UCSF Department of Epidemiology & Biostatistics

Global Burden of Disease Tools & Tinkering

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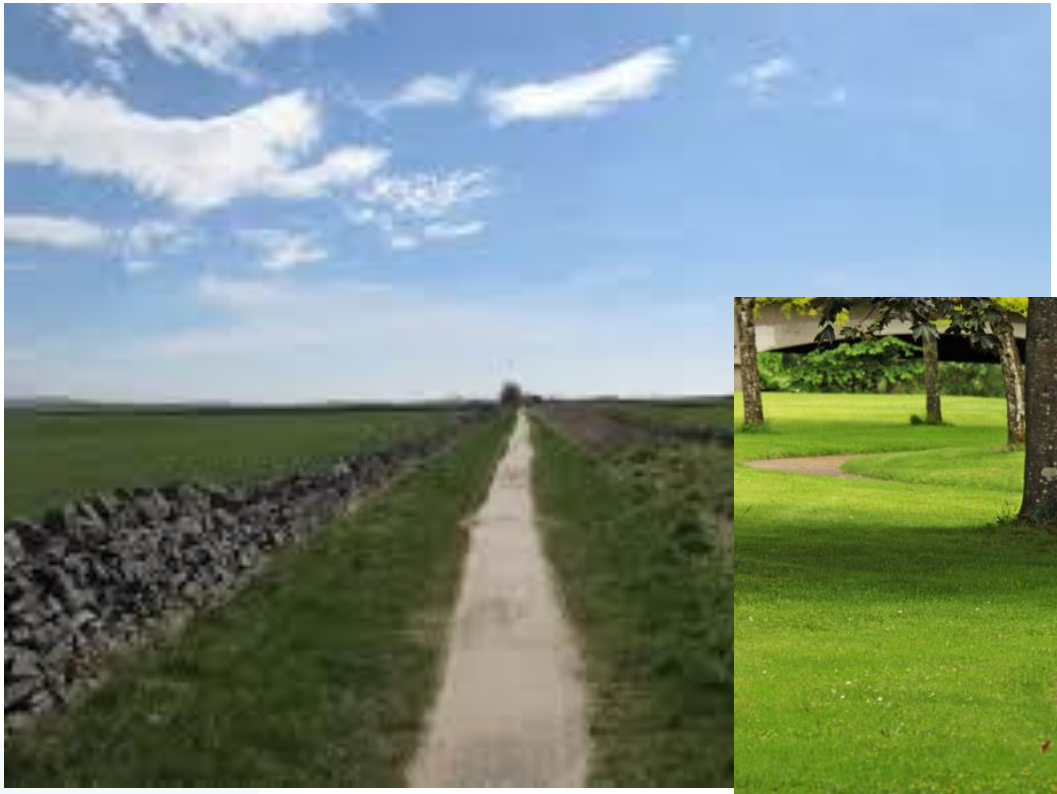
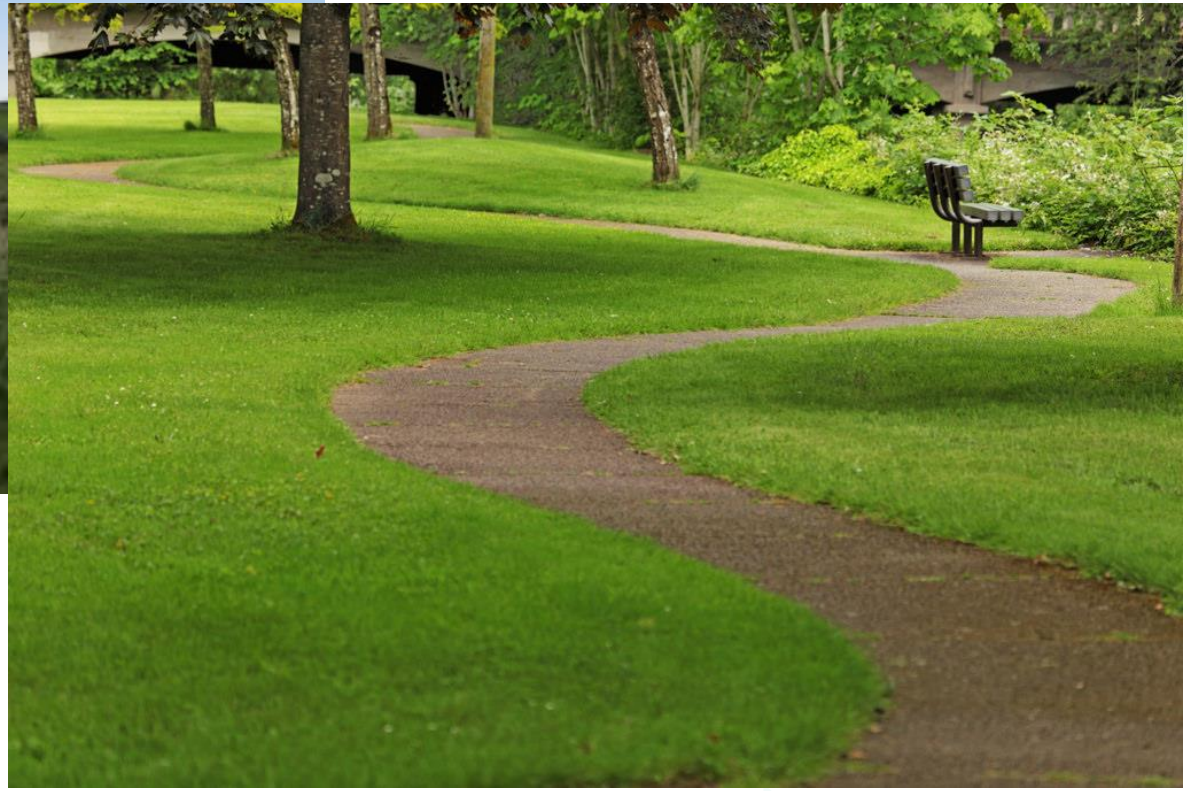
3/25/2019

Paths





Outline

- Introductions (10 minutes)
- Didactics (20 minutes)
- Interactive (30 minutes)

WHO global strategy and plan of action on ageing and health, April 2016

World Health Organization

VISION

A world in which everyone can live a long and healthy life

STRATEGIC OBJECTIVES

1. Commitment to action on Healthy Ageing in every country
2. Developing age-friendly environments
3. Aligning health systems to the needs of older populations
4. Developing sustainable and equitable systems for providing long-term care (home, communities and institutions)
5. Improving measurement, monitoring and research on Healthy Ageing

[4] http://apps.who.int/gb/ebwha/pdf_files/WHA69/A69_17-en.pdf?ua=1

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The big picture of global health

What role does aging play in global health?

