DISEASE CONTROL PRIORITIES PROJECT

Assessing the global burden of risk factors: history and results for 2001

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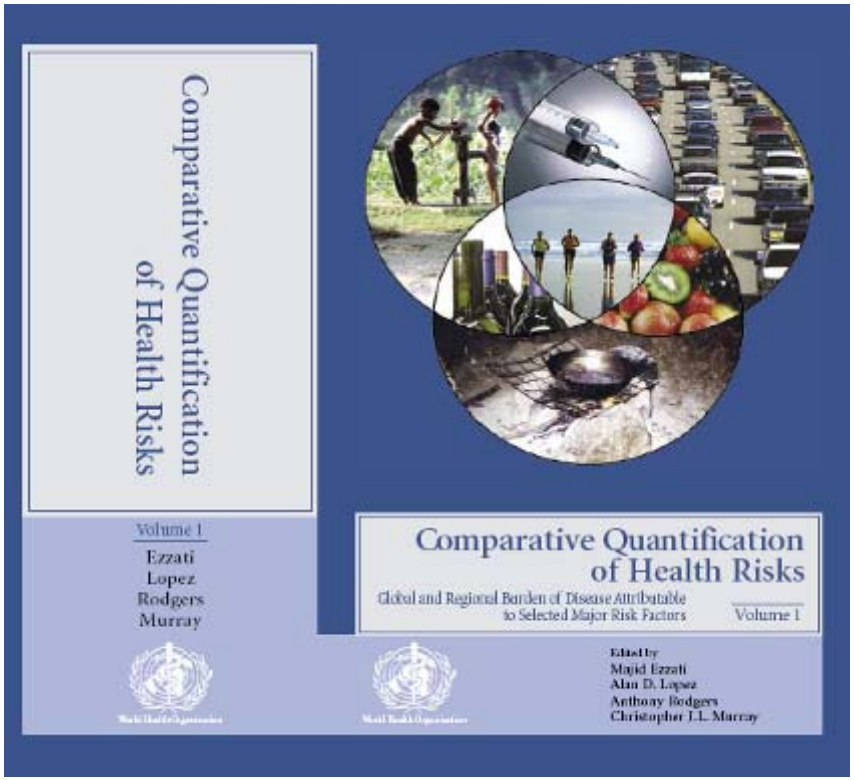
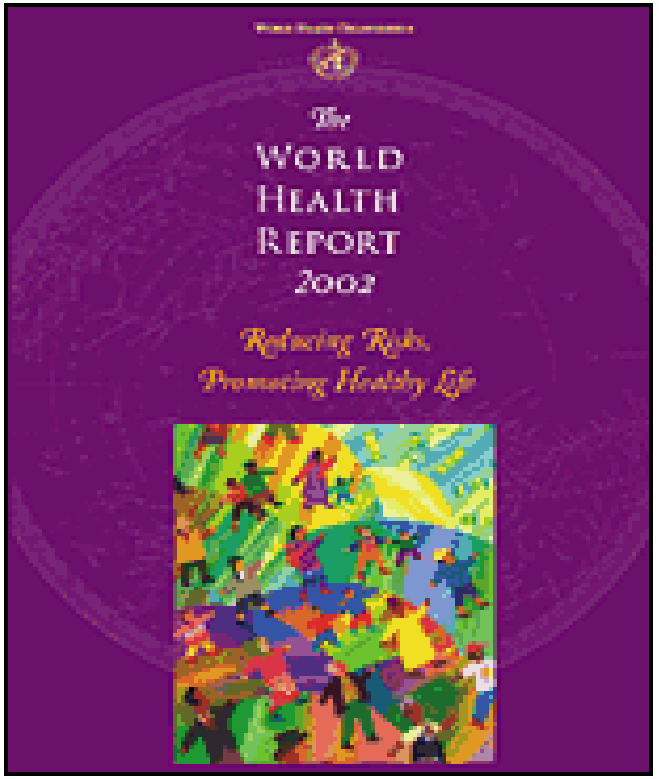
CRA project and WHR 2002





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

Previous estimates of burden due to risk factors

- Specific exposures eg. occupation, blood pressure
- Specific outcomes eg. causes of cancer
- Specific regions eg. European union, Australia and New Zealand

