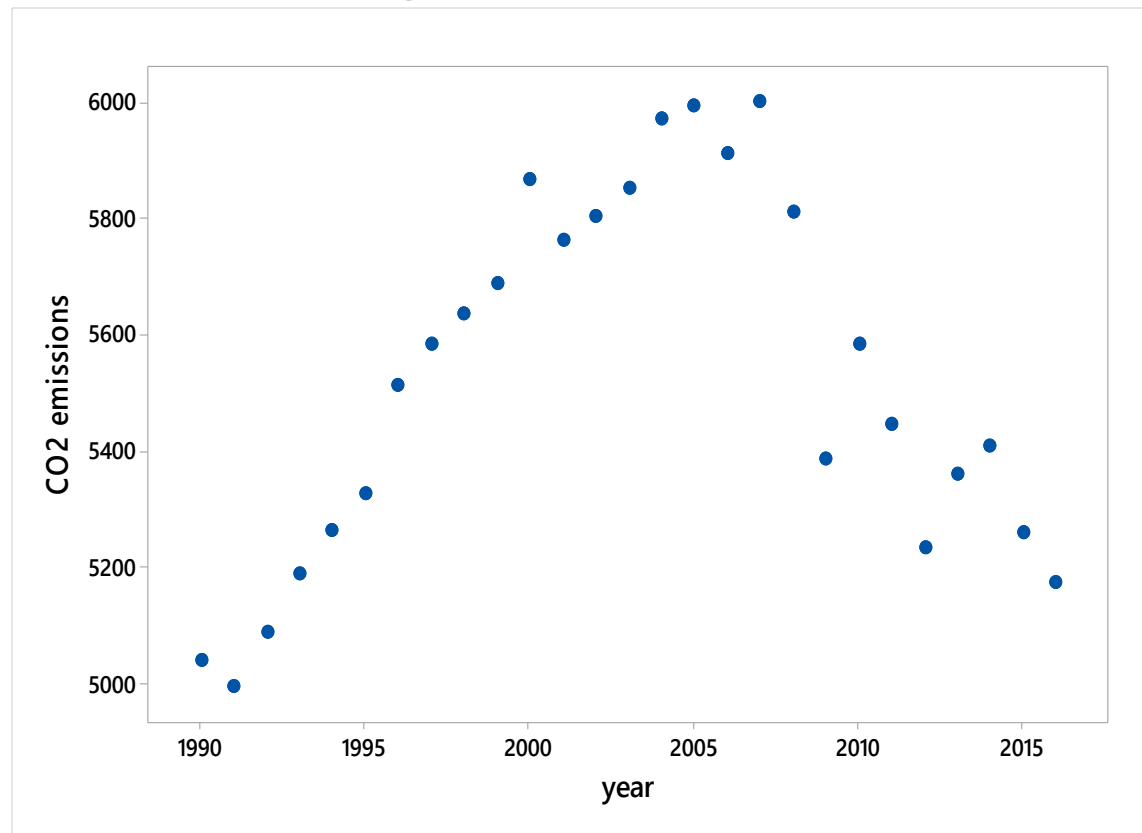
# Example 3: Extreme poverty rate

- **1990: 35.9%**
- **2015: 10.0%**
  - ❑ Source: World Bank Development Research Group


- **Did the percentage who lived in extreme poverty decrease by 25.9% over this period?**
  - ❑ No!
  - ❑ The percentage decreased by 25.9 percentage points, which is different from a 25.9 percent decrease.

# Example 3: Extreme poverty rate

- Percentage change = (new – old) / old × 100%

$$(.100 - .359) / .359 \times 100\%$$
$$= -.259 / .359 \times 100\%$$
$$= -.721 \times 100\%$$
$$= 72.1\% \text{ decrease}$$

# Example 4: Global poverty question

- U.S. survey: 5% of 1005 answered correctly

- Do the sample data provide strong evidence that less than one-third of all Americans would answer correctly?

