Summary measures of population health (SMPH) in health-related impact assessments

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From Wikipedia, the free encyclopedia

Disability-adjusted life year

*The **disability-adjusted life year (DALY)** is a measure of **overall disease burden**. Originally developed by the World Health Organization, it is becoming increasingly common in the field of **public health** and **health impact assessment (HIA)**.*

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Summary measures of population health

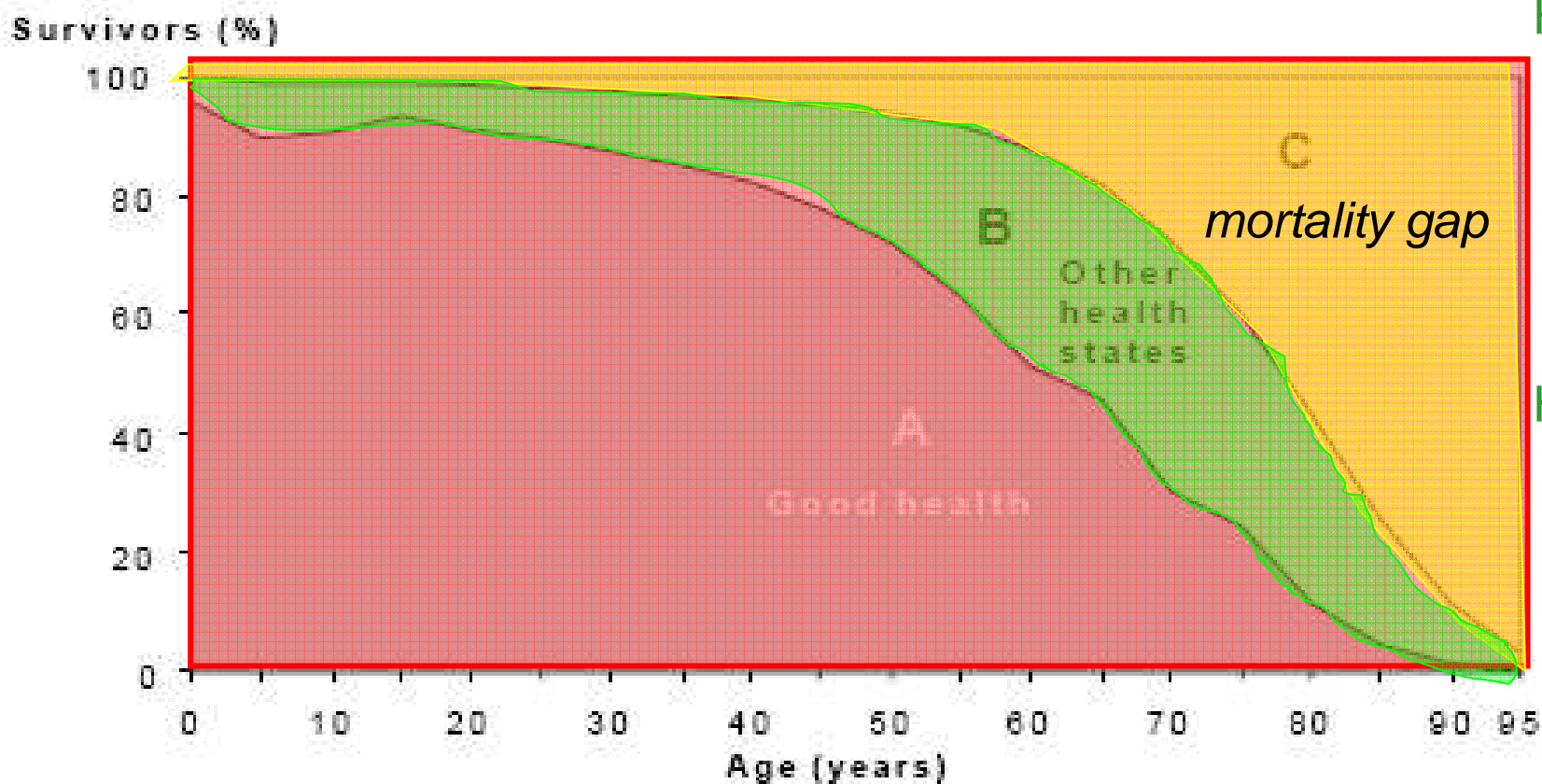## *Health expectancies*

- QALY   Quality adjusted life years
- HEALY   Healthy Life Years
- DFLE   Disability-free life expectancy
- ALE   Active Life Expectancy

Health gaps

- DALY   Disability-adjusted Life Years
- etc.

