



**DISEASE CONTROL  
PRIORITIES PROJECT**



**Health priorities at the beginning  
of the millennium:  
a new assessment of the global burden of  
disease, injuries and risk factors**

**Colin Mathers**

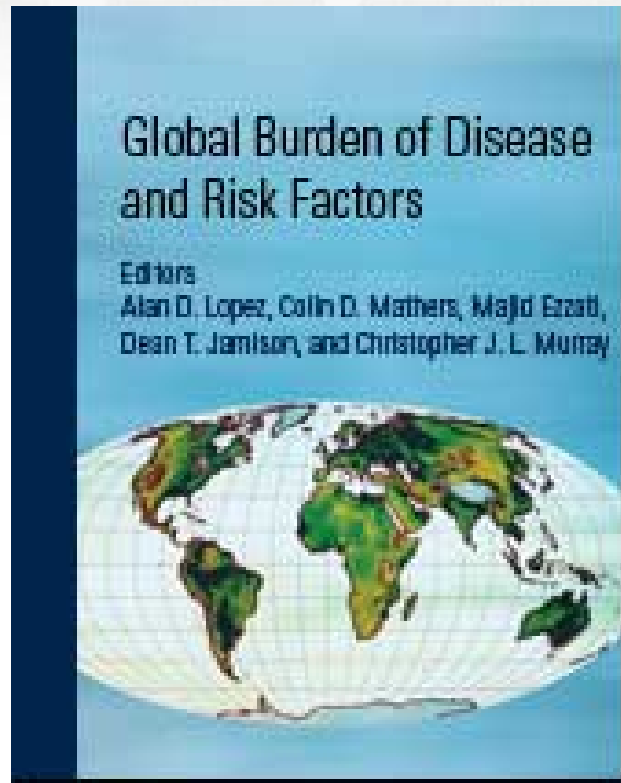
**Evidence and Information for Policy Cluster**

**World Health Organization**

**INVESTING IN GLOBAL HEALTH “BEST BUYS” AND PRIORITIES FOR ACTION IN DEVELOPING COUNTRIES**

[www.dcp2.org](http://www.dcp2.org)

# Disease Control Priorities Project



## Global Burden of Disease (GBD) 2001

Used as basis for disease priorities analyses in DCPD

GBD book – documents data, methods and results

[www.dcp2.org/pubs/gbd](http://www.dcp2.org/pubs/gbd)

# HISTORY

- 1992-96**      **Global Burden of Disease 1990 Study**  
**World Bank 1993, Murray & Lopez 1996**
- 1998-2004**      **WHO assessments of GBD for 1999-2002**  
**World Health Reports 2000 – 2004**
- 2002-2004**      **WHO Comparative Risk Assessment (CRA)**
- 2004-06**      **Disease Control Priorities Project**  
**(GBD for 2001, World Bank regions)**  
**GBD volume**

# GBD Goals

- **Use a standardized framework for integrating all available data on population health levels and causes**
- **Measure loss of health due to comprehensive set of disease injury and risk factor causes in a comparable way**
- **Decouple epidemiological assessment and advocacy**
- **Inject non-fatal health outcomes into health policy debate**
- **Use a common metric for burden of disease assessment using summary measure of population health and cost-effectiveness analysis**

# Disability Adjusted Life Years

$$DALY = YLL + YLD$$

*Time is used as the common metric  
for mortality and health states*

**YLL** Years of life lost due to mortality

**YLD** Equivalent years of healthy life lost due to disability (YLD = inc x Duration x DW)

# DCPP Value Choices for the DALY

**Years lost due to death:** GBD standard life expectancies

**Time discounting:** 3%

**Age weighting:** Not applied

**Disability weights** Largely based on GBD 1990 study with some revisions

# GBD Data sources

## Mortality

⇒ Death registration, sample registration systems, household surveys, surveillance systems, epidemiological studies, population laboratories

## Morbidity/disability

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

## Numbers of data sets – regional distribution

	Death registration data	Child/adult mortality data	Epidemiologic data sources	Total data sources
Asia/Pacific	117	118	1,820	2,055
Europe	149	22	971	1,142
High income	142	16	1,830	1,988
Latin America & Caribbean	286	122	1,311	1,719
Middle East & North Africa	46	67	645	758
Sub-Saharan Africa	30	190	2,185	2,405
<b>World</b>	<b>770</b>	<b>535</b>	<b>8,747</b>	<b>10,052</b>