Australian and NZ burden of disease studies (attributable deaths %)

	NZ	Australia
Smoking	15%	13%
Alcohol	0%	-2%
Fruit & veg	3%	3%
Inactivity	8%	10%
Diabetes (type 2)	5%	
Obesity	4%	5%
High BP	9%	11%
Cholesterol	5%	5%
Illicit drugs		1%
Unsafe sex		1%
Occupation		2%

Global Burden of Disease Study 1990:
DALYs attributable to 10 selected risk factors

Risk factor	Percent global total
Malnutrition	16%
Poor water/sanitation	7%
Unsafe sex	4%
Alcohol	4%
Occupation	3%
Tobacco	3%
Hypertension	1%
Physical inactivity	1%
Illicit drugs	0.6%
Air pollution	0.5%
cf:	
Lower respiratory infection	8%
Congenital anomalies	2%

Ideal features of risk assessment

- Well defined scope
- Risks assessed irrespective of place in a causal chain
- Risks defined and studied comprehensively and with comparable counterfactuals
- “common currency” outcome measures, with impact assessed in terms of lost healthy life years
- Protective as well as hazardous factors
- Population-wide risks as well as high-risk individuals

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 or 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

Addictive substances
Smoking and oral tobacco
Alcohol
Illicit drugs

Sexual and reproductive health risks
Unsafe sex
Non-use and ineffective use of contraception

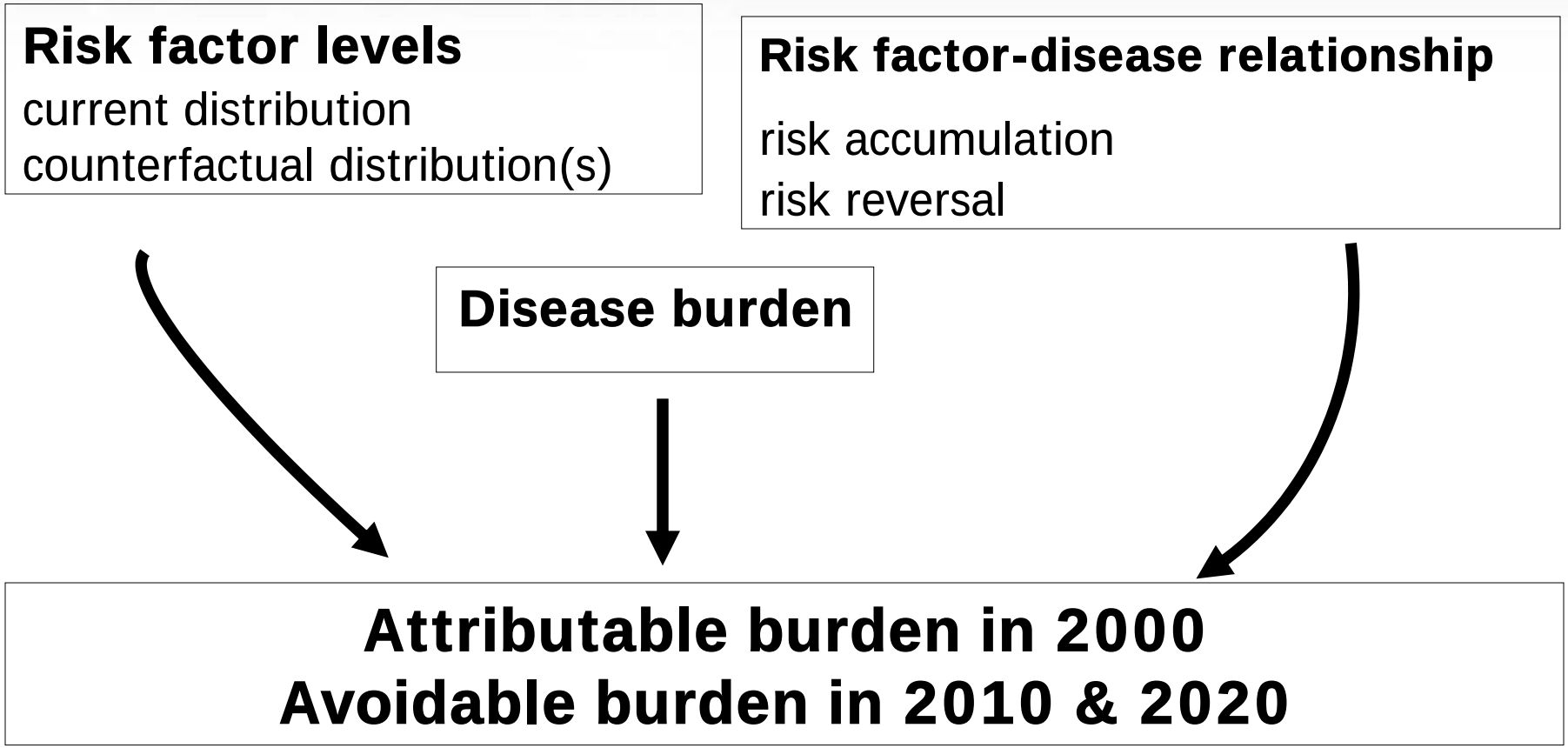
Environmental risks
Unsafe water, sanitation, and hygiene
Urban air pollution
Indoor smoke from solid fuels
Lead exposure
Climate change

