Swiss TPH

Swiss Tropical and Public Health Institute
Schweizerisches Tropen- und Public Health-Institut
Institut Tropical et de Santé Publique Suisse

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Summary measures of morbidity and mortality - DALYs

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Outline

Session 1: Introductory lecture and discussion

- Rationale of summary measures of population health
- Main summary measures - theoretical underpinnings and applications

Session 2: Practical exercise and discussion

- Analyzing burden of disease patterns for selected countries
- Group discussion of differences and meanings

Measuring the burden of disease

How can we objectively compare disease burdens?

- Prevalence? Number of existing cases in the population now

- Incidence? Number of new cases in the population per year

- Mortality?

- Morbidity?/Severity?

- Health service attendance? HMIS "Top 10 Diseases"

Measuring the Burden of Disease

Traditionally health evaluated by mortality based indicators

- **Mortality rates** - e.g. Under five mortality rates
  http://gamapserver.who.int/mapLibrary/Files/Maps/Global_UnderFiveMortality_2015.png

- **Life expectancy:**

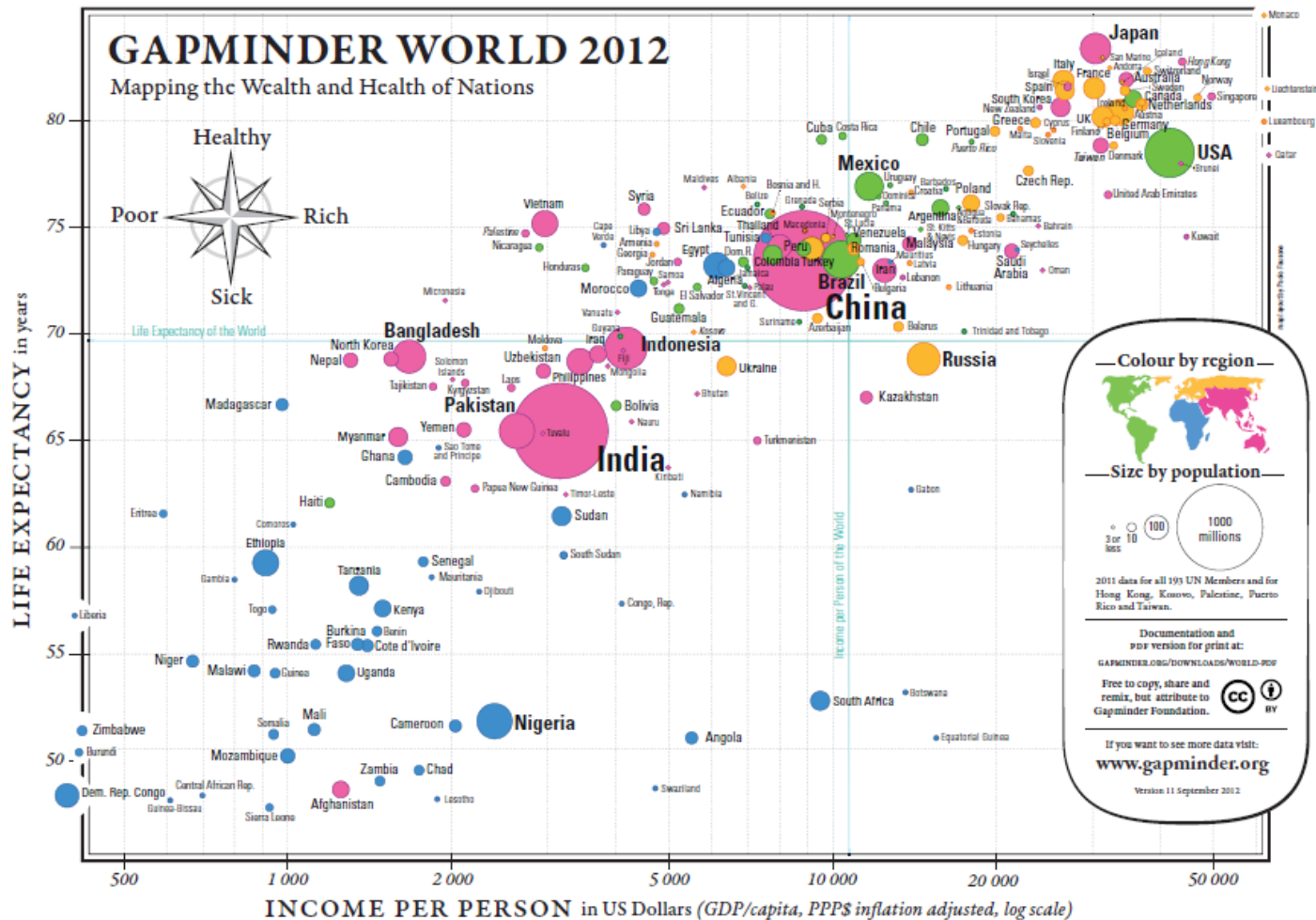 - Average number of years (life span) at a specific age (or at birth) calculated from life tables

  - http://vizhub.healthdata.org/le/

Progress in the last 30 years: Mean age at death

Source: IHME GBD 2010
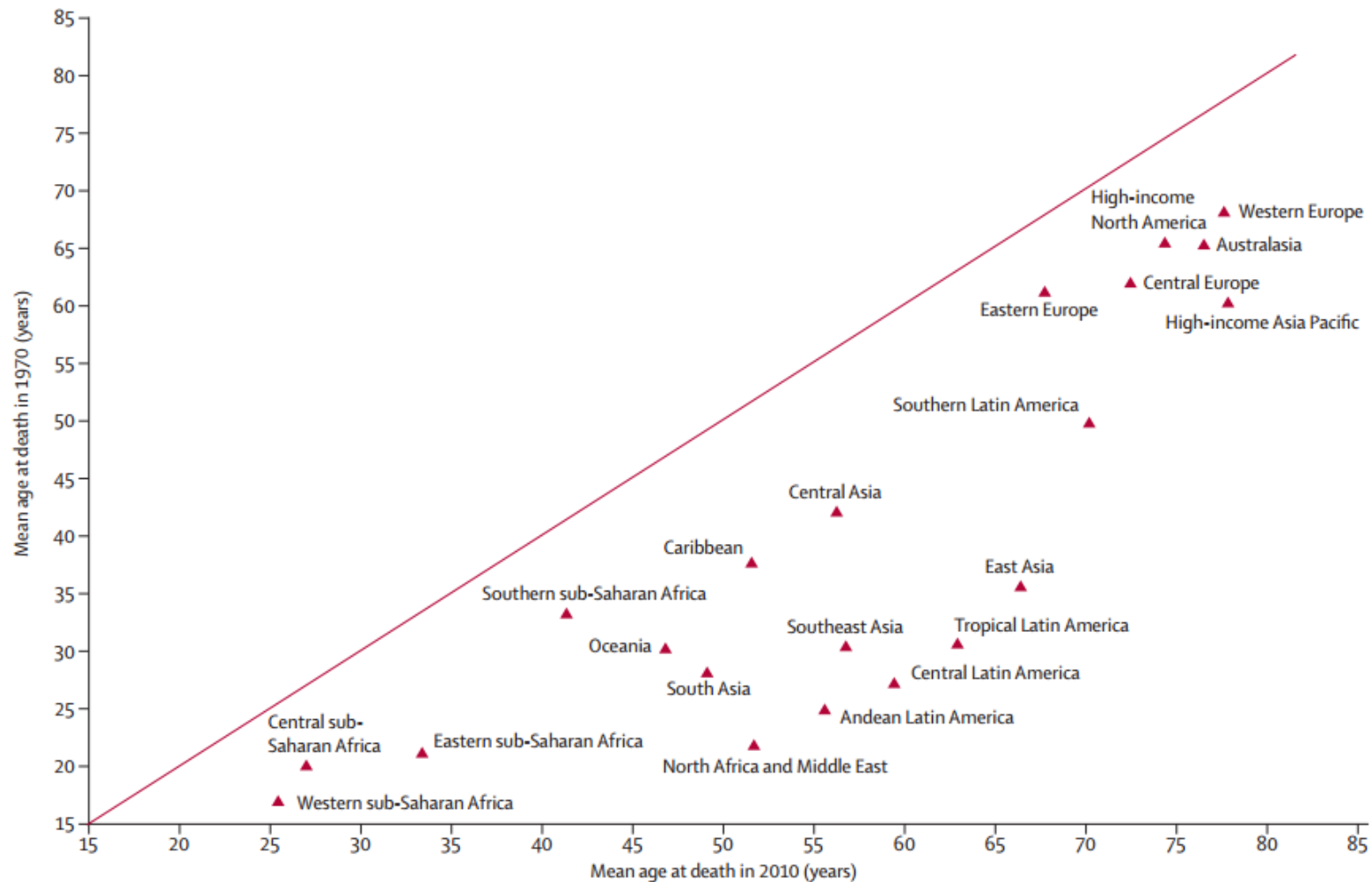
Life expectancy and economic development

Measuring the Burden of Disease

Mortality based indicators limitations – e.g**.**

- Not enough to assess population health and comparative impact of health interventions

- The contribution of chronic diseases, injury, disability to population health goes unrecorded

Summary measures of population health combine mortality and morbitity

Why summary measures of burden of disease?

– Can estimate quantitative health benefits from interventions

– Comparison accross conditions, interventions, populations and points in time

– Assist policy makers in health care planning decisions

– Assist debates on research and development priorities

– Often used in cost-effectiveness analysis as the measure of the «effect» - informinig resource allocation decisions

Major summary measures of population health

Health expectancy – e.g.