# Leading causes of death (millions), 2001

## Low and middle income countries

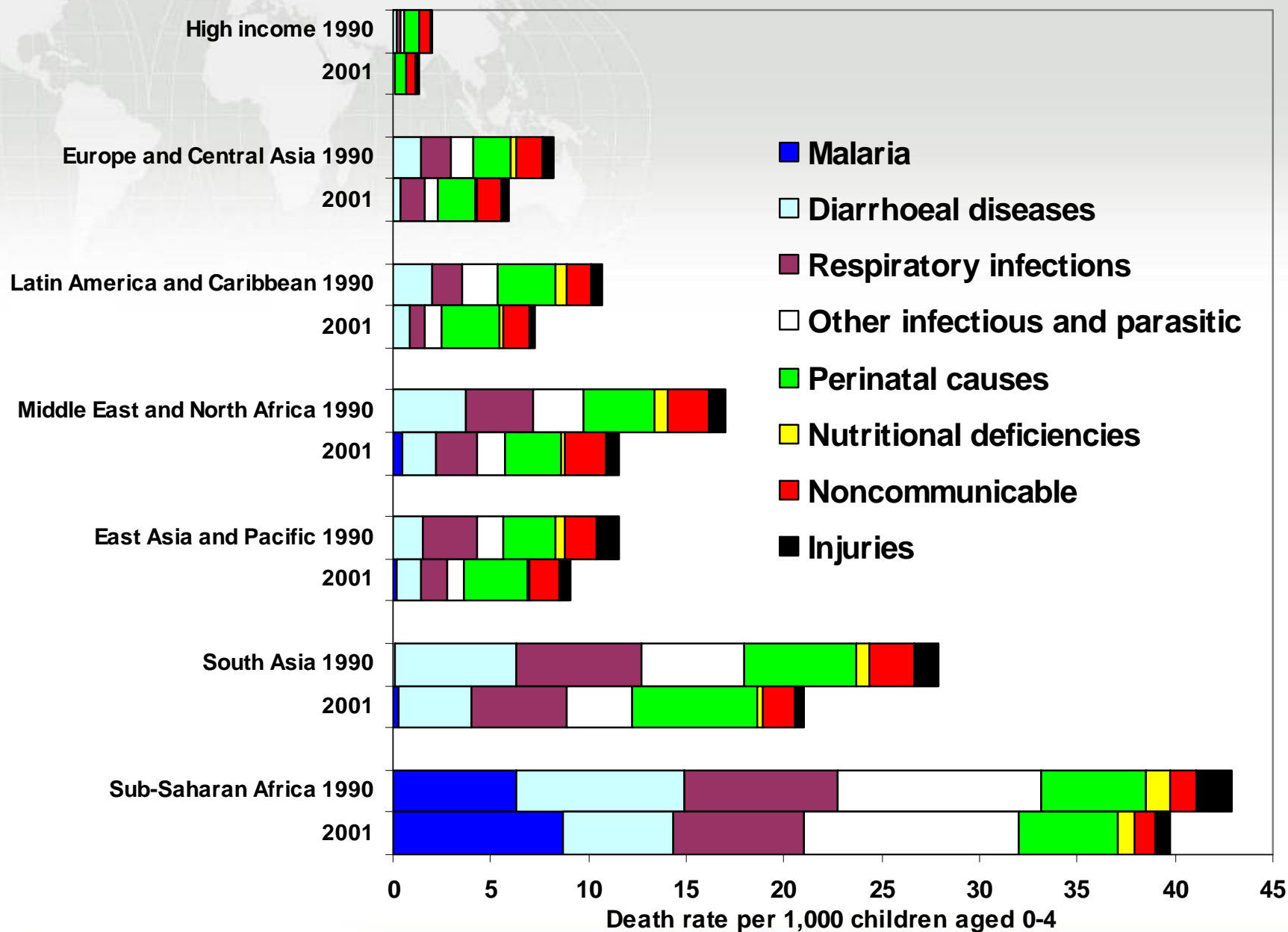
- Ischaemic heart disease 5.7
- Stroke 4.6
- Pneumonia 3.4
- HIV/AIDS 2.6
- Perinatal causes 2.5
- COPD 2.4
- Diarrhoeal diseases 1.8
- Tuberculosis 1.6
- Malaria 1.2
- Road traffic accidents 1.1