Occupational risks
Risk factors for injury
Carcinogens
Airborne particulates
Ergonomic stressors
Noise

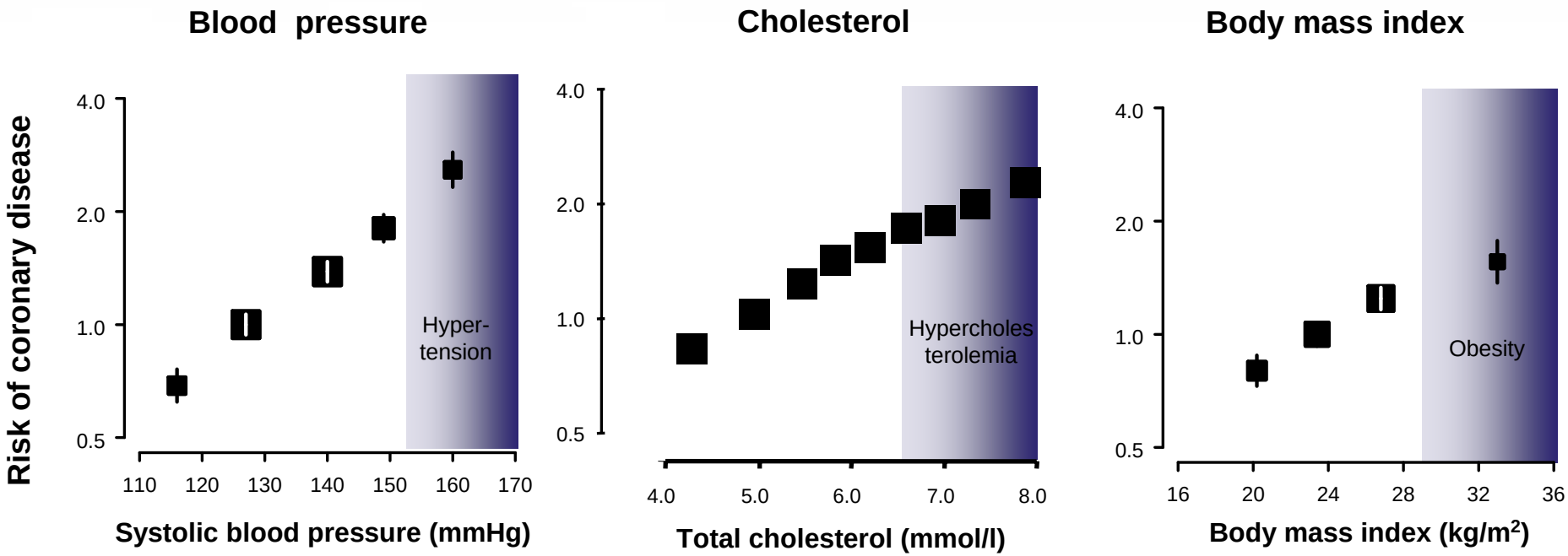
Other selected risks to health
Contaminated health care injections
Child sexual abuse

Distributions of risks by poverty

Basic CRA framework and goals
by age, sex and region subgroups (112)