What do epidemiologists need to do in order to address this problem?

The big picture of global health & aging

Why do we need to isolate specific conditions?

To get visibility as a health care problem

To highlight areas of unmet need

What is epidemiology's role?

- We look at the size, patterns, causes and consequences of health problems in population groups
- This can help to lobby for extra resources by providing a shape and form for health problems
- It can help gauge how advances developed in specialised settings might translate in the community

Accurate depiction of the size and scope of the problem leads to a VOICE

Data

Geography

Scope

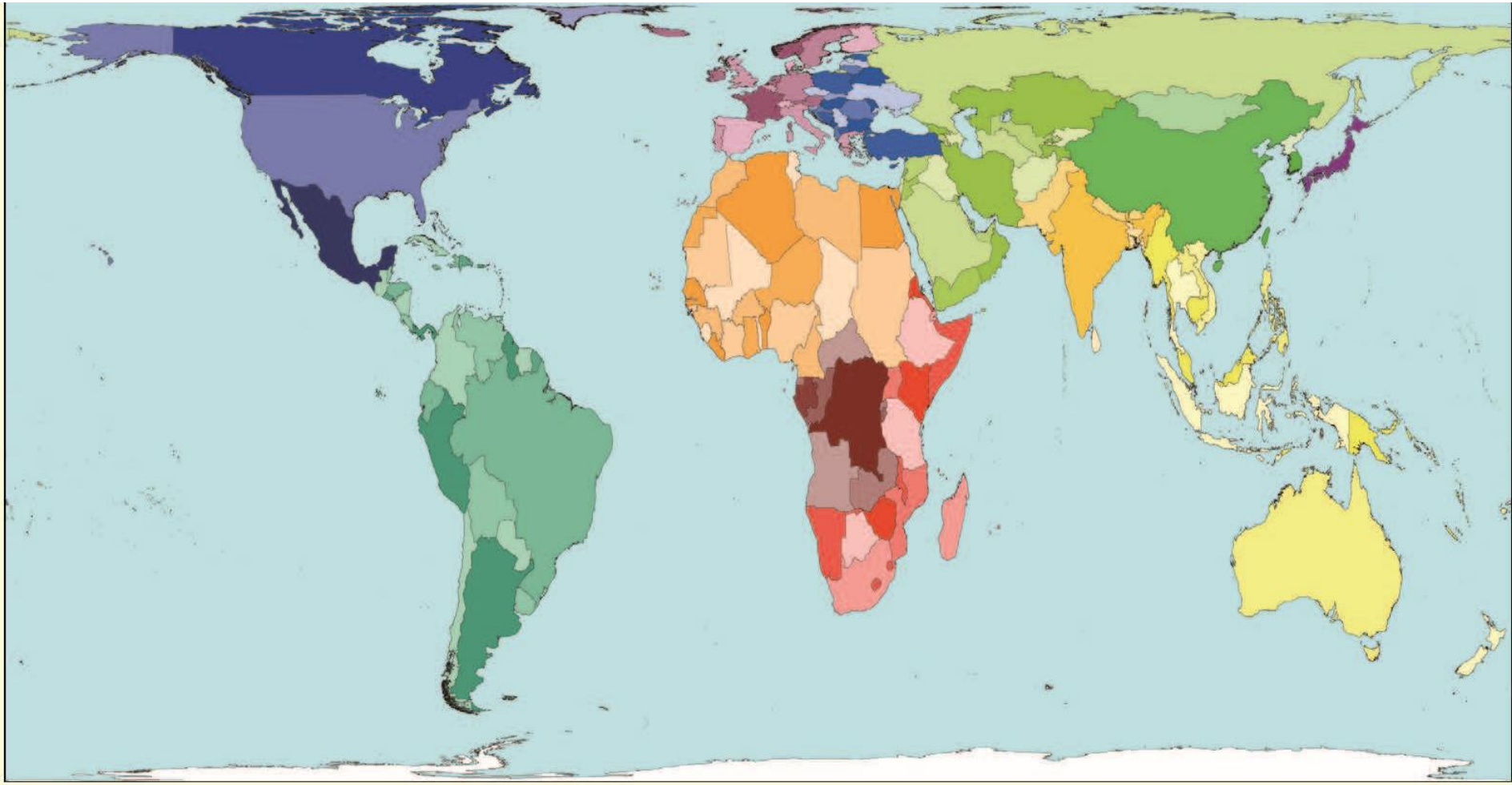
Risk Factors

Now you try: www.worldmapper.org


advocacy
defend
rights
people
views
supports
vulnerable
promote
access
information
understand
providing
empower
particularly
society
voice
express
services
choices
concerns
person
speaking
otherwise
enables
variations
genuinely
wishes
aims
many
seeks

What happens when you contrast land and population?