- Test statistic: $z = \dfrac{.05 - .3333}{\sqrt{\dfrac{.3333 \times .6667}{1005}}} \approx -19.1$ (!!!)

- *Overwhelming* evidence that Americans do worse than random guessing on this question

# Example 5: Global poverty question

- U.S. survey: 59% of 1005 answered "doubled"

- Estimate the proportion of all U.S. adults who would answer "doubled" with 95% confidence

$$.59 \pm .030: (.560, .620)$$

- Interpret this interval.

  - We are 95% confident that between 56% and 62% of all U.S. adults would give the most wrong answer to this question.

# Disclaimer

- Of course I also believe that much progress remains to be made in many important areas

# Quote 4: Fact-based worldview

- "When we have a fact-based worldview, we can see that the world is not as bad as it seems – and we can see what we have to do to keep making it better."

 – Rosling

# End-of-year/decade (Dec 2019)

- Nicholas Kristof, *New York Times*

## This Has Been the Best Year Ever

For humanity over all, life just keeps getting better.

By **Nicholas Kristof**
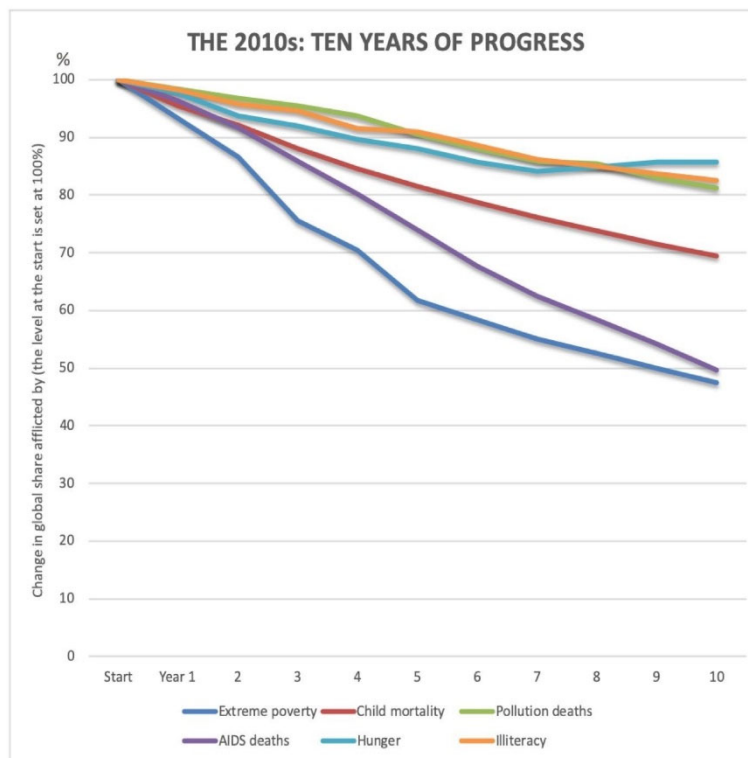Opinion Columnist

- Matt Ridley, *The Spectator* (UK)

## We've just had the best decade in human history. Seriously

Little of this made the news, because good news is no news

**Matt Ridley**

# End-of-year/decade

- ## Johan Norberg



THE 2010s: TEN YEARS OF PROGRESS

Change in global share afflicted by (the level at the start is set at 100%)

Extreme poverty — Child mortality — Pollution deaths — AIDS deaths — Hunger — Illiteracy