− HALE, Health Adjusted Life Expectancy: Number of years of life expectancy lived in perfect health

− **Quality Adjusted Life Years (QALYs):** Number of years of life of any quality added by an intervention

Health gaps measures

− **Disability Adjusted Life Years (DALYs):** Future stream of life lost due to specific conditions or risks

Steps in calculating summary measures

3 general steps in calculating QALYs or DALYs

1. Describing health: i.e. as a health state or as a disease/condition

2. Developing values or weights for the health state or condition: which are called HRQL or disability weights

3. Combining values for different health states or conditions with estimates of life expectancy – time is common metric

Each of these steps includes methodological choices that affect the estimates that are obtained

QALYs: origin and rationale

– Developed in the late 1960s primarily for use in cost-effectiveness analysis (CEA)

– Sum of time spent in different health states using weights on a scale of 0 (dead) to 1 (perfectly healthy) for each health state

– The arithmetic product of duration of life and a measure of quality of the remaining life years (health state weight)

  – Five years of perfect health = 5 QALYs

 – Two years in a state measured as 0.5 of perfect health followed by three years of perfect health = 4 QALYs

QALYs

– QALYs measure health gains and are calculated – for a certain year and condition – as follows:

– QALYs   = I * D * QW ≈ P * QW

– I   = incidence

– D   = duration

– P   = prevalence

– QW   = quality weight (usually so-called health-related quality of life (HRQOL) with scale 0=death and 1=full health)

QALYs

Illustration of the life path of changing HRQOL for an individual from "now" to that person's death with and without an intervention

BRITISH MEDICAL BULLETIN
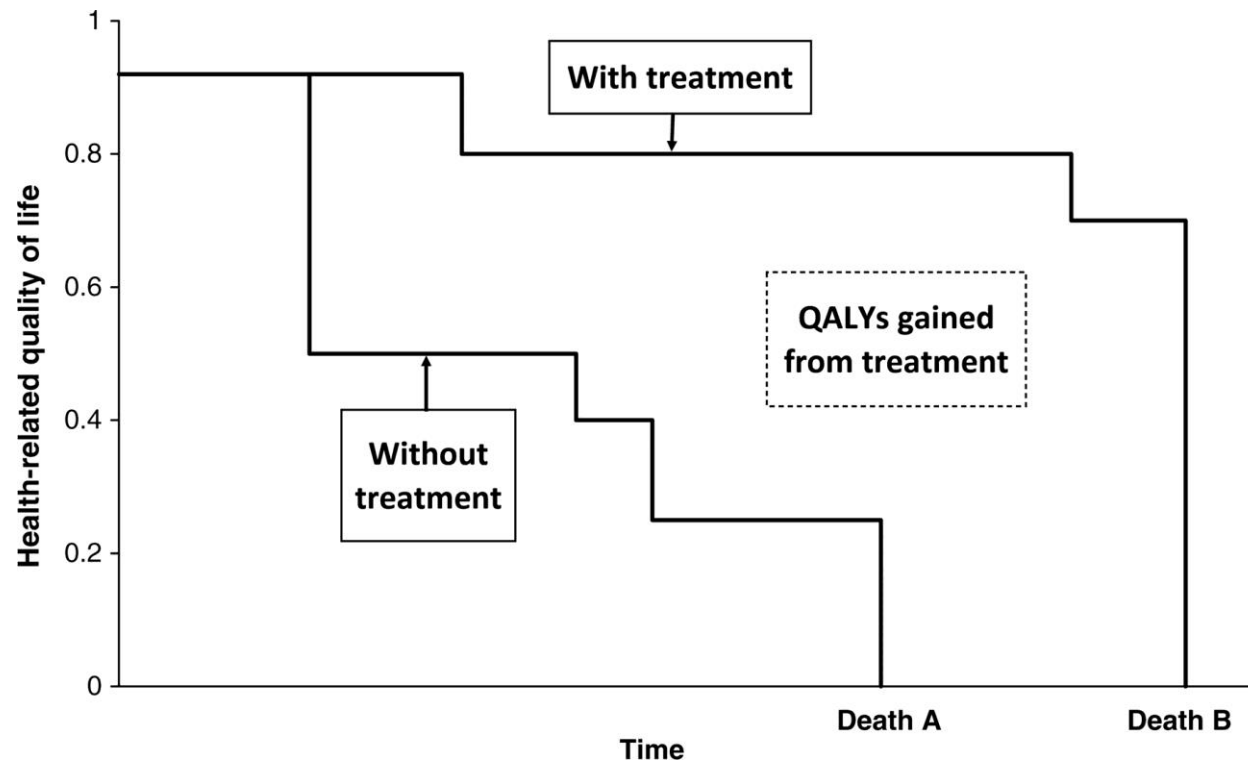
QALYs

- HRQL weights not linked to any particular disease, condition, or disability

- HRQL weights based on the values of individuals for either their own health state (patient weights) or the health states of others that are described to them (community weights)

- Descriptive systems including key domains are used to create QALYs-

    - physical, psychological, and social/role function, health perceptions, and symptoms e.g. the EQ-5D (EuroQoL) - http://www.euroqol.org/

QALYs

– Underlying assumptions of the QALY approach:

– Health is defined as value-weighted time (QALYs) over the relevant time horizon.

– Value is measured in terms of preference (desirability).

– Preferences measured across individuals can be aggregated and used for the group.

– QALYs can be aggregated across individuals, i.e., a QALY is a QALY regardless of who gains/loses it

QALYs

- HRQoL weights, direct or indirect methods (also called generic preference-based measures).

- Direct elicitation methods:

  - Visual analogue scale (VAS)

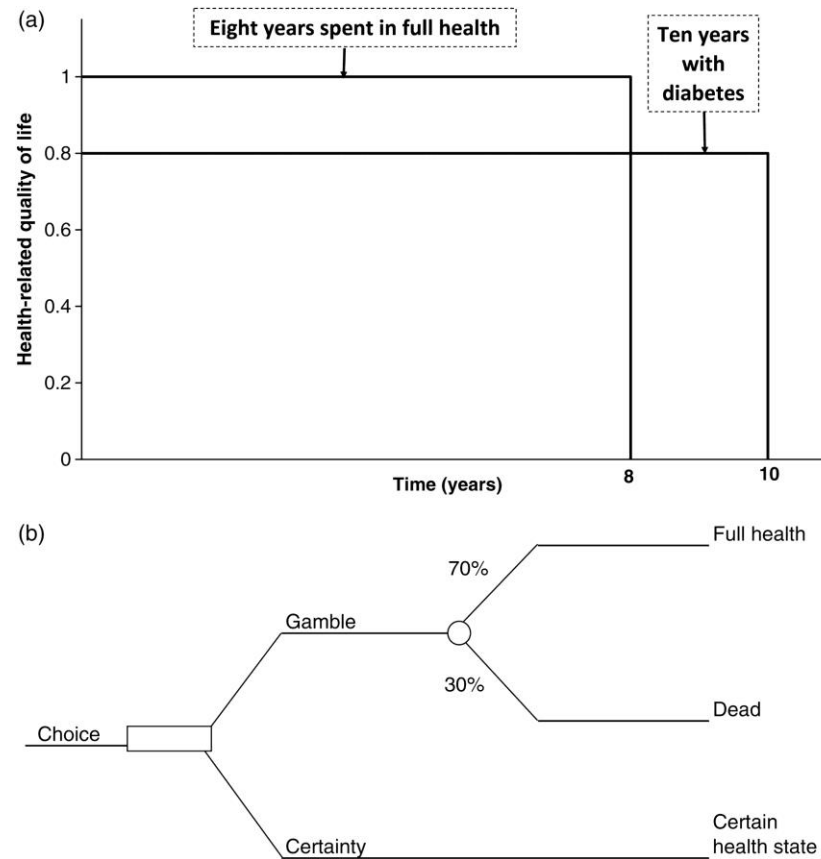 - Time trade-off (TTO)

  - Standard gamble (SG).

Direct measures: Visual analogue scale
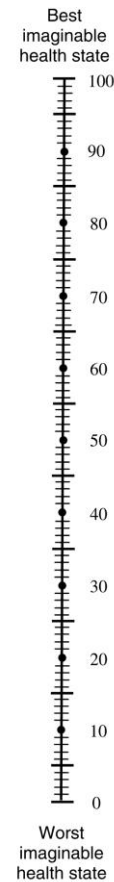
Source: adapted from the EuroQol Group: www.euroqol.org

Sarah J. Whitehead, and Shehzad Ali Br Med Bull 2010;96:5-21

Direct measures: time trade-off and standard gamble (using numerical examples)

Sarah J. Whitehead, and Shehzad Ali Br Med Bull 2010;96:5-21

Indirect elicitation methods

- Indirect elicitation methods involve the use of pre-scored generic preference-based measures (also called 'off-the-shelf' questionnaires or generic multi-attribute systems)

- Health states are described using standardized generic utility questionnaires, which cover general aspects of health.

- Generic preference-based measures – e.g.

  - EuroQol (EQ)-5D,

  - Short Form 6D (SF-6D)

  - Health Utilities Index (HUI)

Indirect elicitation methods

Table 1 Main characteristics of generic preference-based measures.

Instrument	Domains	Levels of response	Potential health states	Valuation method used	Original population preferences are based on
EQ-5D	5	3	245	TTO	Random sample of approximately 3000 adults in the UK
HUI3	8	5–6	972 000	SG and VAS	Random sample of general population adults in Canada
SF-6D	6	4–6	18 000	SG	Random sample of 836 members of general population in the UK

QALYs - EQ-5D (EuroQoL) - http://www.euroqol.org/

Under each heading, please tick the ONE box that best describes your health TODAY.

MOBILITY

I have no problems in walking about ☐

I have slight problems in walking about ☐

I have moderate problems in walking about ☐

I have severe problems in walking about ☐

I am unable to walk about ☐

USUAL ACTIVITIES (e.g. work, study, housework, family or leisure activities)

I have no problems doing my usual activities ☐

I have slight problems doing my usual activities ☐

I have moderate problems doing my usual activities ☐

I have severe problems doing my usual activities ☐

I am unable to do my usual activities ☐

ANXIETY / DEPRESSION

I am not anxious or depressed ☐

I am slightly anxious or depressed ☐

I am moderately anxious or depressed ☐

I am severely anxious or depressed ☐

I am extremely anxious or depressed ☐

SELF-CARE

I have no problems washing or dressing myself ☐

I have slight problems washing or dressing myself ☐

I have moderate problems washing or dressing myself ☐

I have severe problems washing or dressing myself ☐

I am unable to wash or dress myself ☐

PAIN / DISCOMFORT

I have no pain or discomfort ☐

I have slight pain or discomfort ☐

I have moderate pain or discomfort ☐

I have severe pain or discomfort ☐

I have extreme pain or discomfort ☐

EQ-5D-5L

DALYs: origin and rationale

- World Bank and WHO Global Burden of Disease 1990 study – 1992-96 (Murray & Lopez: World Bank 1993, Harvard & WHO 1996)

  - To facilitate the inclusion of nonfatal health outcomes in debates on international health policy

  - To develop objective measure of mortality and disability from a condition

  - To quantify the burden of disease using a measure that could be used for cost-effectiveness analysis

- **DALYs measure the gap between a population's health and a hypothetical ideal for health achievement**

DALYs

–   DALYs attach estimates of HRQL/disability to specific diseases, rather than to health states –

  –   International Classification of Impairments, Disabilities, and Handicaps (ICIDH) focusing on disability

–   DALYs measure health losses and are calculated – for a certain year and condition – as follows:

–   **DALYs = YLL + YLD**

  –   YLL   = years of life lost (due to premature death)

  –   YLD   = years lived with disability

DALYs

Illustration of the life path of changing DW for an individual from "now" to that person's standard life expectancy with and without an intervention.