## High income countries

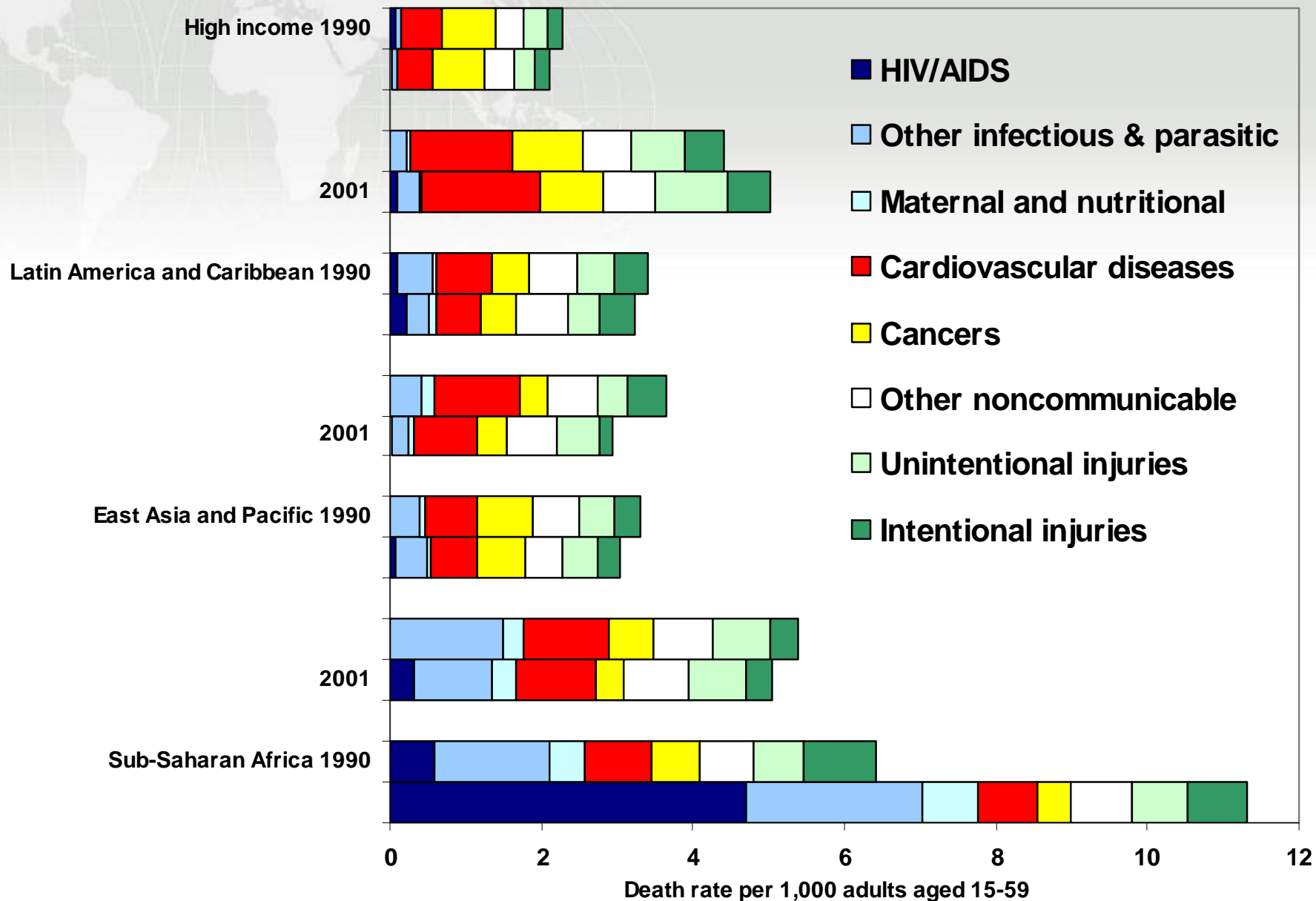
1. Ischaemic heart disease 1.36
2. Stroke 0.78
3. Lung cancer 0.46
4. Pneumonia 0.34
5. Chronic lung disease (COPD) 0.30
6. Colon and rectum cancers 0.26
7. Alzheimer & other dementias 0.21
8. Diabetes mellitus 0.20
9. Breast cancer 0.16
10. Stomach cancer 0.15

Source: Mathers, Lopez & Murray, Burden of Disease Volume, 2006.

## Trends in causes of under 5 mortality, 1990 to 2001



## Trends in causes of mortality for adults aged 15-59 years, 1990 to 2001



# GBD 2001 - Disease models

Internally consistent estimates for incidence, prevalence, remission and case fatality

## Global Incidence (millions)

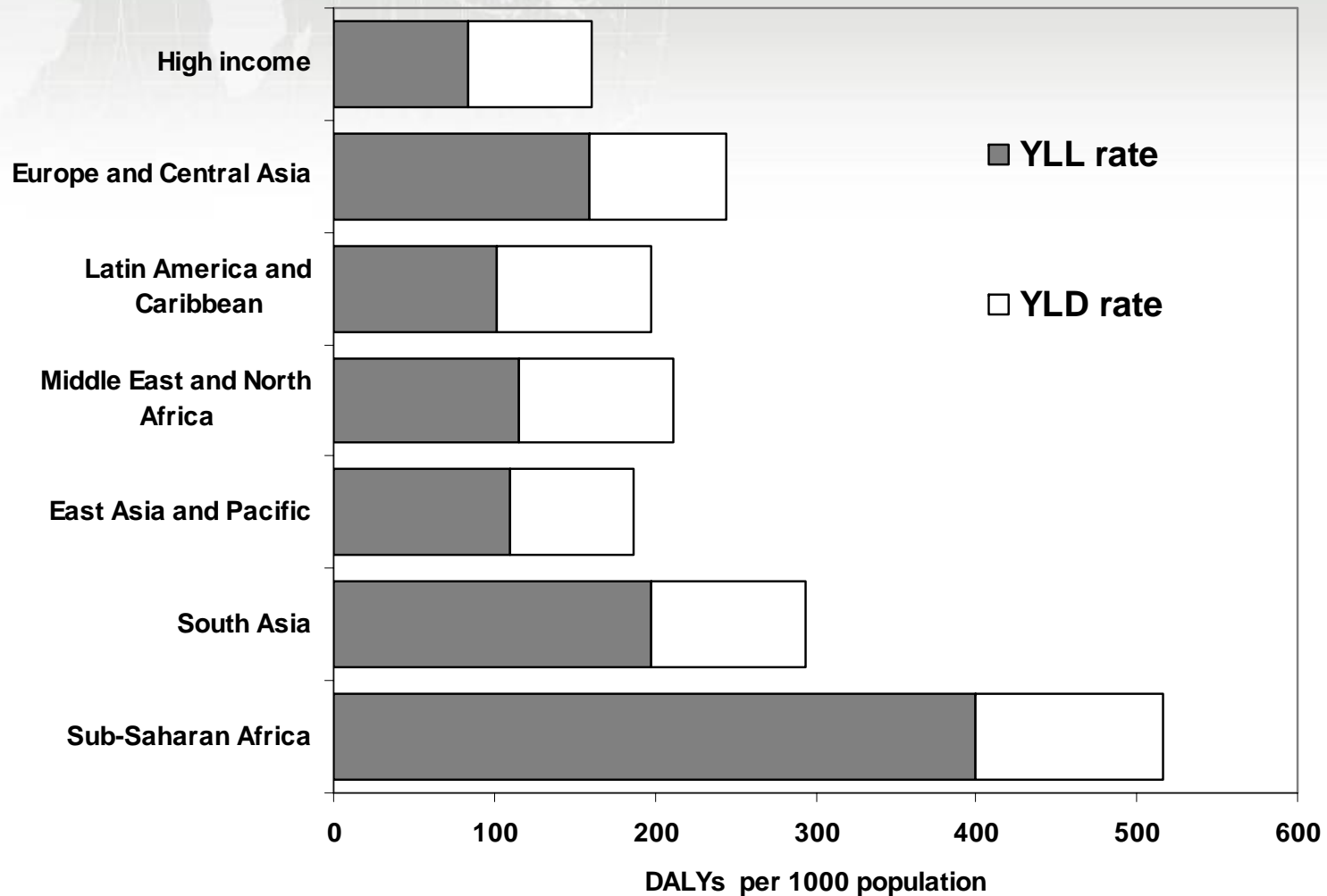
## Global prevalence (millions)