Two families of SMPH

Health expectancies

$= A + f(B)$

Where full health = 1

e.g. HALE

Health gaps

$= C + g(B)$

Where 1 is equivalent to death

e.g. DALY

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Burden of disease: how to measure?

Need of summary measure of population health that combines:

Mortality + Disability

And which allows to address the following questions:

- **How does a death at age 20 compare with a death at age 70?**

- **How do 200 respiratory infections compare to 300 cases of infectious diarrhoea?**

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Summary measure of population health: DALY

Disability-Adjusted Life Years

DALY = YLL + YLD

years of life lost because of premature death (YLLs)

years of life lived with disability (YLDs)

Burden = Mortality + Disability

one DALY = one lost year of healthy life

- Death at age 50 = 30 DALYs
- Mild mental retardation due to lead at birth = 30 DALYs

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Years of Life with disability

YLD = I x DW x d

YLD = Years of life lived with disability

I = Number of incident cases in the population

DW = Disability weight

d = Duration of disability [years]

3 cases of mild mental retardation due to lead at birth:

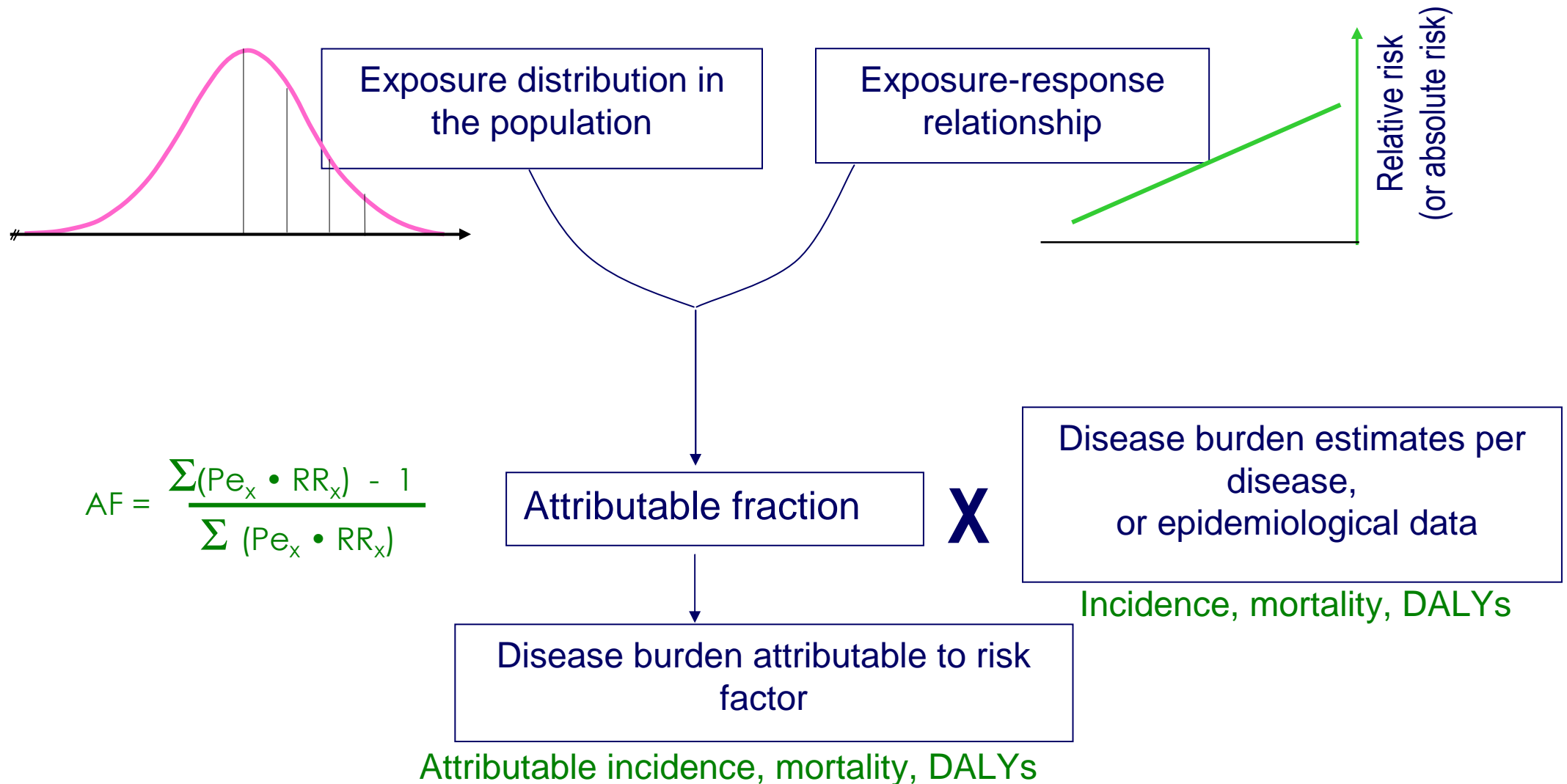3 cases/year x 0.36 x 80 years = 84 YLD

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How to make a quantified health-related impact assessment?

- Guides for EBD assessment at local level are available

- Comprehensive data needed:
  - Exposure data for selected risk factors in a selected setting (PM10, solid fuel use, % access to safe drinking water, etc)
  - Health data (deaths, incidence or DALYs) for given diseases in a selected settings

- Calculations easy to perform

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Assessments for estimating attributable disease

Exposure distribution in the population

Exposure-response relationship

Relative risk (or absolute risk)

$$AF = \frac{\sum (Pe_x \cdot RR_x) - 1}{\sum (Pe_x \cdot RR_x)}$$