Land Area



Technical notes

- Principal data source: United Nations Environment Programme, 2005
- Land area excludes land covered by major rivers, lakes and the sea
- Population data used is from 2002.
- See web site for further information

MOST AND LEAST LAND

Rank	Territory	Value
1	Greenland	821
2	Western Sahara	97
3	Mongolia	60
4	Namibia	41

Rank	Territory	Value
191	Nauru	0.154
192	Barbados	0.143
193	Bahrain	0.101
194	Maldives	0.100

Population aged over 65 years (Worldmapper)

Land area

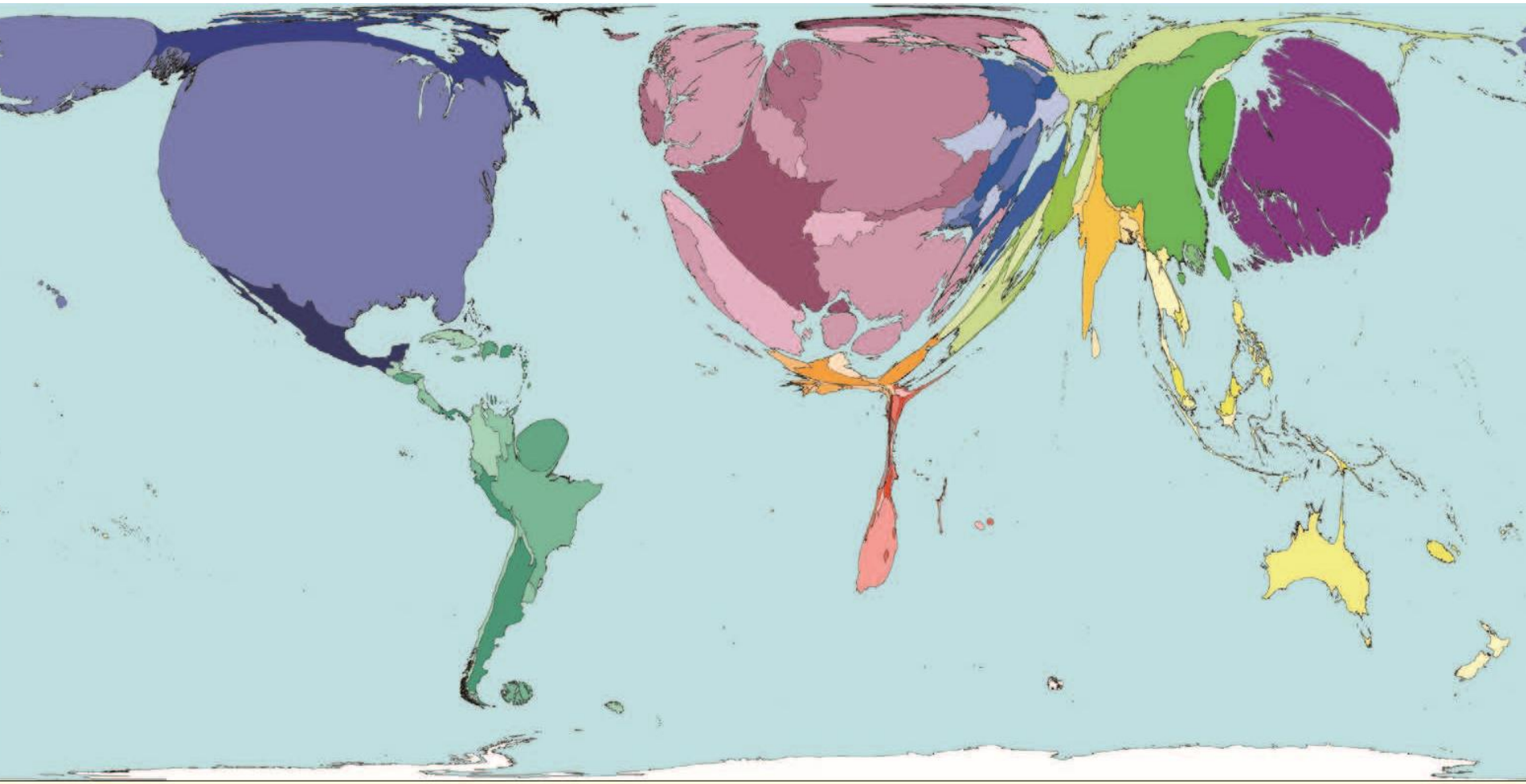
HIGHEST AND LOWEST PROPORTION OF THE POPULATION OVER 65 YEARS OLD

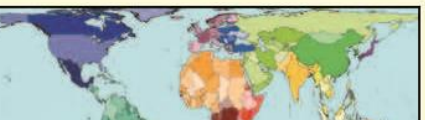
Rank	Territory	Value
1	Italy	19
2	Japan	18
2	Greece	18
4	Sweden	17
5	Belgium	17

Rank	Territory	Value
189	Papua New Guinea	2
189	Comoros	2
193	United Republic Tanzania	2
193	Yemen	2
195	Eritrea	2

of total population

The world sized by global spending on public health (Worldmapper)





MOST AND LEAST PUBLIC HEALTH SPENDING

Rank	Territory	Value	Rank	Territory	Value
1	Luxembourg	3304	191	Burundi	13

What happens when you contrast land, age, and public health spending?

Now you try:

- https://worldmapper.org/

Burden of Disease

- Burden of Disease is a way of measuring and ranking the effects of diseases on the health of *populations*

- Two parts to this: death and disability (and both combined)