Sources:
Overall: Johan Norberg's *Progress*
Poverty 2008-18: The World Bank
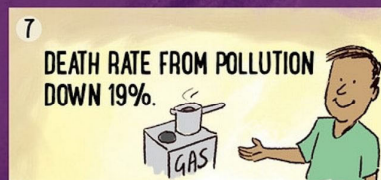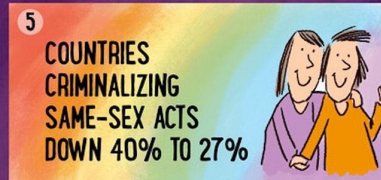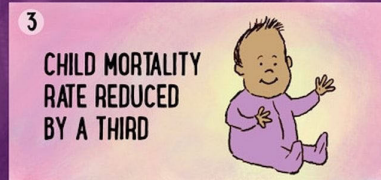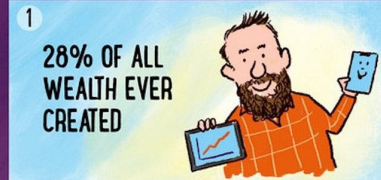Child Mortality 2008-18: The United Nations
Pollution: 2007-17: Our World in Data
AIDS 2007-17: The Global Burden of Disease Project
Hunger 2008-18: Food and Agricultural Organization
Illiteracy 2008-18: The World Bank



2010s: HUMANITY'S BEST DECADE YET — GWPF

1. 28% OF ALL WEALTH EVER CREATED
2. EXTREME POVERTY HALVED.
3. CHILD MORTALITY RATE REDUCED BY A THIRD
4. LIFE EXPECTANCY INCREASED FROM 69.5 TO 72.6 YEARS
5. COUNTRIES CRIMINALIZING SAME-SEX ACTS DOWN 40% TO 27%
6. COUNTRIES WITH LAWS PROTECTING WOMEN UP 53% TO 78%.
7. DEATH RATE FROM POLLUTION DOWN 19%.
8. WEATHER-RELATED DEATHS DECREASE 95% SINCE 1960S
9. "PEAK STUFF" - CONSUMPTION OF 66 OUT OF 72 RESOURCES IS DECLINING.
10. "NOT FREE" COUNTRIES DOWN 34% TO 26%

Sources: Overall: Johan Norberg. "Progress: Ten Reasons to Look Forward to the Future". 1) World Bank. 2) World Bank. 3) UN IGME. 4) UN. 5) ILGA. 6) World Bank. 7) Our World in Data. 8) Our World in Data. 9) McAfee. "More From Less" 2019. 10) Freedom House. Data collecting takes time, so some numbers refer to 2007–2017, 2008–2018 or 2009-19.

# What about 2020?

- **No doubt this has been a horrible year**
  - In many ways unprecedented
  - Many measures of human progress may well decline in 2020, perhaps for a while
- **We are better prepared to face such challenges than ever before**
  - Working remotely
  - Vaccine development

# What about 2020?



JUN 22, 2020

## How a New Vaccine Was Developed in Record Time in the 1960s

It took just four years to get the mumps vaccine ready for market—but its development leaned heavily on groundwork that had been established during World War II.

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## Coronavirus Daily
# A Vaccine in 300 Days

By *James Paton* and *Robert Langreth*
November 18, 2020, 7:30 AM EST

# For more information/data

- [www.gapminder.org](http://www.gapminder.org)

- [ourworldindata.org](http://ourworldindata.org)

- [humanprogress.org](http://humanprogress.org)

- [www.worlddata.io/](http://www.worlddata.io/)

- [https://data.worldbank.org/](https://data.worldbank.org/)

- [informationisbeautiful.net/beautifulnews/](http://informationisbeautiful.net/beautifulnews/)

- [www.toddrjones.com/data-visualization](http://www.toddrjones.com/data-visualization)

# Quote 5: When would you choose?

"If you could choose a moment in history to be born, and you didn't know ahead of time who you were going to be, you'd choose *now*.

Because the world has never been less violent, healthier, better educated, more tolerant, with more opportunity for more people, and more connected than it is today."

– President Barack Obama, July 20, 2016

# Thanks!

- Contact me with questions and comments: arossman@calpoly.edu

- Shameless plug for my weekly blog about teaching introductory statistics: askgoodquestions.blog
  - These slides appear under "presentations"