Global Burden of Disease – past and future

1998 - 2004   WHO assessments of GBD for 1999-2002 (World Health Reports 2000 – 2004, WHO website, reports) 1996)

2005 – 2006   GBD 2001 for Disease Control Priorities Project (Lopez, Mathers et al 2006)

2006 – 2010   GBD 2005 Project (IHME Murray)

2008   Global Burden Disease – 2004 update (WHO 2008)

2009   Global Health Risks 2004 (WHO 2009)

2010   Child Causes of Death 2008 (WHO 2010)

2012   GBD 2010 (IHME Murray)

2014-15   GBD 2013 (IHME Murray)

Theoretical basis of YLLs

- How long should people in good health expect to live? → standard life expectancy

- Are all people equal? → use of same standard life expectancy regardless of local life expectancy

- How to compare years lost due to death with years lived in poor health? → disability weights with values between 0 (perfect health) and 1 (death)

- Value of healthy year of life equal at all ages? → age weights – now removed

- Value of future years of life? → discounting

DALYs - Years of Life Lost

$$YLL = N \times L_x$$

YLL = Years of future life lost due to premature mortality

N   = Number of deaths in the population

L_x = Standard life expectancy at age of death

X   = Age of death

3 deaths at age 50 = 3 x 34 = 102 YLL

Calculating DALYs: Age weighting
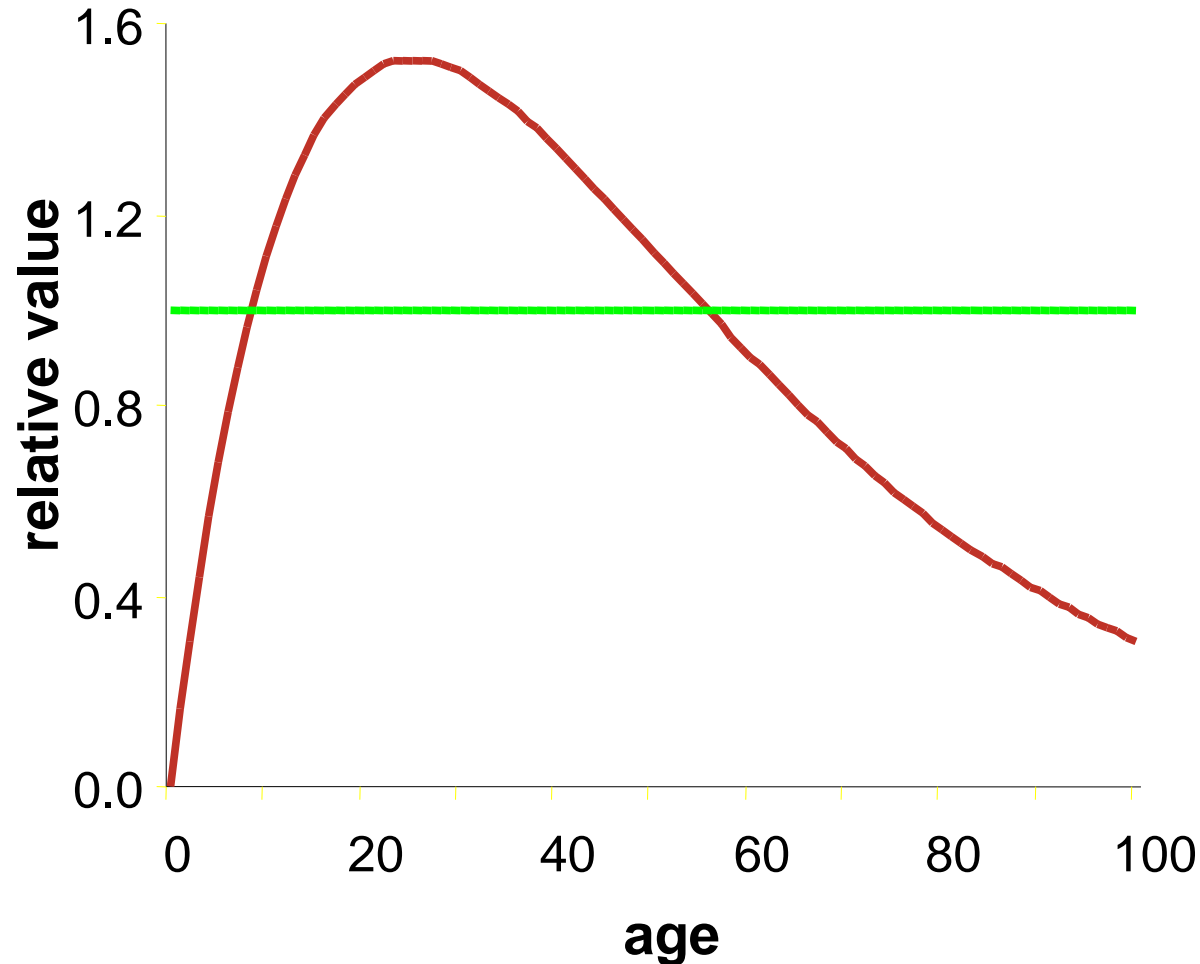
$$C * x * e^{-\beta * x}$$

C = constant (0.1658)

x = age

β = 0.04

Calculating DALYs: Discounting

– Adjusting for societal time preference

– Compares value today with value in the future

– Universal characteristic to prefer a benefit now rather than in the future

– Should we discount future health the same way we discount future money?

– Arbitrarily set to 3% in the Standard (old) DALYs

– Little consequence for BOD rankings

– Profound consequence for cost-effectiveness of certain interventions and hence choice of interventions in health service planning

DALYs - Years of Life with Disability

$$YLD = I \times DW \times d$$

YLD = Years of life lived with disability

I = Number of incident cases in the population

DW = Disability weight

d = Duration of disability [years]

4 cases of mild mental retardation due to lead at birth

4 x 0.36 x 80 years = 115 YLD

DALYs - Disability weights

– Quantify preferences for health states in terms of a single number on an interval scale

– 0 = full health

– 1 = health state equivalent to death

– Disability Weights quantify societal preferences for health states

– (bigger weight ➡ more lost health)

– Disability weights say nothing about the value of the person

– or their quality of life or their utility

Disability weights 2010 – a few examples
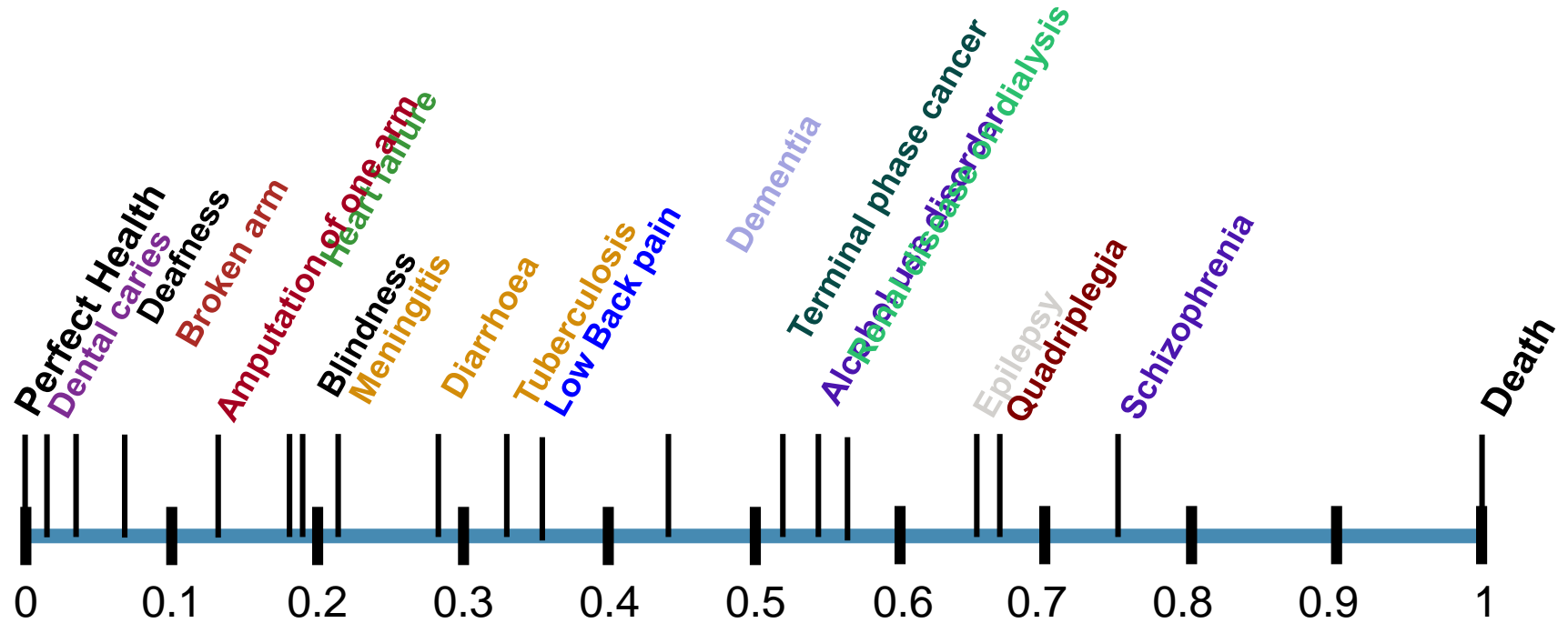
Colour code		
Cancer	Cardiovascular and circulatory diseases	Diabetes, digestive, and genitourinary diseases
Hearing and vision loss	Infectious disease	Injuries
Mental and behavioural disorders	Musculoskeletal disorders	Neurological disorders
Others		