• Tuberculosis	8	• Diabetes mellitus	180
• HIV infection	5	• Major depressive episodes	125
• Diarrhoeal diseases	4,485	• Bipolar affective disorder	28
• Measles	33	• Schizophrenia	25
• Meningitis	1	• Epilepsy (primary)	38
• Hepatitis B and C	2	• Alzheimer & other dementias	22
• Malaria	394	• Migraine sufferers	311
• Malignant neoplasms	12	• Hearing loss, adult onset	251
• Road traffic accidents*	22	• Chronic obstructive lung disease (COPD)	61

\* Incidence of injury severe enough to warrant hospital treatment.

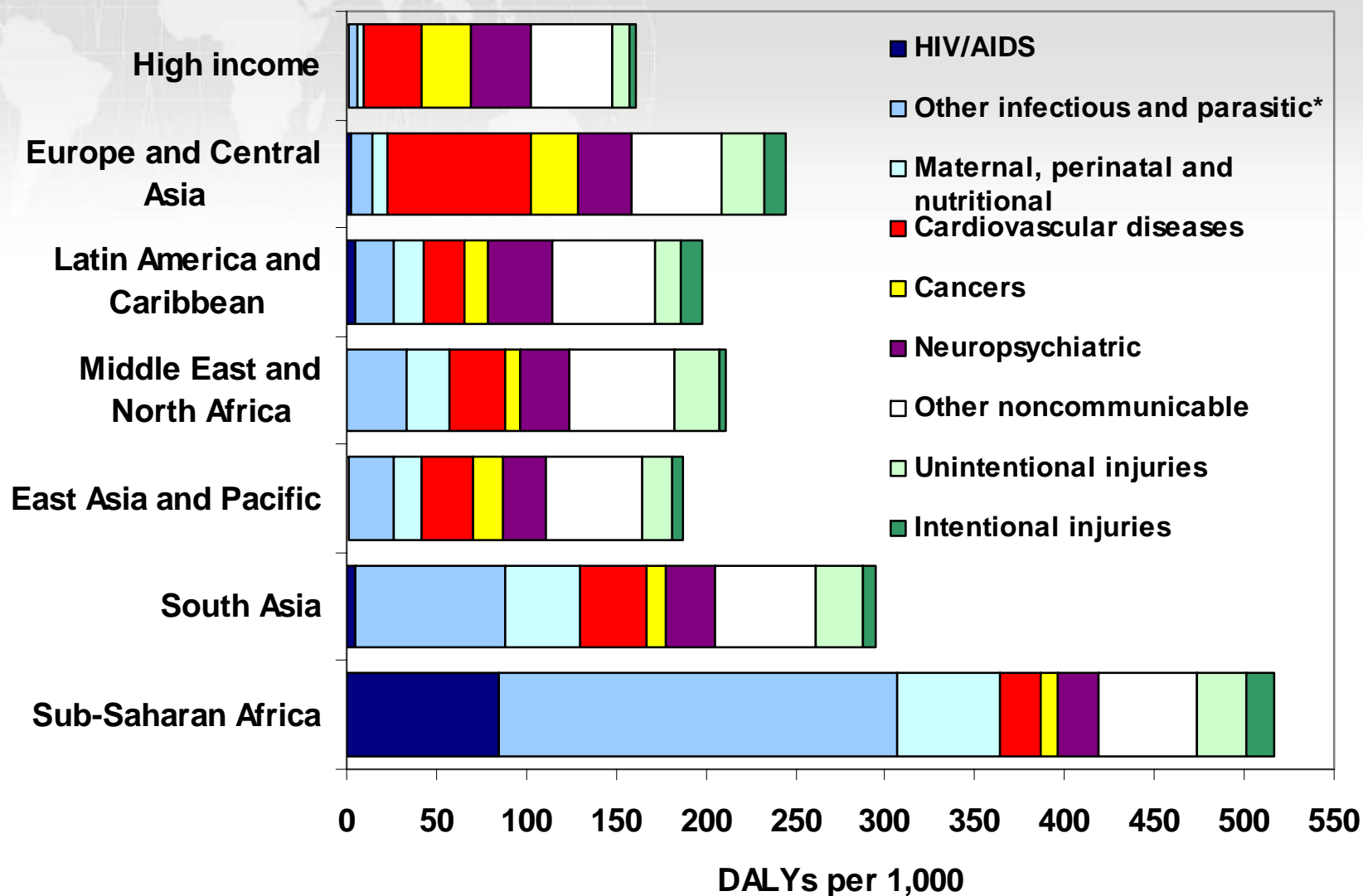
Source: Mathers, Lopez & Murray, Burden of Disease Volume, 2006.