Attributable fraction

X

Disease burden estimates per disease, or epidemiological data

Incidence, mortality, DALYs

Disease burden attributable to risk factor

Attributable incidence, mortality, DALYs

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Why use SPMH for assessing health impacts?

Veerman JL et al (2005) Quantitative HIA: current practice and future directions

- Reviewed assessments included numerous indicators for health outcomes:
    - E.g.: Deaths; hospitalizations for asthma, accident injuries

- SMPH recommended in addition to conventional health outcome measures

Kjellström et al (2003) Comparative assessment of transport risks—how it can contribute to health impact assessment of transport policies

- A common basis for comparison removes ambiguity when trying to make decisions on the basis of the health equivalent of apples and pears that can occur in HIA

- Problem: limited scientific research on changing health risks from transport policies.

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Advantages of using SMPH in HIA

- **Comparable** across health outcomes

- **Comparable** across policy options

- **Common language** across health issues (risk factors, diseases)

- **Standardized** measure

- **Coherent framework** – HIA, EBD, guidelines, status report can all be linked

- **Additional decision-making support** for selecting interventions/policies

- SMPH constitutes a **basis of CEA**

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Works if…

- Burden of disease estimates are known for study population (including future burden?)

- Quantitative evidence for relevant exposure-risks is known

- In addition to conventional health measures, and as relative measure

- Supported by meaningful communication of results

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Example of assessment using a comparative measure

Quantitative HIA of transport policies: two simulations related to speed limit reduction and traffic re-allocation in the Netherlands