Disability weights in comparison

Comparing disability weights 2010 to 2004
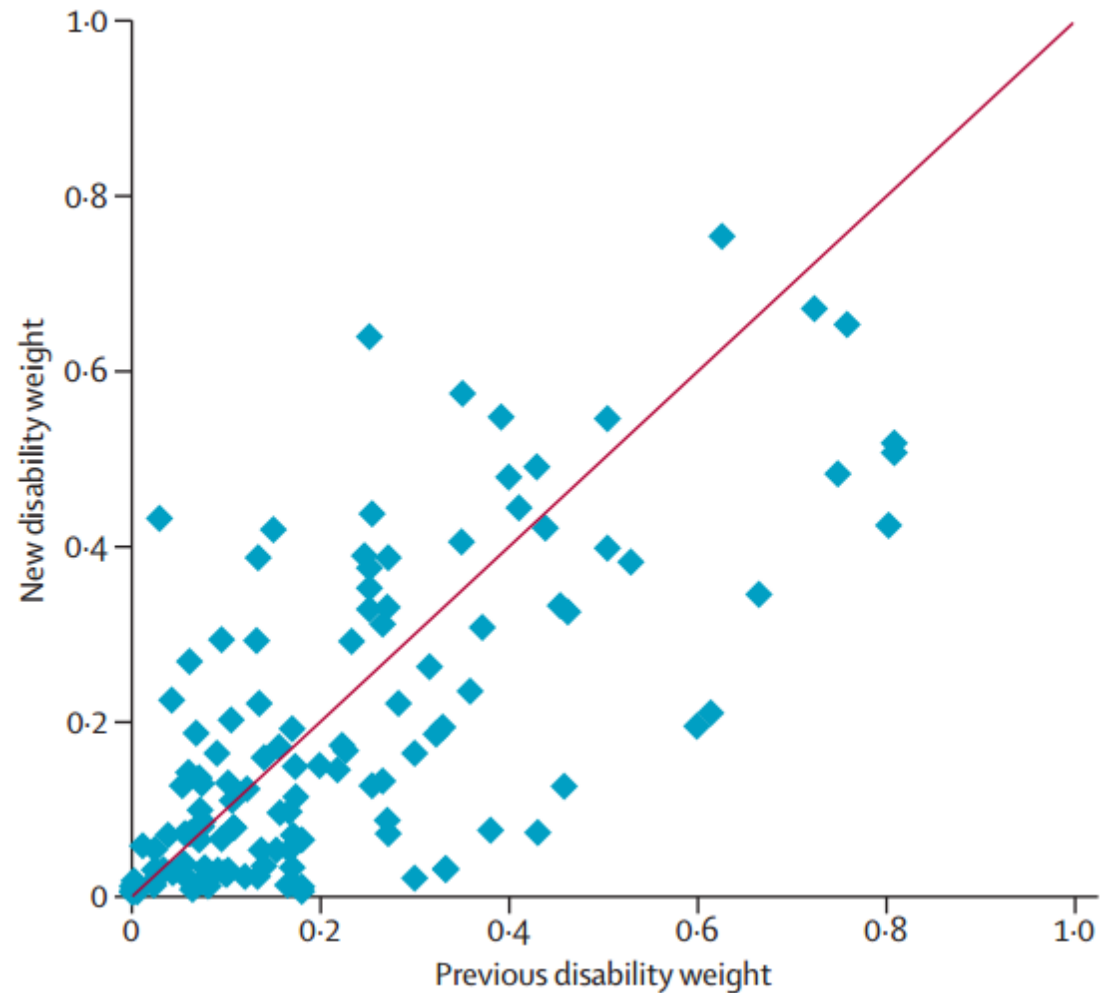
Data sources for DALYs

Mortality

– Vital registration, sample registration systems, household surveys, surveillance systems, epidemiological studies, population laboratories (DSSs)

Morbidity / disability

– Disease registers, population based studies, epidemiological (longitudinal studies), health facility data (injuries)

Criticisms of DALYs

E.g.

– Patient versus community versus health experts valuations of health

– Age-based weighting does not favor the young or old.

– Disabilities are additive in nature and could add up to more than 1 death for persons having more than one disability

– No priority is given to those worse off, unlike the usual societal tendencies to help those worse off

– Does not assess qualitative difference in outcomes.

– Discounts future health outcomes

GBD 2010: What's new in 2013?
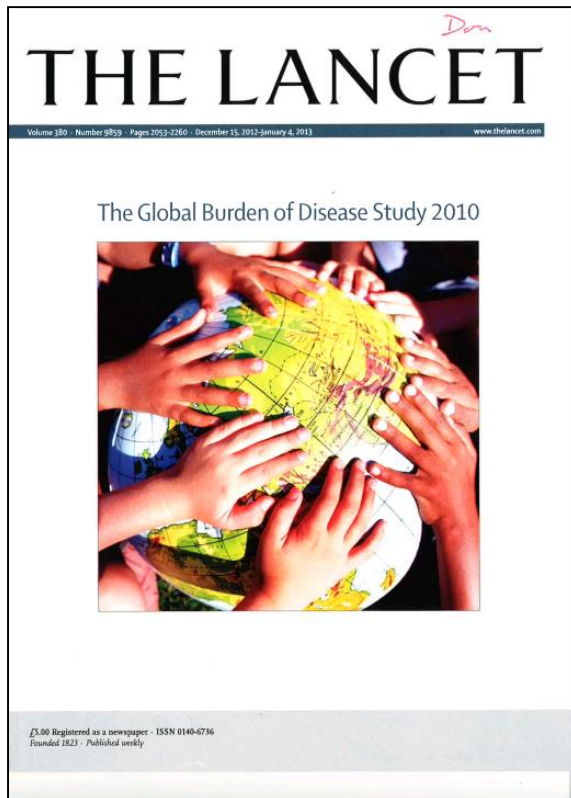
A new touchstone in public health

486 Authors

All new DALY metrics

1. **No age weighting / No discounting**
2. New disability weights & methods
3. 291 diseases   (vs. 166)
4. 67 risk factors (vs. 10)
5. 23 regions   (vs. 6)
6. National level estimates for 187 countries
7. 650 million estimates in total
8. Re-estimation back to 1990
9. Trend forecasting
10. Web-based visualization interface

DALYs – Burden of Disease classification

➢ Group I: Communicable, maternal, perinatal and
        nutritional conditions

➢ Group II: Non-communicable diseases

➢ Group III: Injuries

sub-Saharan Africa
- 7.9%
- 23.7%
- 68.4%
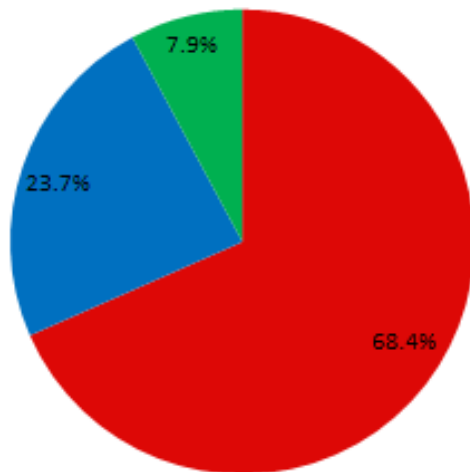
North Africa & Middle East
- 0.121
- 0.222
- 0.652
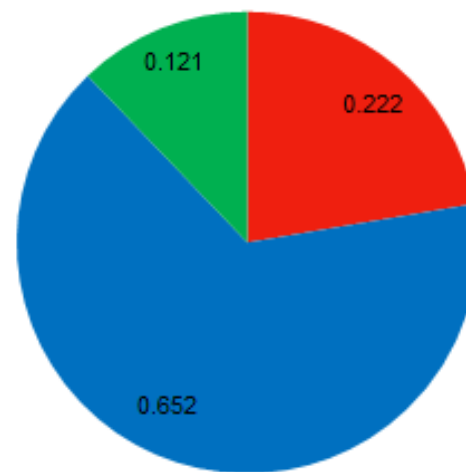
Western Europe
- 4.0%
- 9.3%
- 86.3%
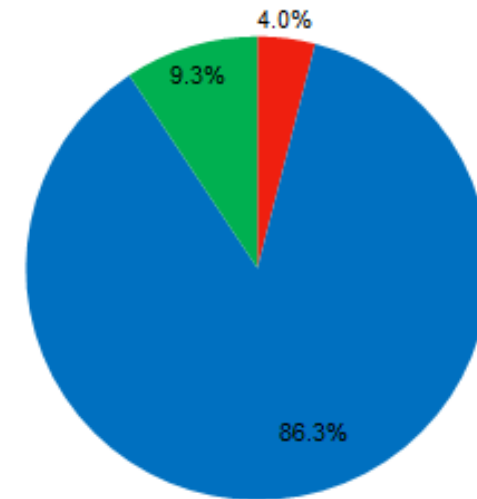
■ Communicable diseases   ■ Non-communicable diseases   ■ Injuries

GBD patterns by broad cause group

GBD 2010: What's changed?

Globally: Some highlights …

1. **We are living longer, but living longer in poor health**

2. **60% drop in under-five mortality since 1990**

3. Globally HIV/AIDS is the single largest cause of death in adult women (14.4%)

4. **Road traffic accidents now equal HIV/AIDS (10.7%) as second leading cause of death in men**

5. New leading risk factors: Physical inactivity and inappropriate diet (low fruit, excess salt) accounts for 10% of lost DALYs

6. **Chronic disease is replacing premature mortality everywhere except Africa**

7. Tobacco, alcohol, mental health, pain and injury move up in proportion along with Alzheimer's, HIV and forces of nature

8. Overweight has replaced under-nutrition as a risk factor for the first time

   But global averages hide important information

   What is happening regionally and nationally is more interesting

GBD 2010: What's changed?