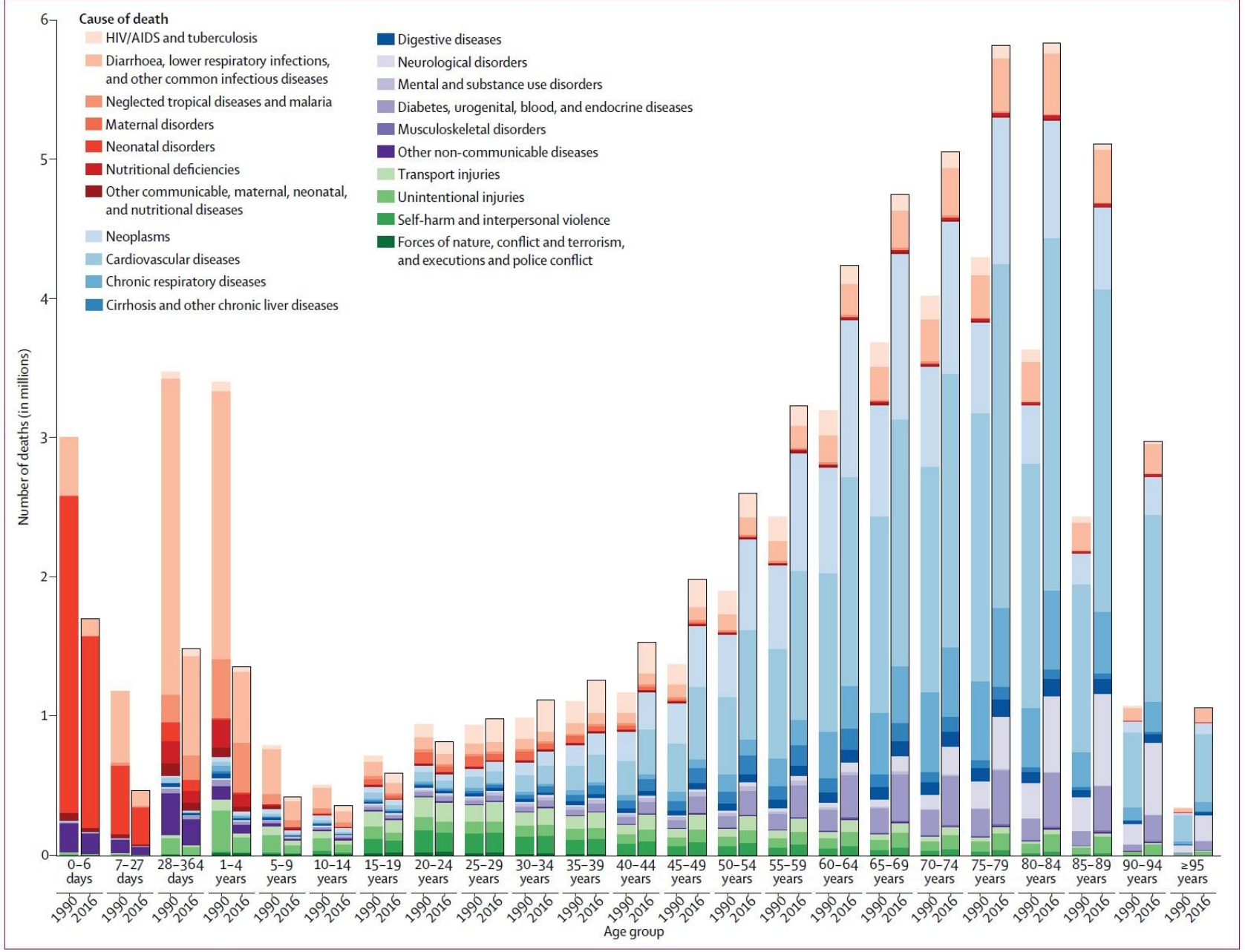


Figure 3: **Global composition of number of deaths by Level 2 causes for 23 GBD age groups, both sexes combined, 1990 versus 2016**

Composition of Level 2 causes of death globally for males and females combined, by age group, showing difference in composition between 1990 and 2016. Number of total deaths due to Level 2 causes is indicated by height of bar; causes are colour-coded to highlight the relative number of total deaths due to a specific cause. GBD=Global Burden of Disease.

The funding hasn't followed this rapid change...