*D Schram-Bijkerk, E van Kempen, A B Knol, et al. (2009)*

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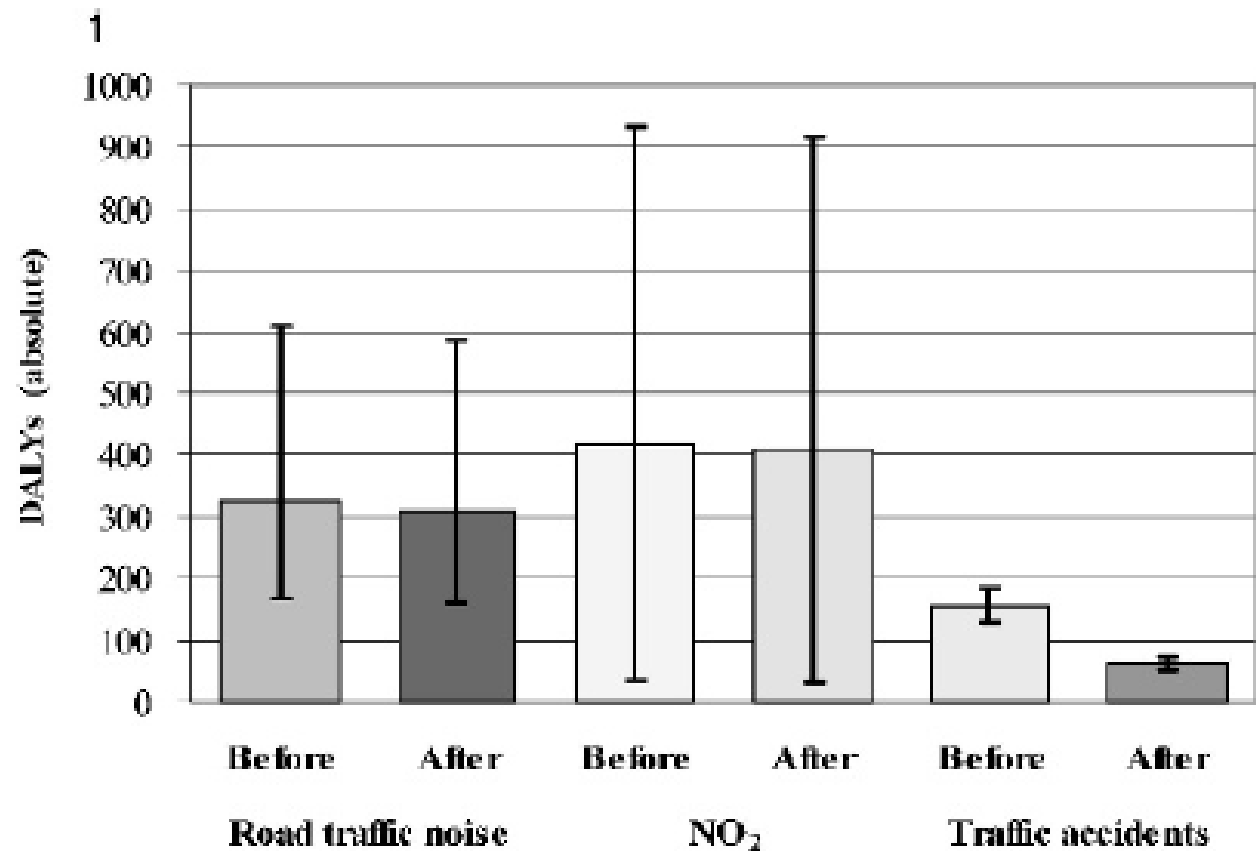
Example of assessment using a comparative measure

Public health benefits of strategies to reduce greenhouse-gas emissions: urban land transport