## Burden of disease due to premature mortality (YLL) and disability (YLD), by region, 2001



Source: Mathers, Lopez & Murray, Burden of Disease Volume, 2006.

## The cause distribution of burden of disease, by region, 2001



Source: Mathers, Lopez & Murray, Burden of Disease Volume, 2006.

## Leading Causes of Mortality and Burden of Disease Low and middle income countries 2001

Mortality		DALYs	
	%		%
• Ischaemic heart disease	11.8	• Perinatal conditions	6.4
• Cerebrovascular disease	9.5	• Lower respiratory infections	6.0
• Lower respiratory infections	7.0	• Ischaemic heart disease	5.2
• HIV/AIDS	5.3	• HIV/AIDS	5.1
• Perinatal conditions	5.1	• Cerebrovascular disease	4.5
• COPD	4.9	• Diarrhoeal diseases	4.2
• Diarrhoeal diseases	3.7	• Unipolar depression	3.1
• Tuberculosis	3.3	• Malaria	2.9
• Malaria	2.5	• Tuberculosis	2.6
• Road traffic accidents	2.2	• COPD	2.4

Source: Mathers, Lopez & Murray, Burden of Disease Volume, 2006.

# Attribution of disease burden and need for Comparative Risk Assessment (CRA)

- Mortality and morbidity can be attributed to
  - disease or injury outcomes
  - risk factors
- Focussing on risk factors is key to prevention
- Comparative risk assessment should be a key input to prioritisation for:
  - health systems faced with many and varied health problems, “rule of rescue” & rare risk newsworthiness
  - research agenda

# Criteria for selecting risks in GBD 2001

- Risk factors quantified by age, sex & region selected on the basis of:
  - potential global impact
  - high likelihood of causality
  - potential modifiability
  - neither too specific nor too broad
  - availability of data on risk factor distributions and risk factor-disease relationships

# Risks quantified in GBD 2001

## **Child & maternal under-nutrition**

Childhood and maternal underweight  
Iron deficiency  
Vitamin A deficiency  
Zinc deficiency

## **Other nutrition-related risks & inactivity**

High blood pressure  
High cholesterol  
Overweight and obesity  
Inadequate fruit and vegetable intake  
Physical inactivity