http://vizhub.healthdata.org/gbd-compare/
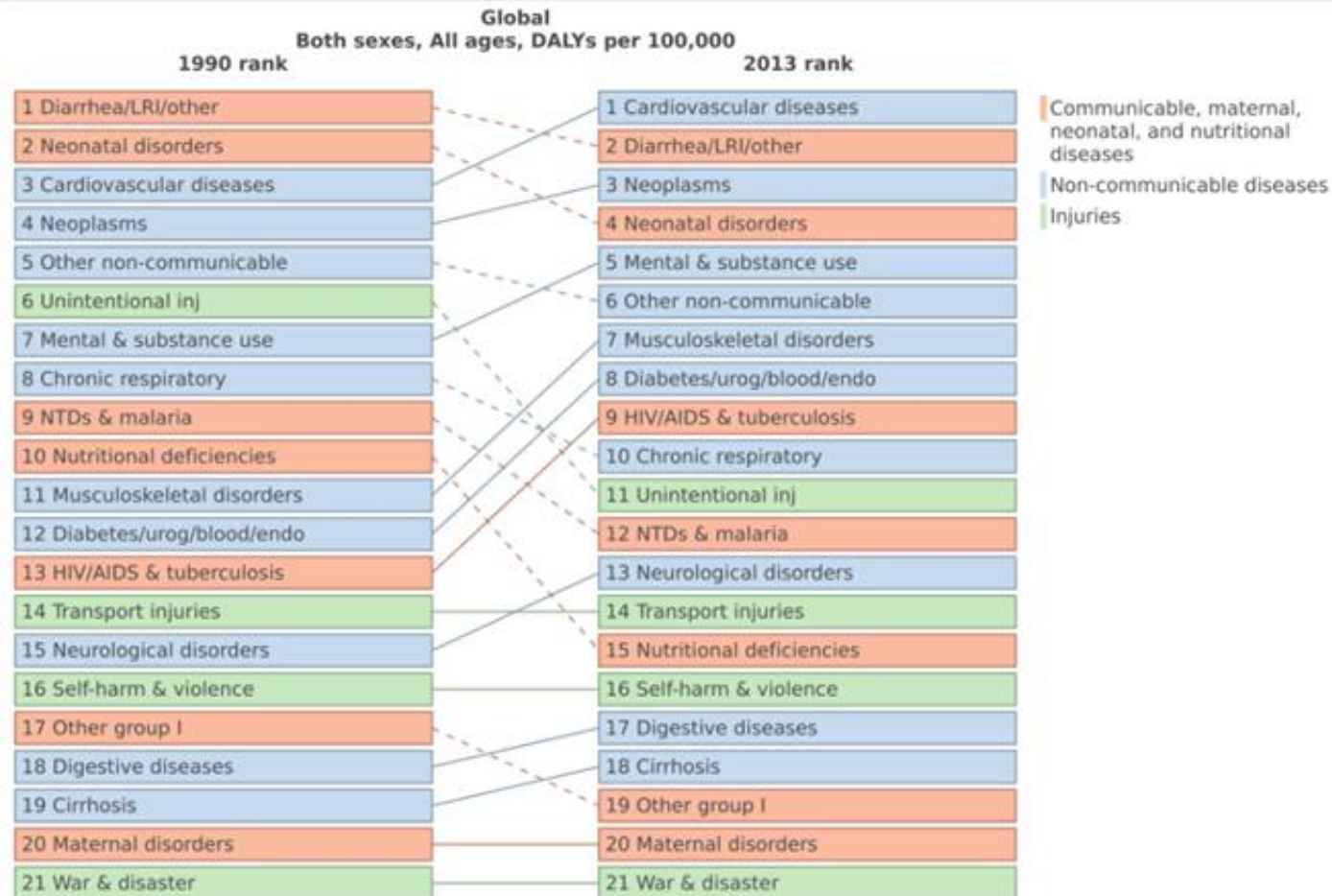
Health challenges of vulnerable groups in low and middle income countries
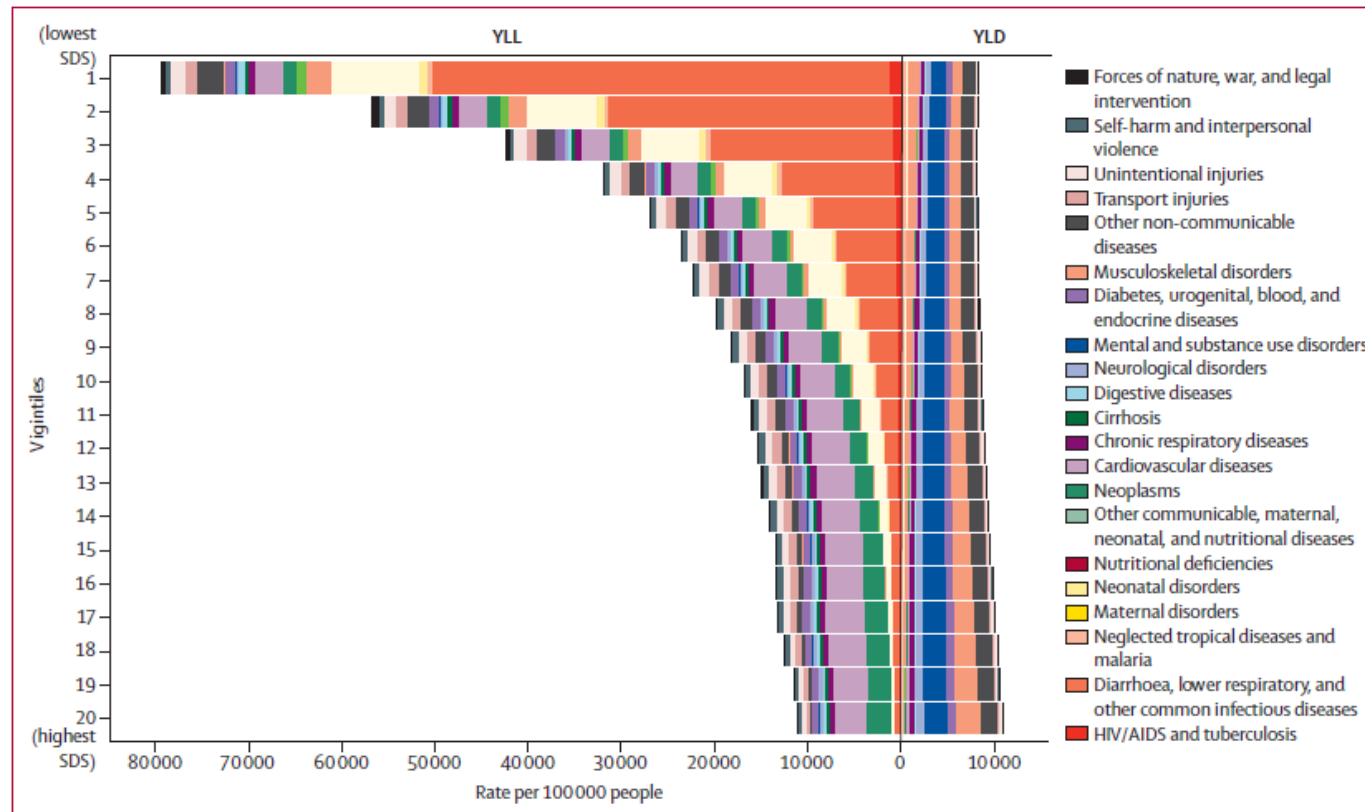
Figure 5: YLL and YLD cause composition of DALY rates by sociodemographic status vigintile

Global, regional, and national disability-adjusted life years (DALYs) for 306 diseases and injuries and healthy life expectancy (HALE) for 188 countries, 1990-2013: quantifying the epidemiological transition. Lancet. 2015 Aug 27.

# Shift in the disease burden towards non communicable diseases
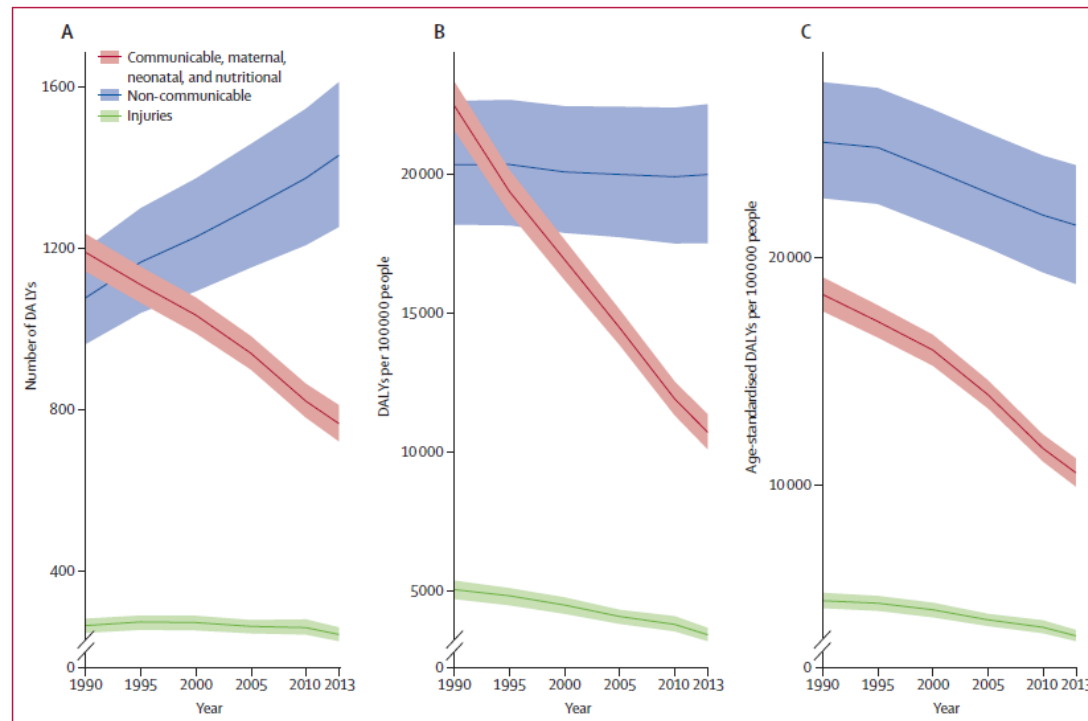
Figure 2: Total DALYs, crude DALY rates, and age-standardised DALY rates from 1990 to 2013
Changes in global DALYs caused by communicable, maternal, neonatal, and nutritional disorders, non-communicable diseases, and injuries shown in terms of numbers of DALYs (A), DALY rates per 100 000 people (B), and age-standardised DALY rates per 100 000 people (C). The difference in trends between A and B is caused by population growth and the difference between B and C because of changes in the percentage distribution of the population by age. Shaded areas show 95% uncertainty intervals. DALY=disability-adjusted life-years.

Global, regional, and national disability-adjusted life years (DALYs) for 306 diseases and injuries and healthy life expectancy (HALE) for 188 countries, 1990-2013: quantifying the epidemiological transition. Lancet. 2015 Aug 27.