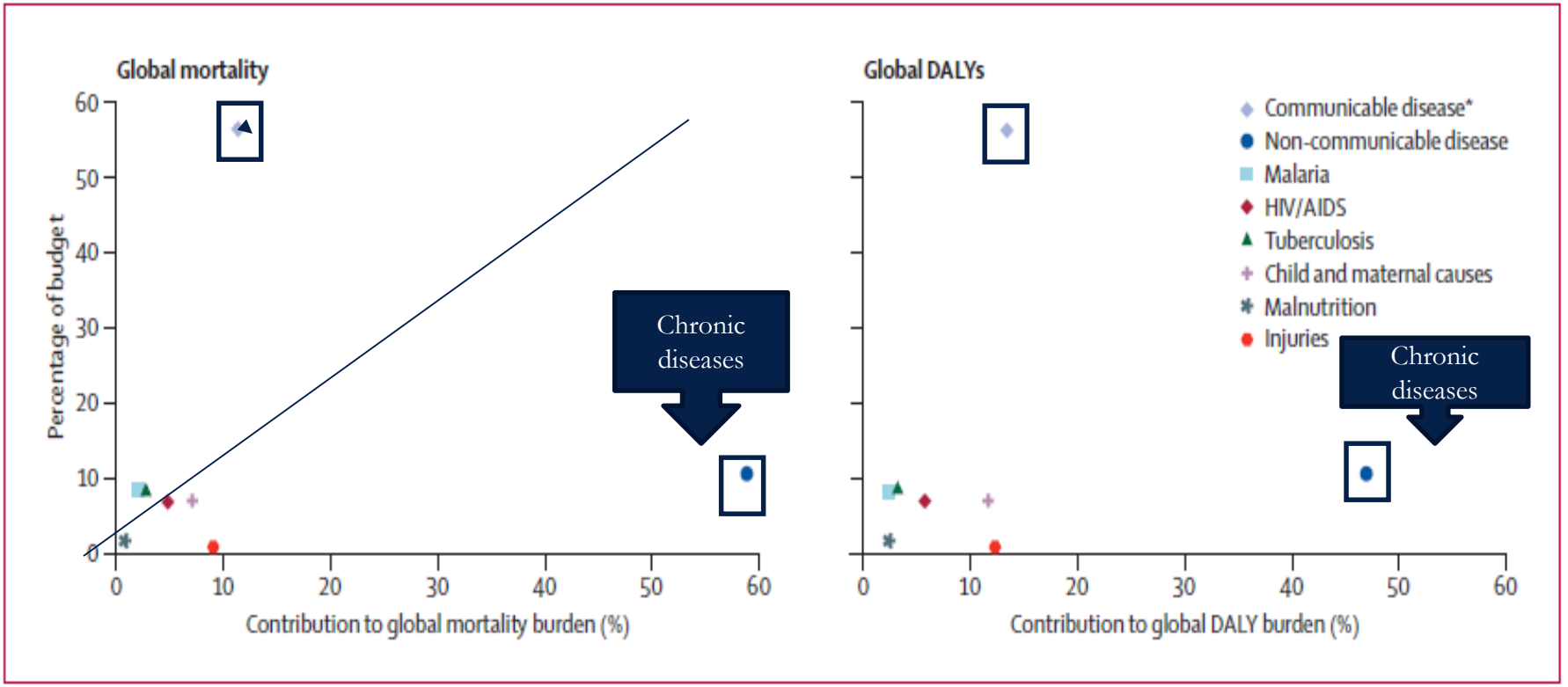


Figure 1: **Relation between WHO budget allocations and the global burden of disease, 2004–05**
Data for global mortality and disability-adjusted life years (DALY) are from the WHO Global Burden of Disease, 2002 edition. DALYs are the sum of years of life lost because of premature mortality and years of life lost because of disability. *Communicable diseases excluding HIV, tuberculosis, and malaria.

Stuckler et al, Lancet 2008

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Impact of previous GBD findings

- Highly influential
- Stimulated national burden of disease studies
- informed governmental and non-governmental priorities for research, development, policies and healthcare funding

GBD 2017 Overall Aims

- To produce new, robust, and reliable estimates of burden for all major diseases, injuries, and risks that are ***widely disseminated, understood, and easily used by policymakers, researchers, funders and practitioners.***

- More than 175 diseases and injuries, 20 risk factors

- More than 400 experts around the world involved

Let's dig a little deeper…

- What country had…
  - Greatest gains in life expectancy (both sexes)
  - Which country had the longest healthy life expectancy for women?
- Using the probability of death (all cause), view each age range in succession
  - What do you notice?
- Locking down on one specific disease of interest, can you find the country with the greatest probability of death due to that cause?
- Specifically older adults, what trends do you find interesting? Is there anything you note that you hadn't realized before?

Let's have a discussion

- What would you use these data visualizations for?
- What audience would be receptive to the data presented?
- How could that help your research?

Journal Article:

Global, regional, and national disability-adjusted life-years (DALYs) for 359 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017

*GBD 2017 DALYs and HALE Collaborators**

Summary

Background How long one lives, how many years of life are spent in good and poor health, and how the population's state of health and leading causes of disability change over time all have implications for policy, planning, and provision of services. We comparatively assessed the patterns and trends of healthy life expectancy (HALE), which quantifies the number of years of life expected to be lived in good health, and the complementary measure of disability-adjusted life-years (DALYs), a composite measure of disease burden capturing both premature mortality and prevalence and severity of ill health, for 359 diseases and injuries for 195 countries and territories over the past 28 years.

Methods We used data for age-specific mortality rates, years of life lost (YLLs) due to premature mortality, and years

Lancet 2018; 392: 1859–922

*Collaborators listed at the end of the paper

Correspondence to:
Prof Christopher J L Murray, Institute for Health Metrics and Evaluation, Seattle, WA 98121, USA
cjlm@uw.edu

Years of Life Lost (YLL)

For a given cause, age and sex:

Years of Life Lost = Number of deaths x Standard life expectancy at the age at which death occurs

- Formula YLL= N x D
- Description: YLL basically correspond to the number of deaths multiplied by the standard life expectancy at the age at which death occurs.
- Because YLL measure the incident stream of lost years of life due to deaths, an incidence perspective has also been taken for the calculation of YLD in the original Global Burden of Disease Study for year 1990

Years of Life with Disability (YLD)

For a given cause, age and sex:

Years of Life with Disability

- Formula YLD= I x DW x L
  - I = number of incident cases
  - DW = disability weight
  - L = average duration of the case until remission or death (years)
- Description: the number of incident cases in that period is multiplied by the average duration of the disease and a weight factor that reflects the severity of the disease on a scale from 0 (perfect health) to 1 (dead).

Years of Life with Disability (YLD)-revised GBD 2010

For a given cause, age and sex:

Years of Life with Disability

- Formula YLD= P x DW
  - P = number of prevalent cases
  - DW = disability weight
- Description: the number of incident cases in that period is multiplied by the average duration of the disease and a weight factor that reflects the severity of the disease on a scale from 0 (perfect health) to 1 (dead).

DALY Disability Adjusted Life Year

- One DALY can be thought of as one lost year of "healthy" life.
- DALY= YLL+YLD
- Sum of these DALYs across the population=burden of disease
  - Can be thought of as a measurement of the gap between current health status and an ideal health situation where the entire population lives to an advanced age, free of disease and disability

Health Adjusted Life Year

- **healthy life expectancy (HALE)**
- **Complementary measure to the DALY**

HALE **DALY**

Central Question:

According to the article, are the additional years of life gained are spent in good health or poor health?

What does this table, page 1863 mean?

	Life expectancy at birth				HALE at birth			
	Females		Males		Females		Males	
	1990	2017	1990	2017	1990	2017	1990	2017
Global	68·0 (67·8–68·3)	75·6 (75·3–75·9)	63·2 (62·9–63·4)	70·5 (70·1–70·8)	58·4 (55·7–60·8)	64·8 (61·7–67·4)	55·6 (53·5–57·5)	61·8 (59·4–64·0)
Low SDI	54·8 (54·3–55·4)	67·3 (66·7–67·9)	53·0 (52·4–53·6)	64·5 (63·8–65·1)	46·4 (44·0–48·5)	57·3 (54·5–59·8)	46·1 (44·1–47·9)	56·2 (53·9–58·4)
Low-middle SDI	61·9 (61·5–62·3)	70·1 (69·5–70·7)	59·0 (58·5–59·4)	66·3 (65·7–66·9)	52·6 (50·0–55·0)	59·8 (56·9–62·4)	51·5 (49·3–53·5)	58·0 (55·6–60·1)
Middle SDI	70·0 (69·7–70·3)	77·4 (77·1–77·7)	65·7 (65·3–66·1)	71·7 (71·4–72·1)	60·8 (58·2–63·1)	67·0 (64·1–69·5)	58·4 (56·3–60·2)	63·6 (61·2–65·6)
High-middle SDI	73·1 (72·9–73·4)	79·4 (79·1–79·7)	66·8 (66·5–67·0)	73·3 (73·0–73·7)	63·1 (60·4–65·5)	68·5 (65·4–71·1)	59·0 (56·9–61·0)	64·7 (62·2–66·8)
High SDI	79·3 (79·3–79·3)	83·7 (83·5–83·9)	72·6 (72·5–72·6)	78·5 (78·3–78·6)	67·9 (64·6–70·7)	71·1 (67·6–74·2)	63·8 (61·3–66·0)	68·2 (65·4–70·8)