## **Sexual and reproductive health risks**

Unsafe sex  
Non-use and ineffective use of contraception

## **Addictive substances**

Smoking and oral tobacco  
Alcohol  
Illicit drugs

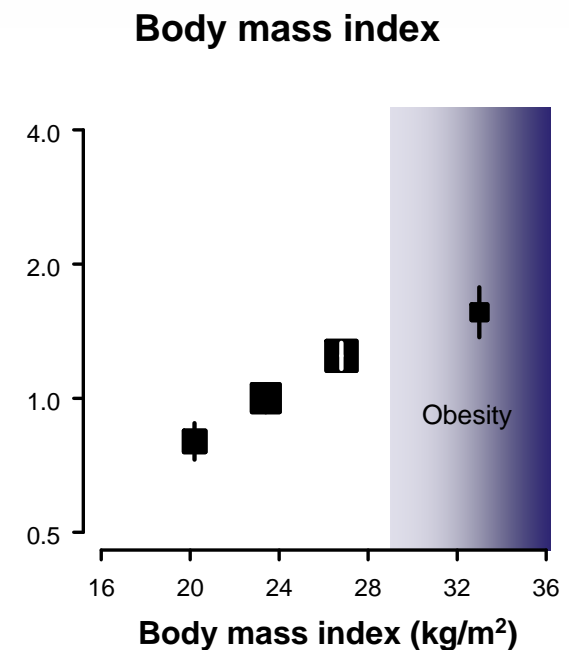
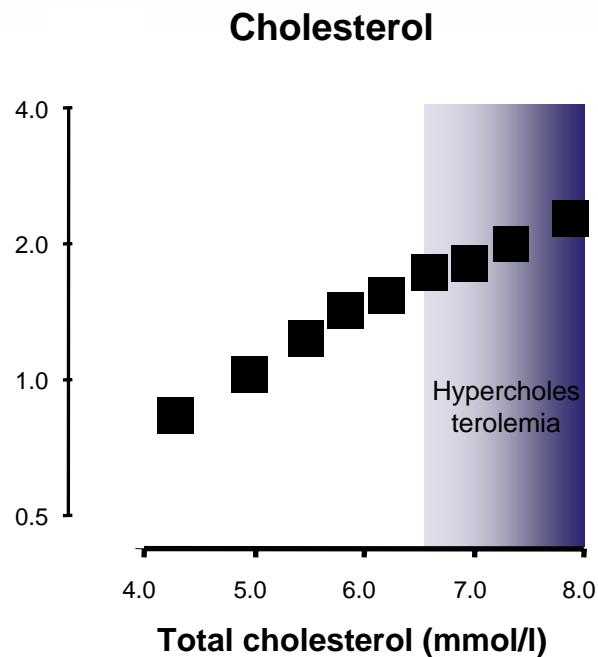
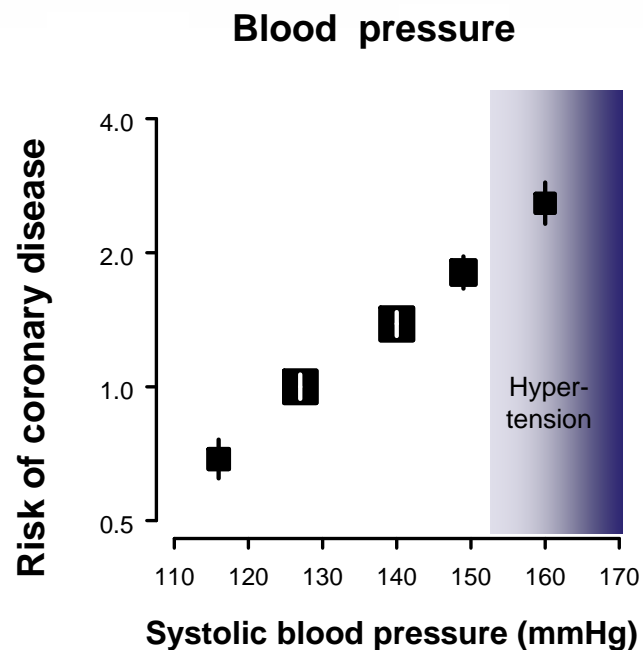
## **Environmental risks**

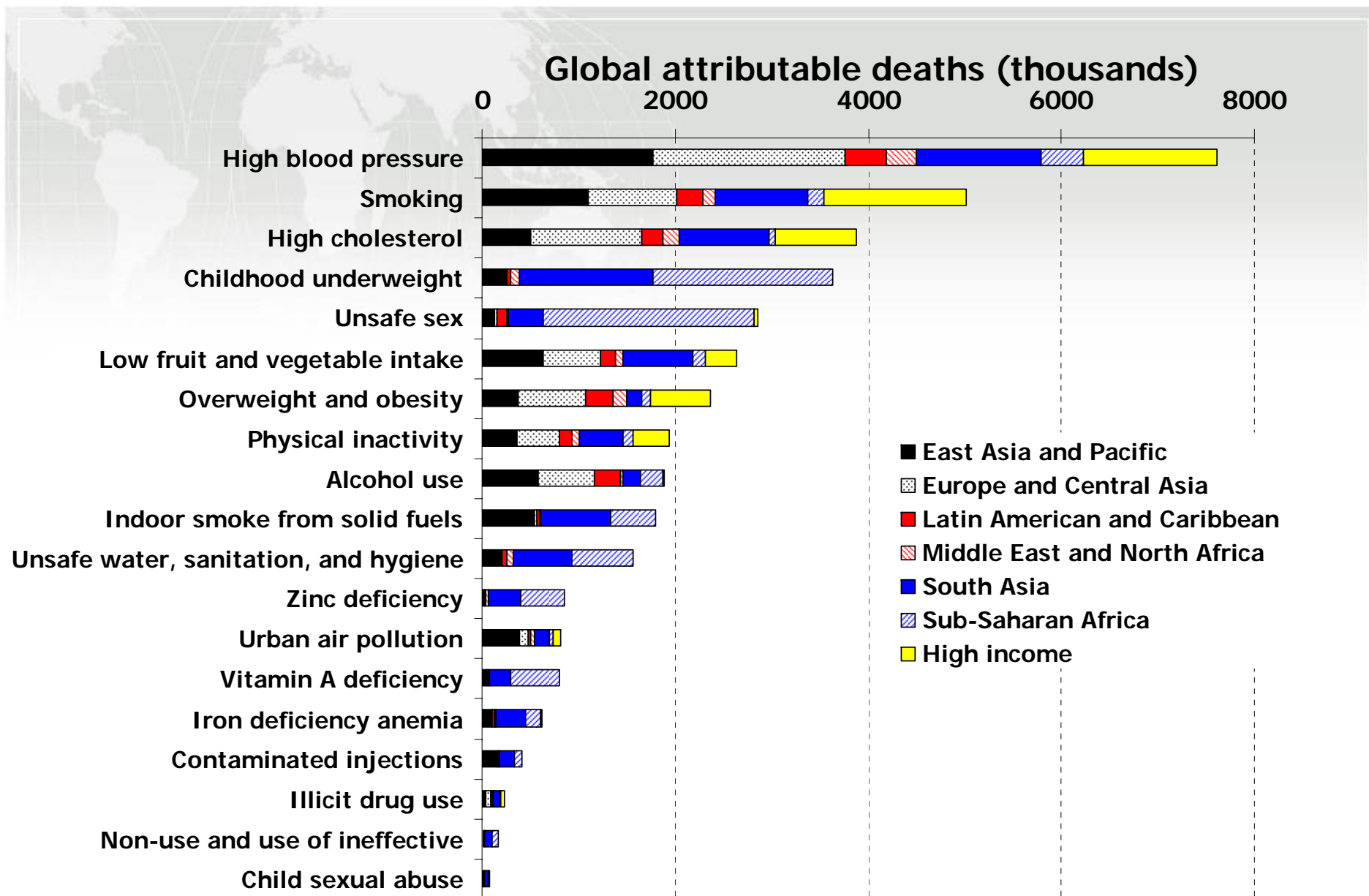
Unsafe water, sanitation, and hygiene  
Urban air pollution  
Indoor smoke from solid fuels  
Lead exposure  
Climate change