GBD Visualizations dash board
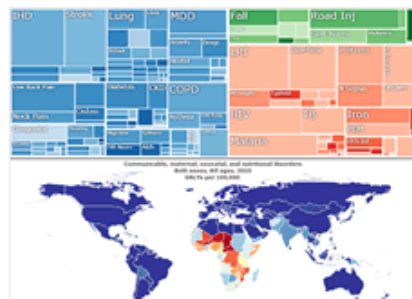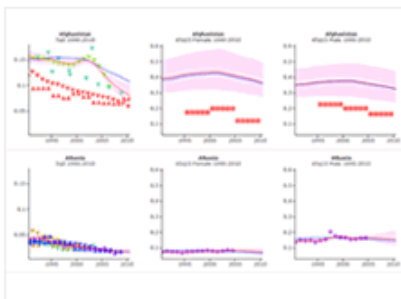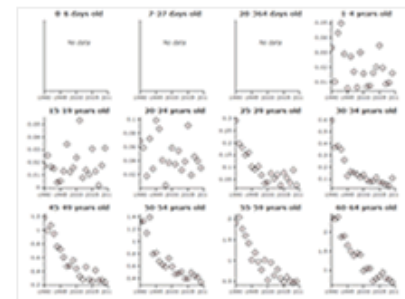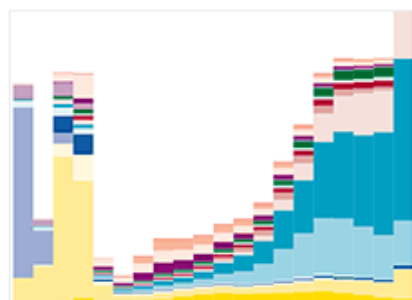
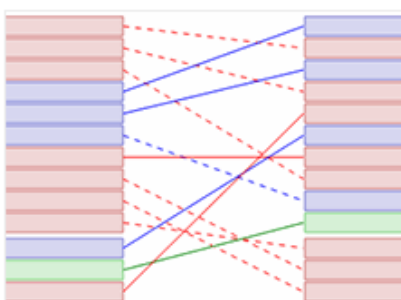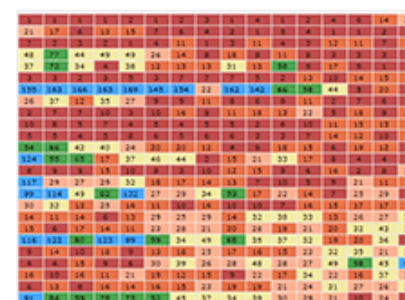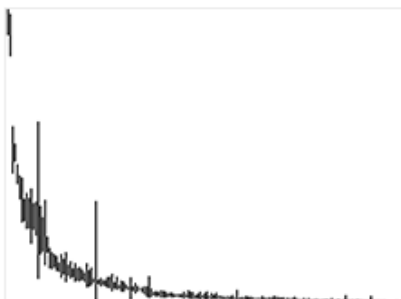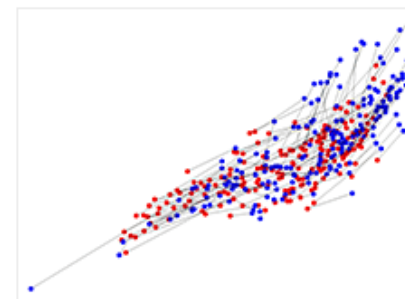# Uses of summary measures of population health

- Comparing the health of one population to the health of another population

- Comparing the health of the same population at different points in time

- Identifying and quantifying overall health inequalities within populations

- Providing appropriate and balanced attention to the effects of non-fatal health outcomes on overall population health

Uses of summary measures of population health

– Moving from attributable burden due to diseases and risk factors to avertable burden due to interventions

– Informing debates on priorities for health service delivery and planning

– Informing debates on priorities for research and development in the health sector

– Analyzing the benefits of health interventions for use in cost-effectiveness analyses

– Estimating the potential gain in population health (DALYs) through specified investments in interventions or mixes of interventions

Benefits and costs of 47 interventions
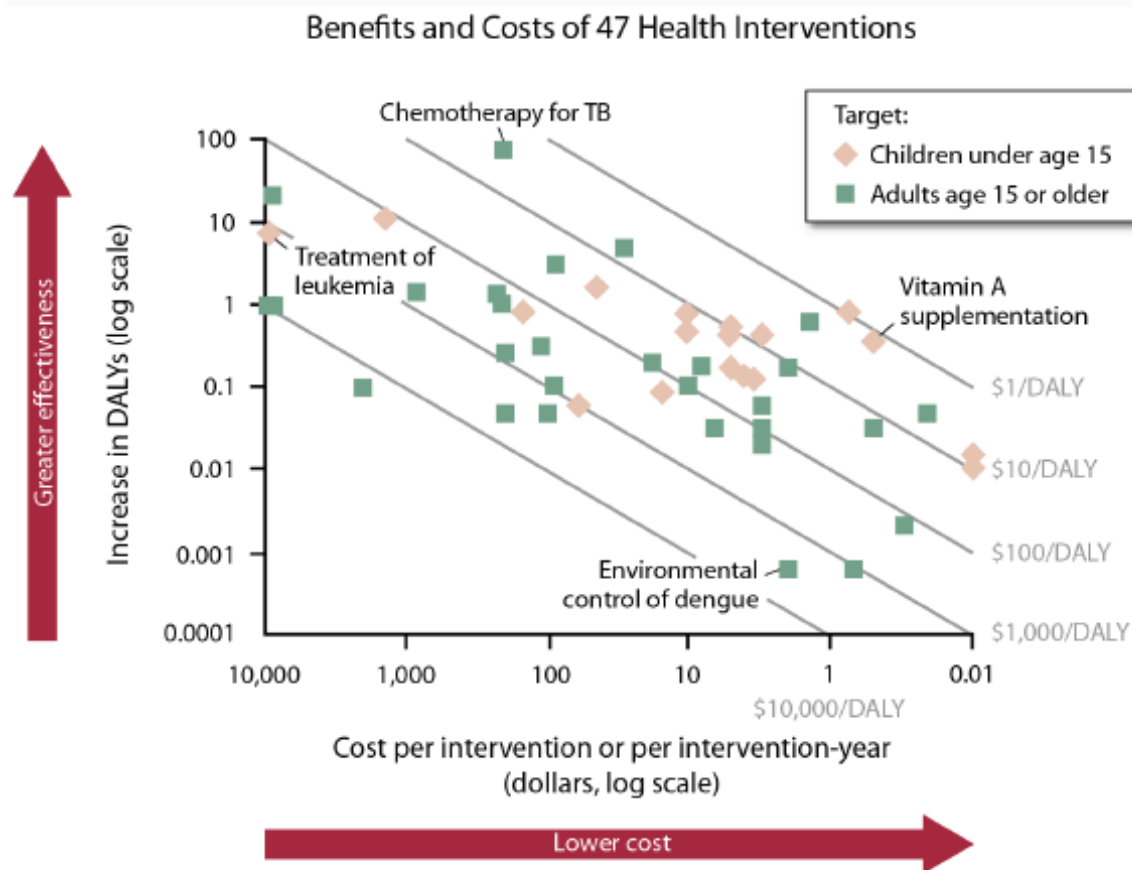
Benefits and Costs of 47 Health Interventions

Example: Scenarios compared for elimination and eradication of Lymphatic Filariasis

Key features of the proposed scenarios for elimination and eradication of LF

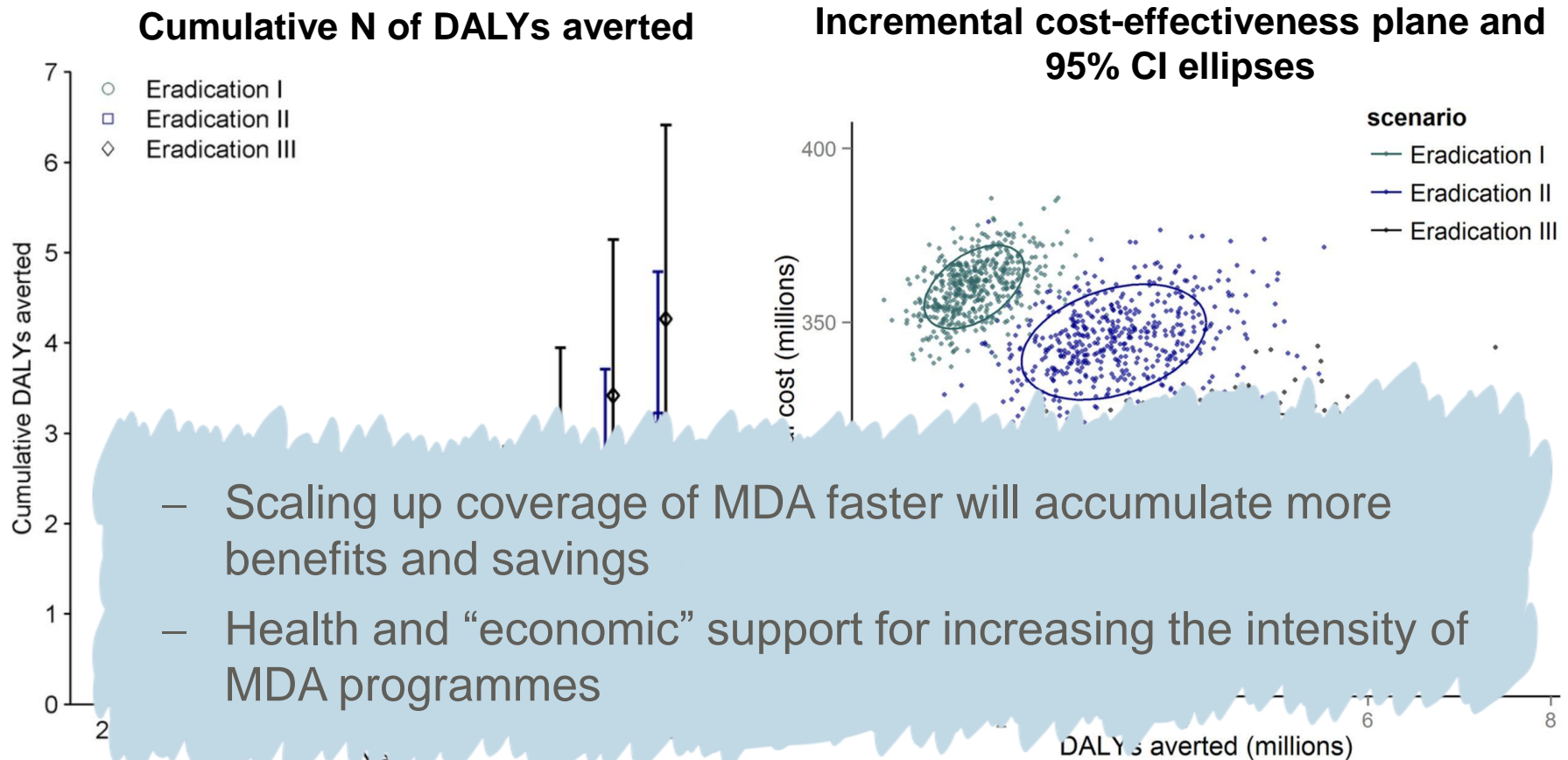|	Elimination (comparator)	Eradication I	Eradication II	Eradication III
Intervention	MDA	MDA	MDA	MDA
Coverage rate	85%	85%	85%	85%
Countries considered	All LF endemic countries that have previously conducted MDA[¥]	All LF endemic countries[¥], including all countries co-endemic with *L. loa*	All LF endemic countries[¥], including all countries co-endemic with *L. loa*	All LF endemic countries[¥], including all countries co-endemic with *L. loa*
Rate of scale-up	Countries with previous MDA continue at same rate as historically	Countries with previous MDA continue at same historical rate, countries without previous progress begin at an 'average' rate of MDA scale-up (schedule II)	Schedule I: All countries add 20% of their at-risk populations to the MDA schedule annually	All countries treat 100% of their at-risk populations annually