(Table 1 continues on next page)

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(Table 1 continues on next page)

www.thelancet.com Vol 392 November 10, 2018

On average, globally men and women are gaining in Life expectancy and Healthy life expenctancy from 1990 to 2017.

Varies by country income, where lower SDI region is gaining more than High SDI

What does this table page 1878 mean?

	All-age DALYs (thousands)						Age-standardised DALY rate (per 100 000)					
	2017			Percentage change, 2007–17			2017			Percentage change, 2007–17		
	Males	Females	Both	Males	Females	Both	Males	Females	Both	Males	Females	Both
All causes	1 340 000 (1 240 000 to 1 460 000)	1 160 000 (1 040 000 to 1 290 000)	2 500 000 (2 290 000 to 2 740 000)	−1·4% (−3·0 to 0·1)	−1·6% (−3·5 to 0·2)	−1·5% (−3·1 to 0·1)	35 834·3 (33 218·6 to 38 740·3)	29 934·6 (26 981·7 to 33 211·3)	32 796·9 (30 041·9 to 35 849·3)	−15·9% (−17·2 to −14·6)*	−16·7% (−18·3 to −15·1)*	−16·2% (−17·6 to −14·8)*

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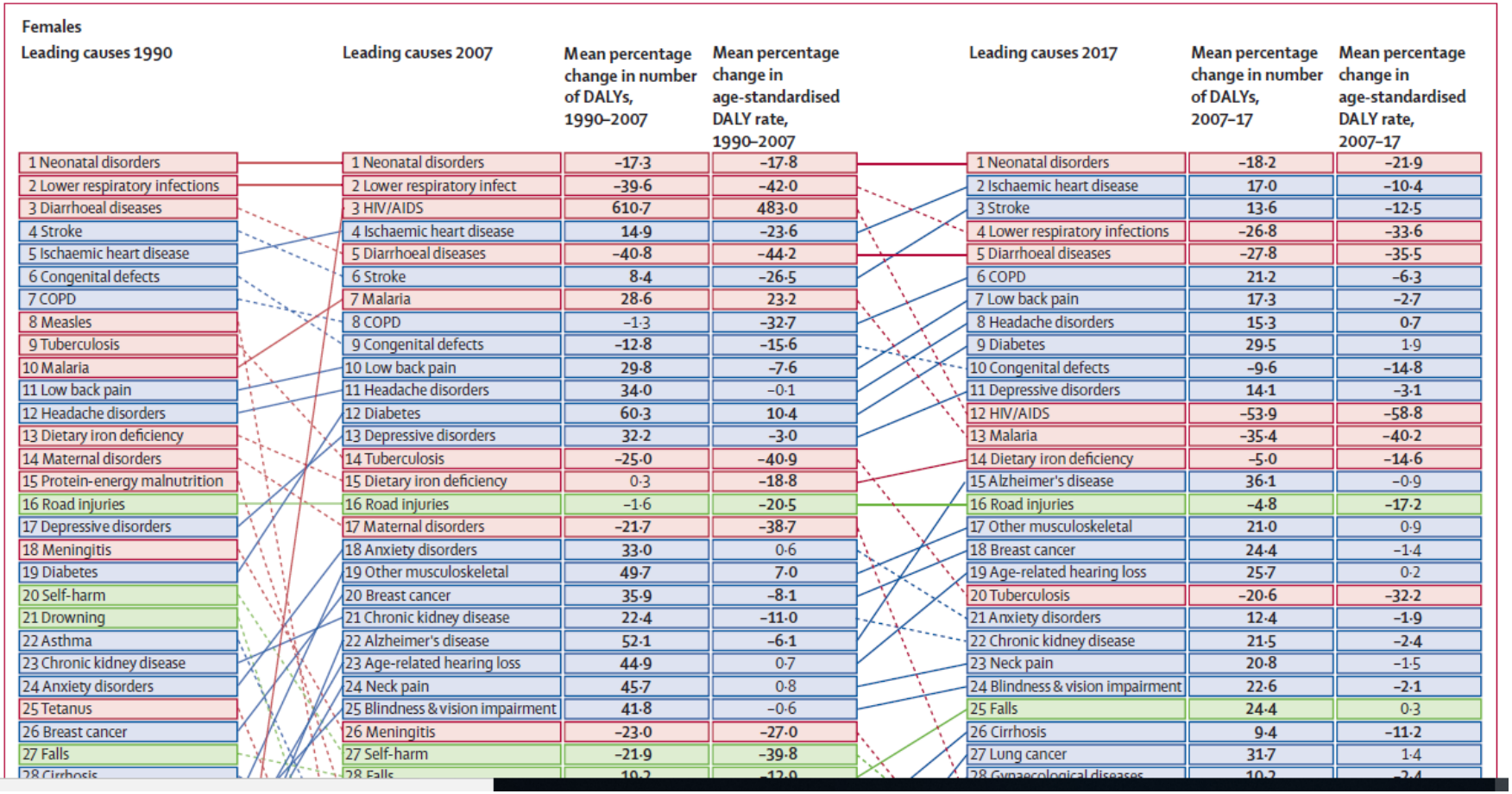
DALYs (Diability Adjusted Life Years went DOWN for both men and women from 2007-2017)

Why? What's behind the changes?