## **Other selected risks to health**

Contaminated health care injections  
Child sexual abuse

# Continuous exposure and disease associations





# Leading 10 selected risk factors

## *Middle and low income countries*

<b>Africa and South Asia</b>	<b>% DALYs</b>	<b>Other low/middle income</b>	<b>% DALYs</b>
Underweight	14.0	Blood pressure	8.6
Unsafe sex	9.6	Tobacco	6.2
Unsafe water, S&H	5.2	Alcohol	6.0
Indoor smoke	4.2	Cholesterol	4.3
Zinc deficiency	3.4	Overweight/obesity	4.2
Blood pressure	3.1	Low fruit & vegetables	3.2
Vitamin A deficiency	3.0	Underweight	2.3
Tobacco	2.5	Physical inactivity	2.2
Iron deficiency	2.2	Unsafe water, S&H	2.0
Cholesterol	2.1	Indoor smoke from solid fuels	1.6

# Deaths and DALYs due to leading 5 global risks

	Deaths (M)		DALYs (M)	
	No.	%	No.	%
Underweight	3.7	6.7	137.8	9.5
Unsafe sex	2.9	5.2	91.9	6.3
Blood pressure	7.1	12.8	64.3	4.4
Tobacco	4.9	8.8	59.1	4.1
Alcohol	1.8	3.2	58.3	4.0
<i>Joint effects</i>		<i>31%</i>		<i>25%</i>