[¥]Assuming country requires MDA

doi:10.1371/journal.pntd.0004147.t001

Kastner RJ, Tediosi F et al (2015) What Is Needed to Eradicate Lymphatic Filariasis? A Model-Based Assessment on the Impact of Scaling Up Mass Drug Administration Programs. PLoS Negl Trop Dis 9(10)

Impacts of LF elimination and eradication strategies

Cumulative N of DALYs averted

Incremental cost-effectiveness plane and 95% CI ellipses

- Scaling up coverage of MDA faster will accumulate more benefits and savings
- Health and "economic" support for increasing the intensity of MDA programmes

Stone CM, Tediosi F et al. *Modelling the health impact and cost-effectiveness of lymphatic filariasis eradication under varying levels of mass drug administration scale-up and geographic coverage.* BMJ Global Health 2016;1

Example: Public health impact and cost-effectiveness of RTS,S malaria vaccine

Prediction of the likely pubic health impact and cost-effectiveness of Malaria vaccine RTS,S for 42 countries

GAVI vaccine investment strategy, demand forecasting, delivery modality investigations, country specific implementation/investigations

OpenMalaria

code.google.com/p/openmalaria/

# Public Health Impact: EPI cumulative DALYs averted end 2030

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DALYs Averted by Vaccine

Legend:
- 1,253,662–6,032,220
- 764,585–1,253,662
- 318,261–764,585
- 119,547–318,261
- 29,995–119,547
- 0–29,995
- No data
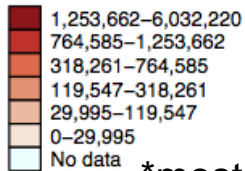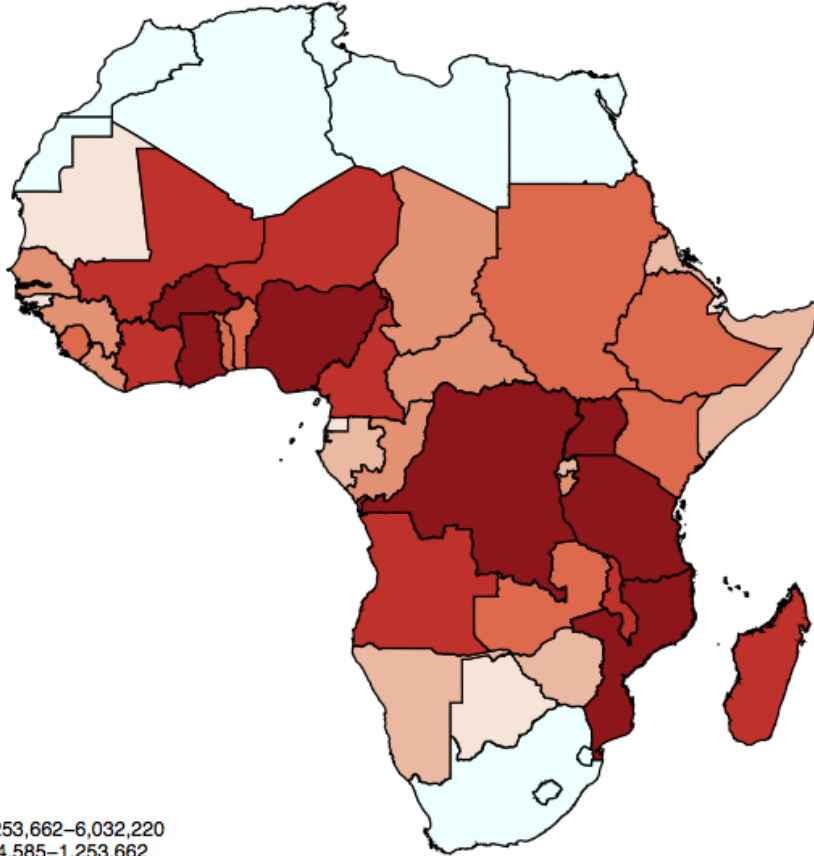
*most DALYs averted: Burkina Faso, Ghana, DRC, Uganda, Tanzania, Mozambique, Nigeria

DALYs Averted by Vaccine per 100000 FVC

Legend:
- 16,557–24,172
- 13,613–16,557
- 10,900–13,613
- 6,429–10,900
- 3,909–6,429
- 0–3,909
- No data
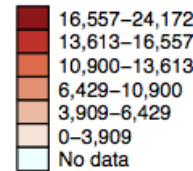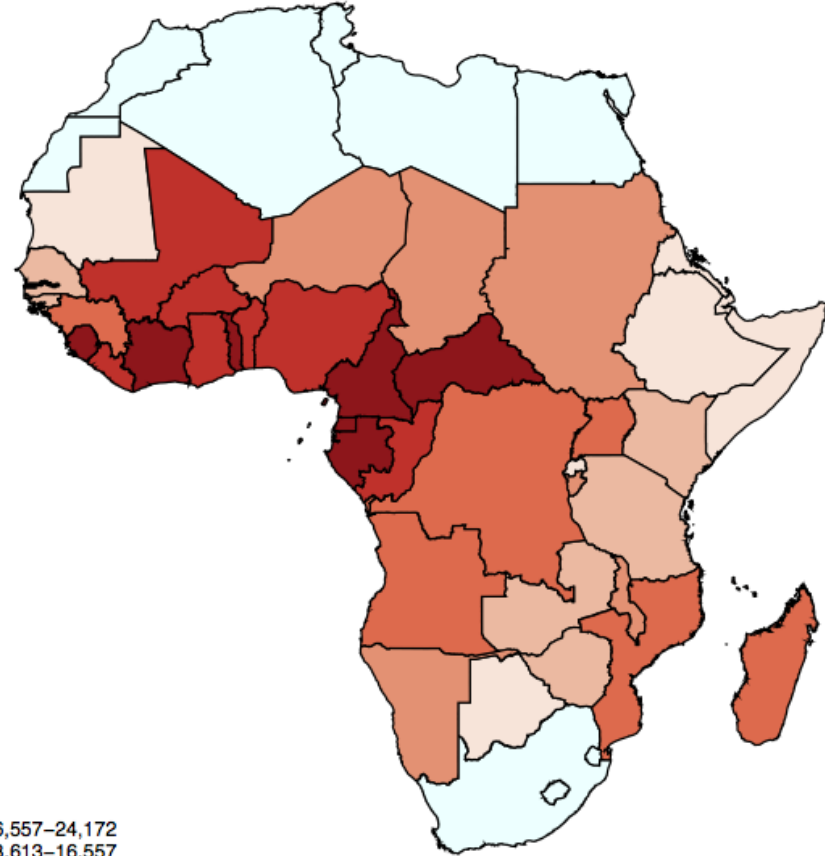
*most DALYs per FV averted: Sierra Leone, Cote d'Ivoire, Togo, Gabon, Eq. Guinea, Cameroon, CAR, The Gambia, Guinea-Bissau

Cost-per DALY averted by delivery strategy & EIR

Scatter plot: y-axis I$/DALY (0 to 2,000), x-axis weighted mean EIR (0 to 100). Legend: ● EPI (black), ● EPI Booster (orange), ● 5-17 months (blue), ● 5-17 months Booster (magenta)
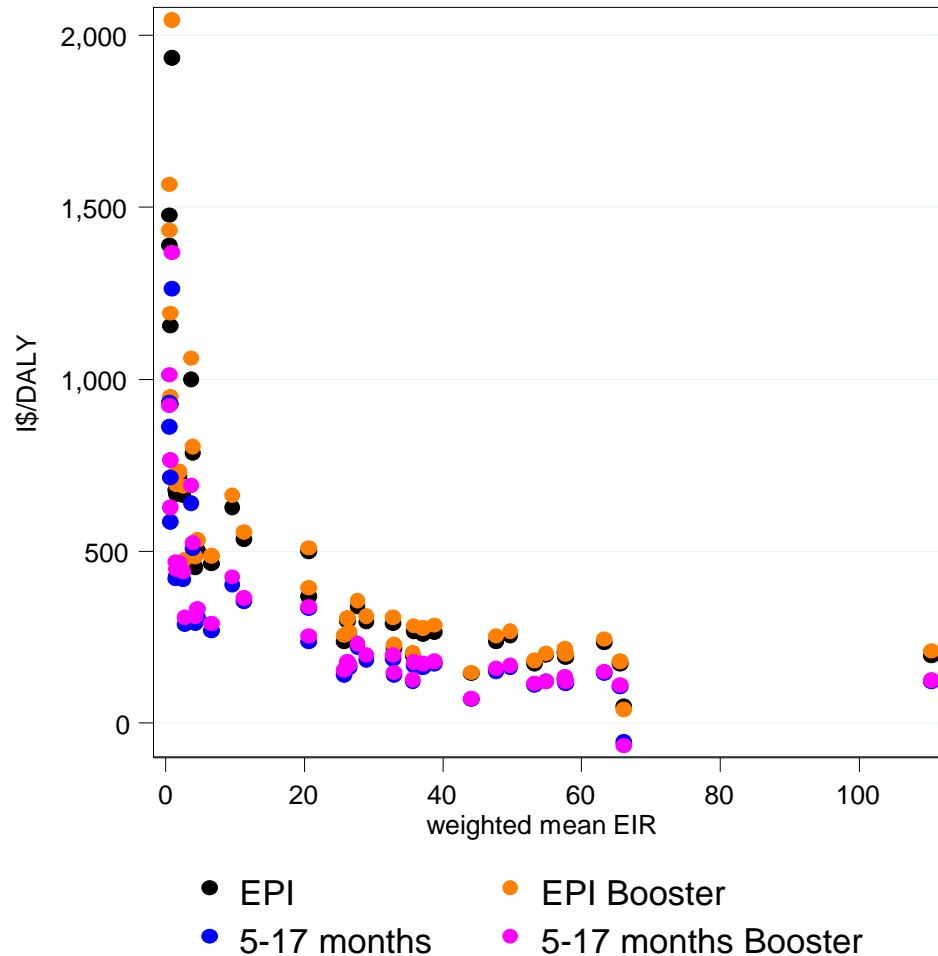
- RTS,S is cost effective, particularly in countries with medium levels of transmission

- At GDP per capita threshold the vaccine is cost-effective in more than half of the countries

- At twice GDP per capita the vaccine is cost-effective in all countries considered

- Much variation in CE in low-medium transmission settings (EIR<10)

- Relatively small differences in CER across delivery strategies

Burden of disease country profiles

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GBD PROFILE: SWITZERLAND

GLOBAL BURDEN OF DISEASES, INJURIES, AND RISK FACTORS STUDY 2010

The Global Burden of Disease Study 2010 (GBD 2010) is a collaborative project of nearly 500 researchers in 50 countries led by the Institute for Health Metrics and Evaluation (IHME) at the University of Washington. It is the largest systematic scientific effort in history to quantify levels and trends of health loss due to diseases, injuries, and risk factors. GBD serves as a global public good to inform evidence-based policymaking and health systems design.