Leading causes of DALYs- pg 1900

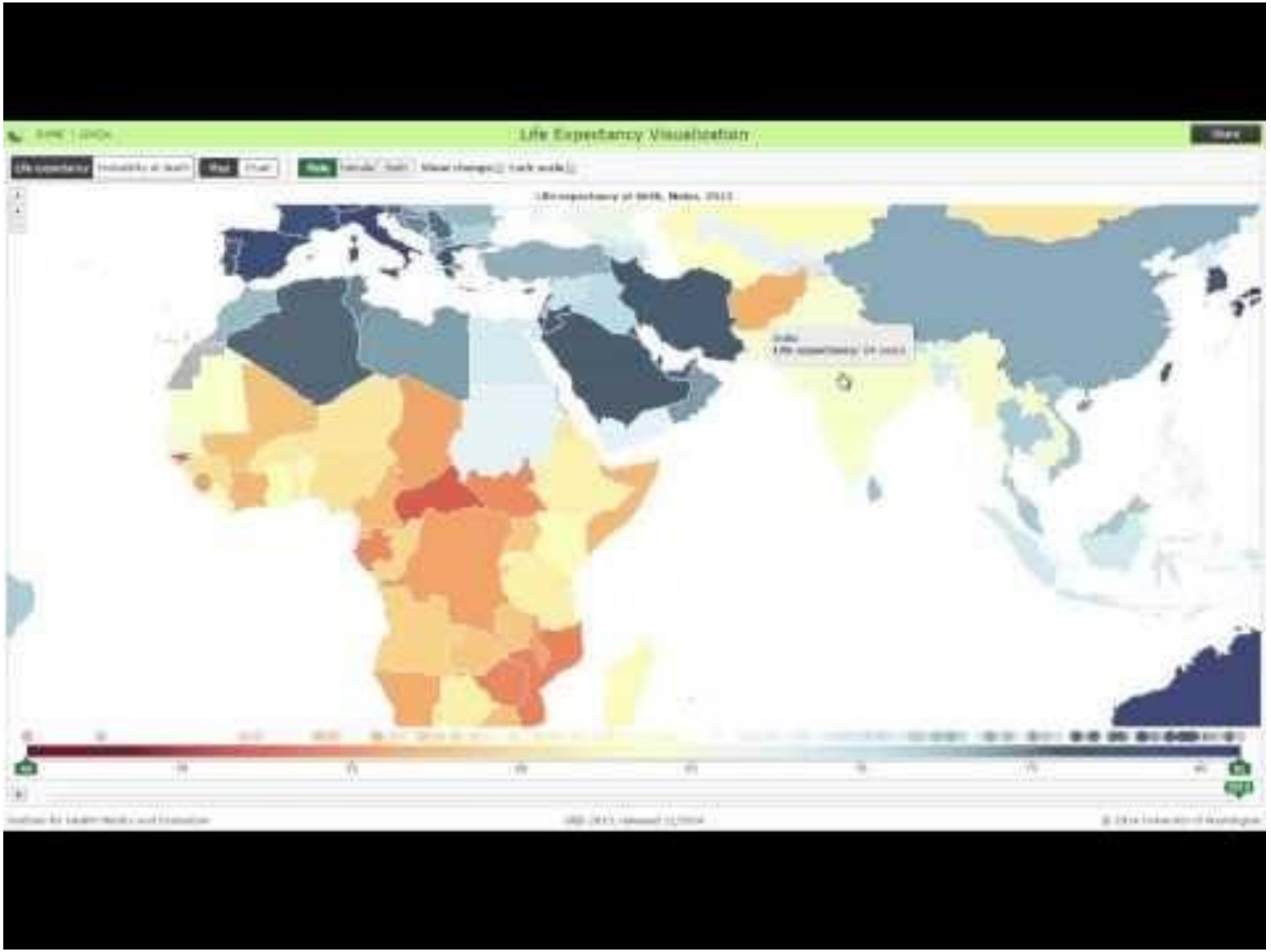


Females

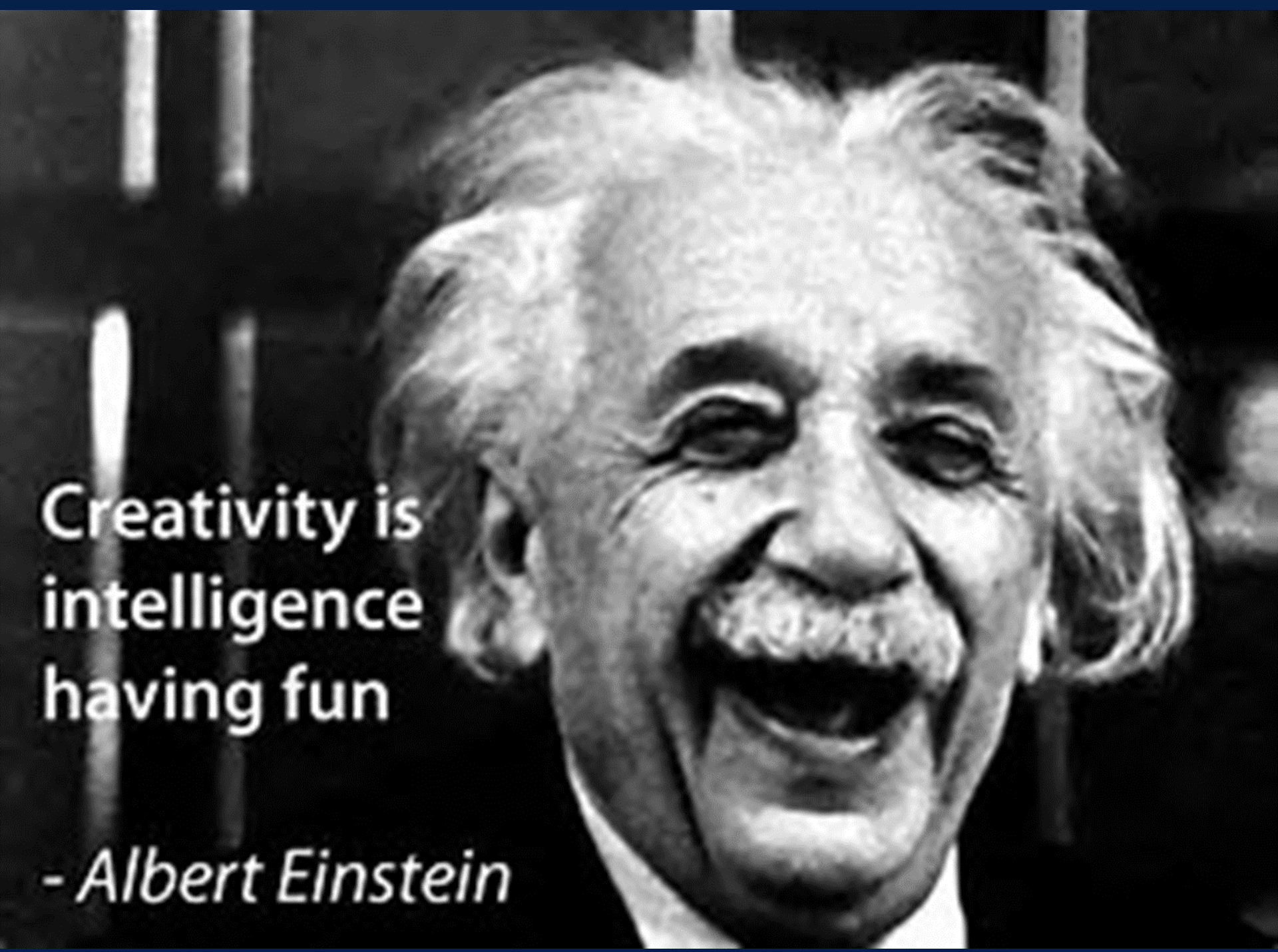
Leading causes 1990	Leading causes 2007	Mean percentage change in number of DALYs, 1990–2007	Mean percentage change in age-standardised DALY rate, 1990–2007	Leading causes 2017	Mean percentage change in number of DALYs, 2007–17	Mean percentage change in age-standardised DALY rate, 2007–17
1 Neonatal disorders	1 Neonatal disorders	−17·3	−17·8	1 Neonatal disorders	−18·2	−21·9
2 Lower respiratory infections	2 Lower respiratory infect	−39·6	−42·0	2 Ischaemic heart disease	17·0	−10·4
3 Diarrhoeal diseases	3 HIV/AIDS	610·7	483·0	3 Stroke	13·6	−12·5
4 Stroke	4 Ischaemic heart disease	14·9	−23·6	4 Lower respiratory infections	−26·8	−33·6
5 Ischaemic heart disease	5 Diarrhoeal diseases	−40·8	−44·2	5 Diarrhoeal diseases	−27·8	−35·5
6 Congenital defects	6 Stroke	8·4	−26·5	6 COPD	21·2	−6·3
7 COPD	7 Malaria	28·6	23·2	7 Low back pain	17·3	−2·7
8 Measles	8 COPD	−1·3	−32·7	8 Headache disorders	15·3	0·7
9 Tuberculosis	9 Congenital defects	−12·8	−15·6	9 Diabetes	29·5	1·9
10 Malaria	10 Low back pain	29·8	−7·6	10 Congenital defects	−9·6	−14·8
11 Low back pain	11 Headache disorders	34·0	−0·1	11 Depressive disorders	14·1	−3·1
12 Headache disorders	12 Diabetes	60·3	10·4	12 HIV/AIDS	−53·9	−58·8
13 Dietary iron deficiency	13 Depressive disorders	32·2	−3·0	13 Malaria	−35·4	−40·2
14 Maternal disorders	14 Tuberculosis	−25·0	−40·9	14 Dietary iron deficiency	−5·0	−14·6
15 Protein-energy malnutrition	15 Dietary iron deficiency	0·3	−18·8	15 Alzheimer's disease	36·1	−0·9