# Contribution of risk factors to 5 leading diseases

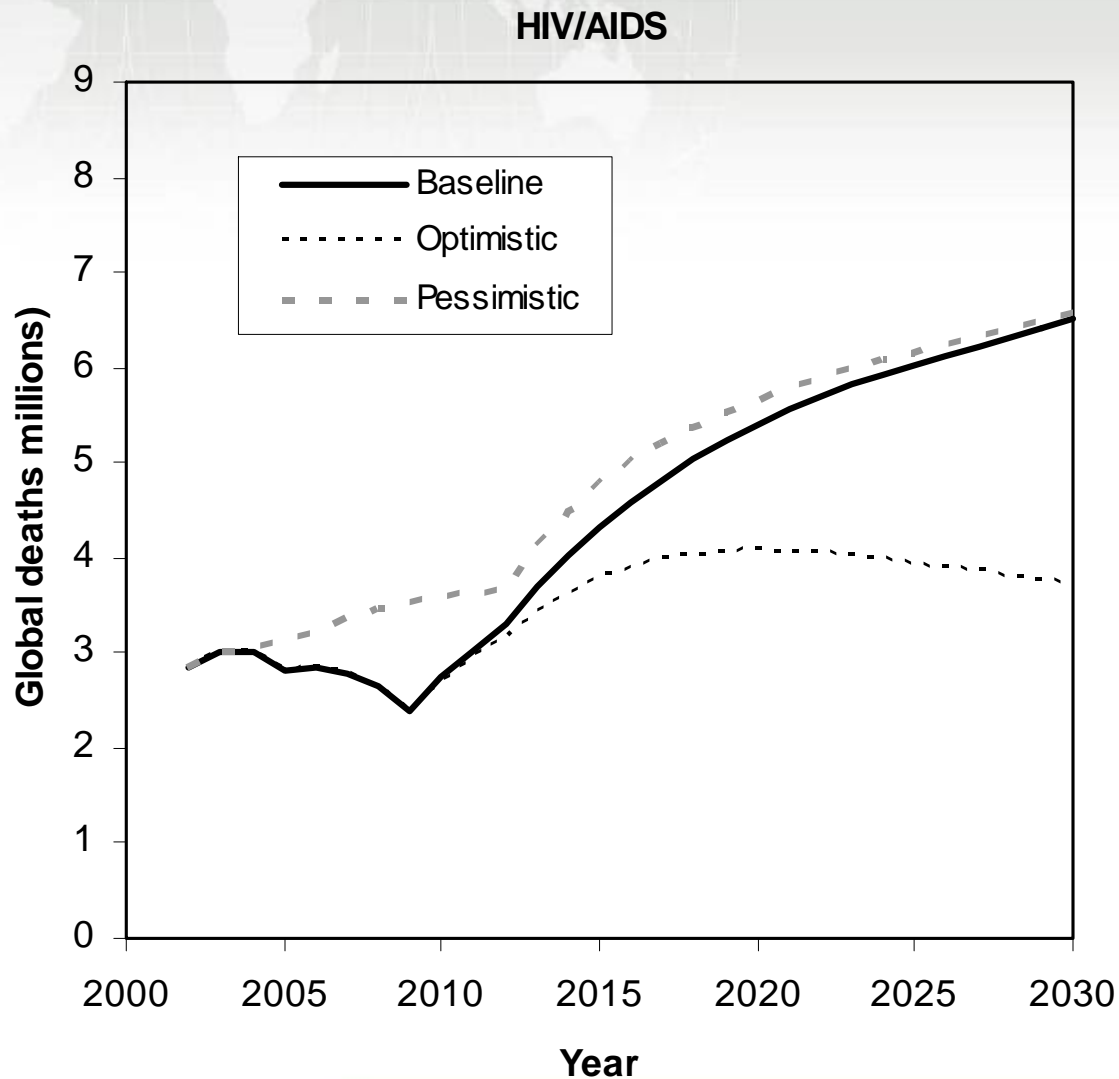
## *Low and middle income countries*

<b>Disease</b>	<b>Contributing risks</b>	<b>Joint contribution (%)</b>
Lower respiratory infections	Underweight, Zinc deficiency, indoor smoke, tobacco	52
Ischaemic heart disease	High BP, high chol, overweight, low fruit & veg, inactivity, tobacco, alcohol	80
HIV/AIDS	Unsafe sex, unsafe medical injections, illicit drugs	97
Stroke	High BP, high chol, overweight, low fruit & veg, inactivity, tobacco, alcohol	64
Diarhoeal disease	Underweight, vit A & zinc deficiency, unsafe water and sanitation	94
Unipolar depressive disorder	Alcohol, childhood sexual abuse	6

# Conclusions (1)

- Large improvements in health status globally and for low and middle income countries
- Unacceptable health disparities remain, and have grown for some regions
- 20% decline in Group I deaths from 1990 to 2001, could have been 30% without HIV/AIDS
- 70% of child deaths are from a few preventable causes
- Unfinished agenda for infectious diseases, particularly HIV/AIDS prevention
- Double burden of disease – non-communicable diseases becoming increasingly important: CVD burden now greater than that of HIV/AIDS, TB and malaria combined

# Projected global AIDS deaths



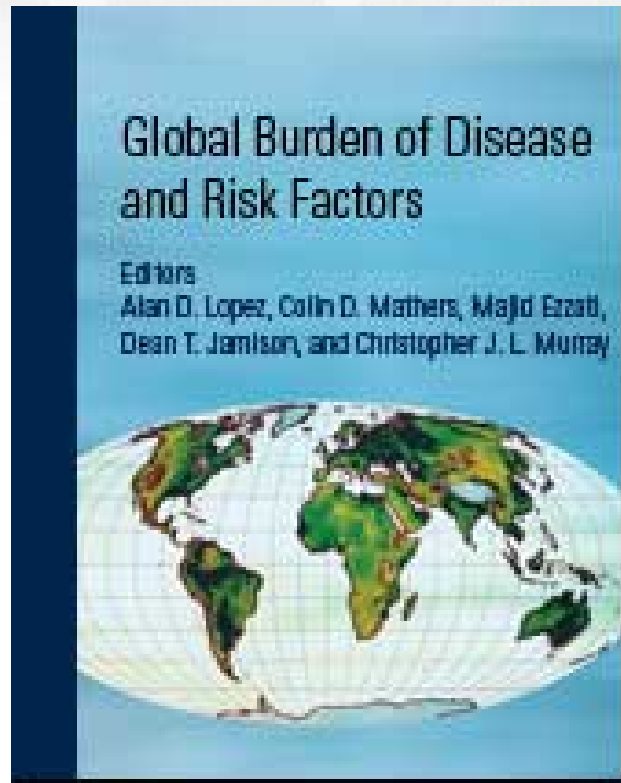
Source: Mathers and Loncar, PLoS Medicine (in press)



## Conclusions (2)

- Non-communicable diseases cause more than 50% of deaths in all regions except Africa and South Asia
- 90% of NCD deaths under age 60 are in low and middle income countries
- Cause(s) known of more than two-thirds of many major diseases eg. ischaemic heart disease, stroke, diabetes
- Large and mostly unrecognized potential for prevention
- We have some tested and affordable interventions to tackle these risks eg. for cardiovascular disease
  - Tobacco taxation and smoking cessation interventions, reduced salt in manufactured foods
  - Medical management of CVD risks (BP, cholesterol etc), the polypill (BP, statins, aspirin etc)
- Greater effort is needed to develop simple and affordable tools for mass application for non-communicable diseases in developing countries

# Disease Control Priorities Project



**GBD book – documents data, methods and results for 2001 by World Bank Region**

Print version: OUP 2006

Web version: DCPD website

[www.dcp2.org/pubs/gbd](http://www.dcp2.org/pubs/gbd)