PROFILE OVERVIEW

- In terms of the number of years of life lost (YLLs) due to premature death in Switzerland, ischemic heart disease, trachea, bronchus, and lung cancers, and cerebrovascular disease were the highest ranking causes in 2010.
- Of the 25 most important causes of burden, as measured by disability-adjusted life years (DALYs), road injury showed the largest decrease, falling by 39% from 1990 to 2010.
- The leading risk factor in Switzerland is dietary risks.

ALL-CAUSE MORTALITY RATE

- This chart shows the decline in mortality rate at every age range. The higher points on the chart indicate that declines in mortality rates were faster in those age groups between 1990 and 2010.
- The greatest reductions in all-cause mortality rate were experienced by males aged 30-34 years (61%). Females aged 80+ years saw the smallest decrease in mortality rate (12%).

Percent decline in age-specific mortality rate by sex from 1990-2010 in Switzerland
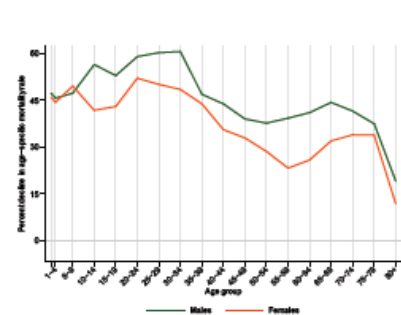
CAUSES OF PREMATURE DEATH

Years of life lost (YLLs) quantify premature mortality by weighting younger deaths more than older deaths.

Ranks for top 25 causes of YLLs 1990-2010, Switzerland

# YLLs in thousands (% of total)	Rank and disorder 1990	Rank and disorder 2010	# YLLs in thousands (% of total)	% change
196 (18.8%)	1 Ischemic heart disease	1 Ischemic heart disease	144 (16.9%)	-27
84 (8.0%)	2 Stroke	2 Lung cancer	58 (6.8%)	0
67 (6.4%)	3 Self-harm	3 Stroke	55 (6.4%)	-36
59 (5.6%)	4 Lung cancer	4 Self-harm	47 (5.5%)	-29
49 (4.7%)	5 Road injury	5 Colorectal cancer	30 (3.6%)	-2
34 (3.3%)	6 Breast cancer	6 Breast cancer	28 (3.3%)	-19
31 (2.9%)	7 Colorectal cancer	7 COPD	25 (2.9%)	-4
26 (2.5%)	8 COPD	8 Falls	21 (2.5%)	-12
25 (2.4%)	9 Congenital anomalies	9 Road injury	20 (2.4%)	-59
24 (2.3%)	10 Lower respiratory infections	10 Diabetes	19 (2.3%)	1
24 (2.3%)	11 Falls	11 Lower respiratory infections	19 (2.2%)	-22
19 (1.8%)	12 Diabetes	12 Pancreatic cancer	18 (2.1%)	22
19 (1.9%)	13 Cirrhosis	13 Alzheimers disease	17 (2.0%)	57
19 (1.8%)	14 Other cardio & circulatory	14 Prostate cancer	17 (2.0%)	-4
18 (1.7%)	15 Prostate cancer	15 Cirrhosis	17 (2.0%)	-12
17 (1.6%)	16 HIV/AIDS	16 Other cardio & circulatory	17 (1.9%)	-13
16 (1.5%)	17 Stomach cancer	17 Congenital anomalies	13 (1.5%)	-50
15 (1.4%)	18 Pancreatic cancer	18 Brain cancer	13 (1.5%)	14
11 (1.1%)	19 Leukemia	19 Liver cancer	11 (1.3%)	46
11 (1.1%)	20 Brain cancer	20 Leukemia	11 (1.3%)	-3
11 (1.1%)	21 Alzheimers disease	21 Stomach cancer	11 (1.2%)	-35
9 (0.9%)	22 Rheumatic heart disease	22 Kidney cancers	10 (1.2%)	41
9 (0.9%)	23 Hypertensive heart disease	23 Non-Hodgkin lymphoma	10 (1.1%)	7
9 (0.9%)	24 Bladder cancer	24 Ovarian cancer	9 (1.0%)	-2
9 (0.9%)	25 Non-Hodgkin lymphoma	25 Esophageal cancer	8 (1.0%)	7
	26 Ovarian cancer	26 Hypertensive heart disease		
	27 Liver cancer	27 Bladder cancer		
	28 Esophageal cancer	33 HIV/AIDS		
	31 Kidney cancers	41 Rheumatic heart disease		

This chart shows the change in the top 25 causes of YLLs due to premature mortality from 1990 to 2010. Solid lines indicate a cause has moved up in rank or stayed the same. Broken lines indicate a cause has moved down in rank. The causes are color coded by blue for non-communicable diseases, green for injuries, and red for communicable, maternal, neonatal, and nutritional causes of death.

YEARS LIVED WITH DISABILITY (YLDs)

Years lived with disability (YLDs) are estimated by weighting the prevalence of different conditions based on severity. The top five leading causes of YLDs in Switzerland are major depressive disorder, low back pain, chronic obstructive pulmonary disease, falls, and neck pain.

Switzerland YLDs by cause and age 2010
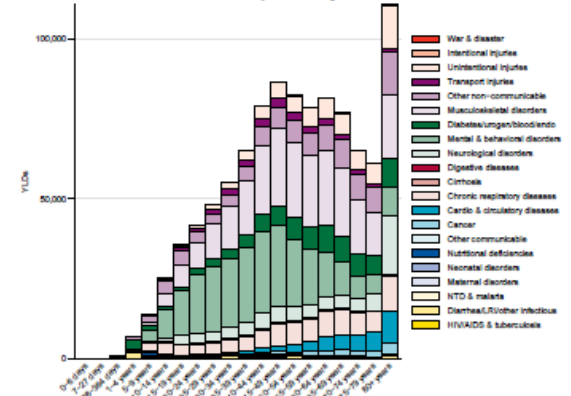
The size of the colored portion in each bar represents the number of YLDs attributable to each cause. The height of each bar shows which age groups had the most YLDs in 2010. The causes are aggregated. For example, musculoskeletal disorders include low back pain and neck pain.

DISABILITY-ADJUSTED LIFE YEARS (DALYs)

Disability-adjusted life years (DALYs) quantify both premature mortality (YLLs) and disability (YLDs) within a population. In Switzerland, the top three causes of DALYs in 2010 were ischemic heart disease, low back pain, and major depressive disorder. Two causes that appeared in the 10 leading causes of DALYs in 2010 and not 1990 were diabetes mellitus and other musculoskeletal disorders.

Leading causes of DALYs and percent change 1990 to 2010 for Switzerland
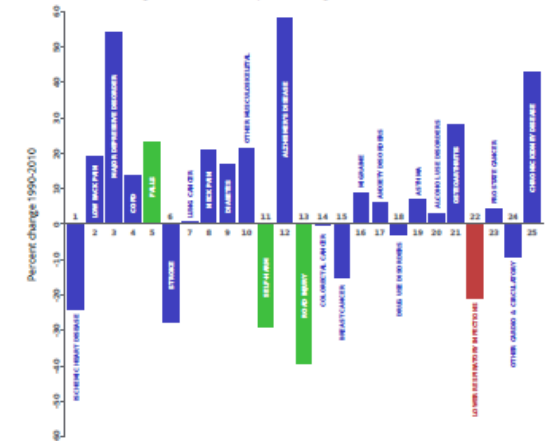
The top 25 causes of DALYs are ranked from left to right in order of the number of DALYs they contributed in 2010. Bars going up show the percent by which DALYs have increased since 1990. Bars going down show the percent by which DALYs have decreased. Globally, non-communicable diseases and injuries are generally on the rise, while communicable, maternal, and nutritional causes of DALYs are generally on the decline.

- Communicable, maternal, neonatal, and nutritional
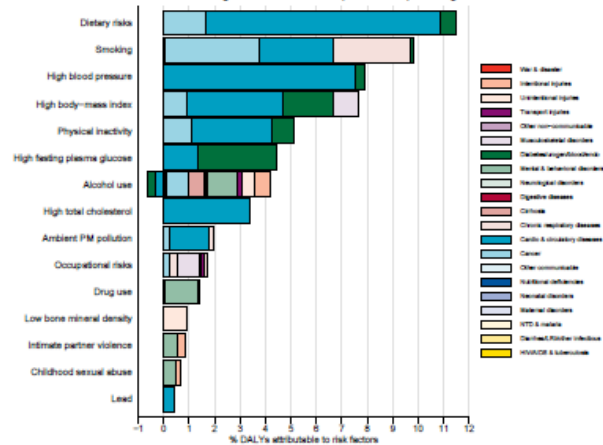- Non-communicable
- Injuries

Burden of disease country profiles

RISK FACTORS

Overall, the three risk factors that account for the most disease burden in Switzerland are dietary risks, tobacco smoking, and high blood pressure. The leading risk factors for children under 5 and adults aged 15-49 years were tobacco smoking and alcohol use, respectively, in 2010. Tobacco smoking as a risk factor for children is due to second-hand smoke exposure.

The graph shows the top 15 risk factors for Switzerland. The colored portion of each bar represents the specific diseases attributable to that risk factor while bar size represents the percentage of DALYs linked to specific risk factors.

Burden of disease attributable to 15 leading risk factors in 2010, expressed as a percentage of Switzerland DALYs

COUNTRY BENCHMARKING OF BURDEN OF DISEASE

Understanding the relative performance of Switzerland against other comparator countries provides key insight into public health successes and areas where Switzerland might be falling behind. The table identifies Switzerland's rank across 14 other comparator countries, selected and ordered by income per capita, for five metrics of interest, with 1 indicating the best rank and 15 indicating the worst rank.

- Age-standardized rates are used to make meaningful comparisons across time by adjusting for changes in population size and age structure.
- Life expectancy incorporates mortality, and health-adjusted life expectancy further incorporates years lived in less than ideal health.
- In 2010, Switzerland ranked 2nd for health-adjusted life expectancy and 4th for age-standardized YLD rate.

COUNTRY BENCHMARKING OF BURDEN OF DISEASE, CONTINUED

This figure shows the rank of Switzerland relative to the same comparator countries for the leading causes of DALYs in 1990 (top) and 2010 (bottom).

- The columns are ordered by the absolute number of DALYs in Switzerland for that particular year, with greatest burden on the left.
- The numbers indicate the rank across countries for each cause in terms of age-standardized DALY rates, with 1 as the best performance and 15 as the worst.