16 Road injuries	16 Road injuries	−1·6	−20·5	16 Road injuries	−4·8	−17·2
17 Depressive disorders	17 Maternal disorders	−21·7	−38·7	17 Other musculoskeletal	21·0	0·9
18 Meningitis	18 Anxiety disorders	33·0	0·6	18 Breast cancer	24·4	−1·4
19 Diabetes	19 Other musculoskeletal	49·7	7·0	19 Age-related hearing loss	25·7	0·2
20 Self-harm	20 Breast cancer	35·9	−8·1	20 Tuberculosis	−20·6	−32·2
21 Drowning	21 Chronic kidney disease	22·4	−11·0	21 Anxiety disorders	12·4	−1·9
22 Asthma	22 Alzheimer's disease	52·1	−6·1	22 Chronic kidney disease	21·5	−2·4
23 Chronic kidney disease	23 Age-related hearing loss	44·9	0·7	23 Neck pain	20·8	−1·5
24 Anxiety disorders	24 Neck pain	45·7	0·8	24 Blindness & vision impairment	22·6	−2·1
25 Tetanus	25 Blindness & vision impairment	41·8	−0·6	25 Falls	24·4	0·3
26 Breast cancer	26 Meningitis	−23·0	−27·0	26 Cirrhosis	9·4	−11·2
27 Falls	27 Self-harm	−21·9	−39·8	27 Lung cancer	31·7	1·4
28 Cirrhosis	28 Falls	10·2	−12·0	28 Gynaecological diseases	10·2	−2·4

Alzheimer's and Dementia

- In terms of the visualizations, the tool that may be best for you is:
- http://www.healthdata.org/data-visualization/gbd-compare
- If you use the drop down under 'cause' and click on B.6.1-Alzheimer's diseaase you can visualize a map of deaths, years of life lived with disability or disability-adjusted life years. This can be displayed using a map or line graphs (far left). There is also an option to map changes over time.


Life Expectancy Visualization

Turn and talk where could you use one of these visualizations?


Creativity is
intelligence
having fun
- Albert Einstein