J Woodcock et al. Lancet, 2009

Measure: per million population

	Delhi	
	Lower-carbon-emission motor vehicles	Increased active travel
Physical activity		
Premature deaths	0	−352
YLL	0	−6040
YLD	0	−816
DALYs	0	−6857
Air pollution		
Premature deaths	−74	−99
YLL	−1696	−2240
YLD	0	0
DALYs	−1696	−2240
Road traffic crashes*		
Premature deaths	0	−67
YLL	0	−2809
YLD	0	−730
DALYs	0	−3540
Total†		
Premature deaths	−74	−511
YLL	−1696	−10 969
YLD	0	−1547
DALYs	−1696	−12 516
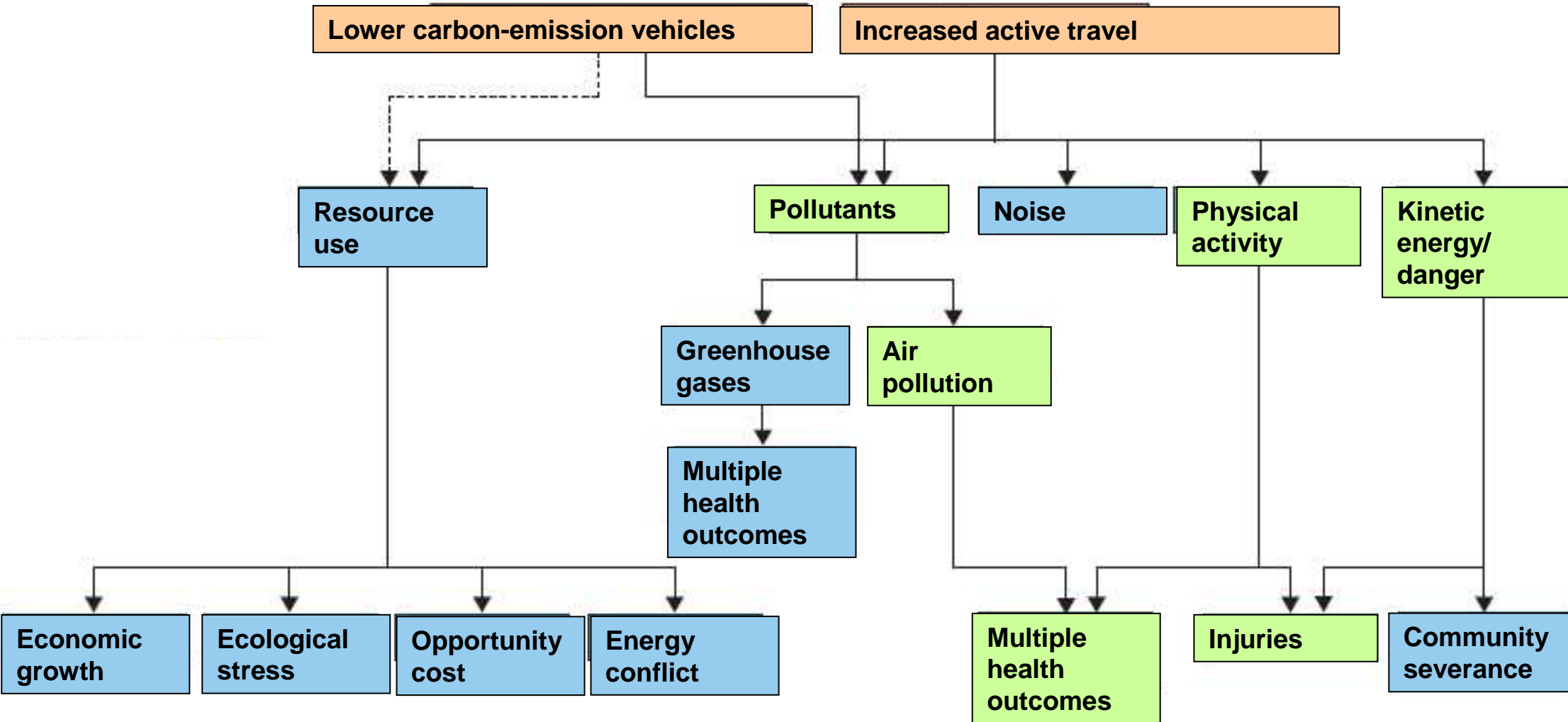
Source: J Woodcock et al. Lancet, 2009

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Larger scale assessments: Energy policies in Africa
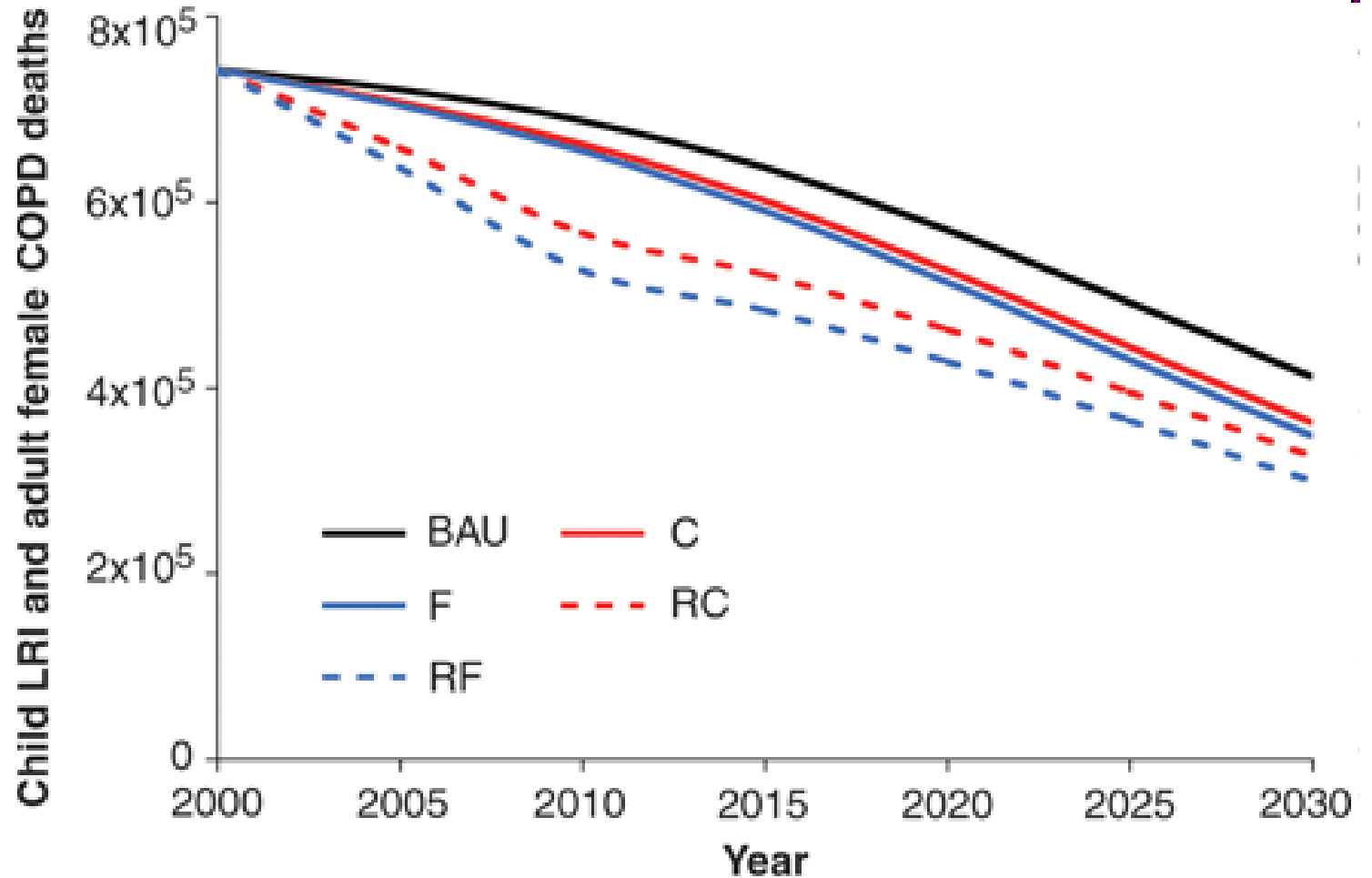
BAU: Business as usual

F, RF: fossil fuel–intensive scenarios

C, F: gradual transitions to charcoal (C) and fossil fuels (F)

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From: Mortality and Greenhouse Gas Impacts of Biomass and Petroleum Energy Futures in Africa

Bailis et al. (2005)

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Other studies/potential applications

- Replacement of 10% gasoline by biofuels in the USA: Life Cycle Impact Assessment. *McKone, Horvath and Lobscheid (2009)*

- **Second-hand smoke policies**

- **Solid fuel use**

- **Water, sanitation and hygiene**

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Tools for estimating impacts

- **Spreadsheets to assist estimation of health impacts from change in:**
  - Exposure to second-hand smoke
  - Exposure to outdoor air pollution (PM$_{10,2.5}$)
  - Solid fuel use for cooking
  - Blood lead levels
  - Mercury concentration in hair

Etc.

Series of guides on EBD for national or local assessment

- Lead

- Malnutrition

- Water, sanitation & hygiene

- Indoor air from solid fuels

- Ambient air

- Climate change

- UV radiation

- Community noise

+ calculation spreadsheets

- Occupation
  - carcinogens
  - dusts
  - back pain
  - needlestick injuries

- Poverty (only association)

- Housing

- Radon

- Mercury

- Second-hand smoke

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Conclusions

- SMPH is one of the only comparable measures across multiple health impacts (compares HIA apples with oranges)

- Standardized measure, therefore transparent (under certain conditions)

- Increased application of SPMH for policies is relatively recent, as are calculation tools and common understanding

- SMPH can only translate impacts in areas with sufficient scientific knowledge

- Need to be communicated in a user-friendly way

- Can be a basis for costing health impacts

- Allows to speak in a common language

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More information and references

WHO's web sites on:

Global burden of disease

http://www.who.int/healthinfo/global_burden_disease/en/index.html

Quantifying health impacts from environmental risks

http://www.who.int/quantifying_ehimpacts/en/

Health impact assessment

http://www.who.int/hia/en/

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