Continuous exposure and disease associations



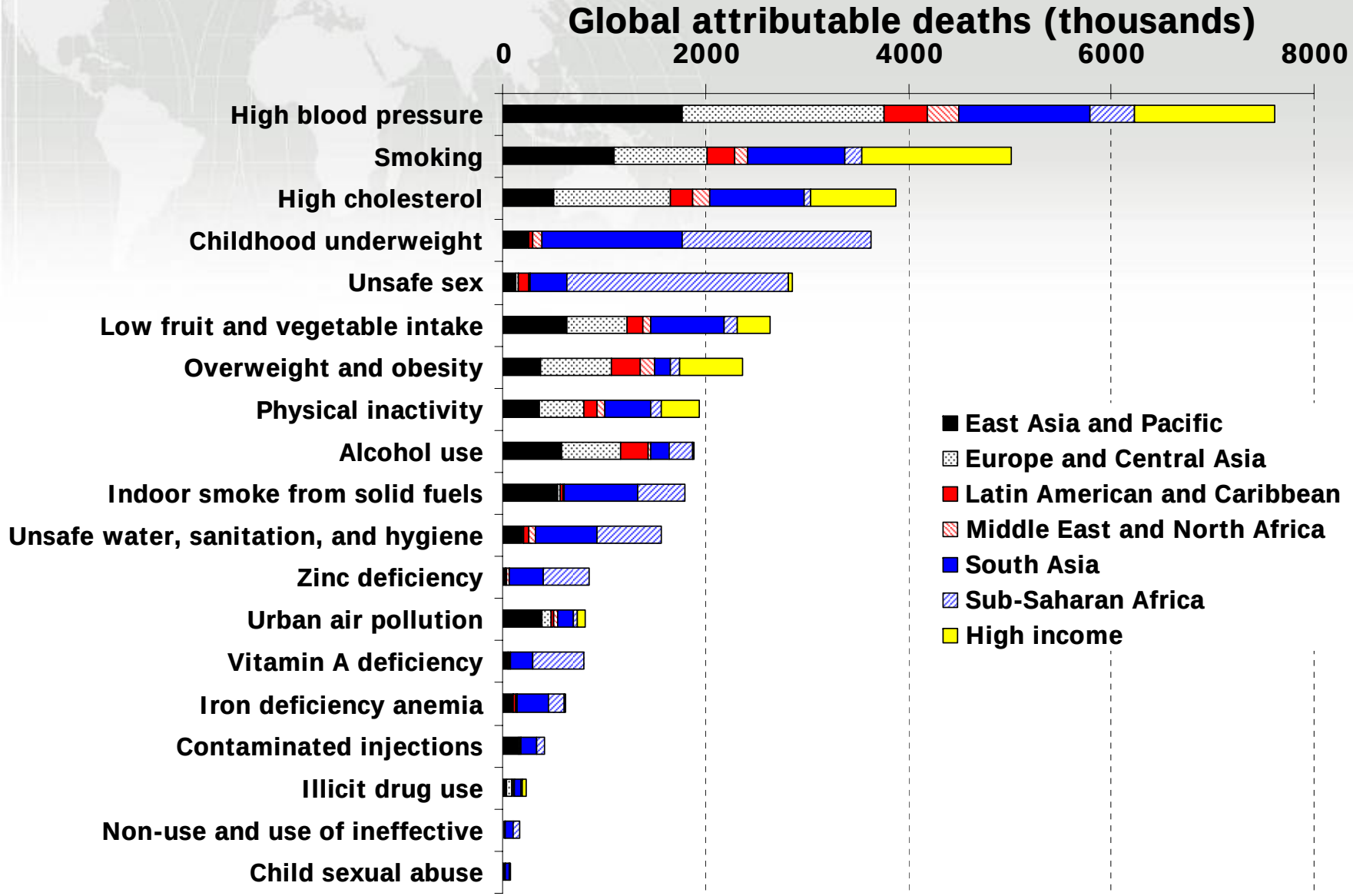
Calculating Attributable/Avoidable Burden

$$AF_j = \frac{\int_{x=0}^{m} R_j(x)P(x) - \int_{x=0}^{m} R_j(x)P^1(x)}{\int_{x=0}^{m} R_j(x)P(x)}$$

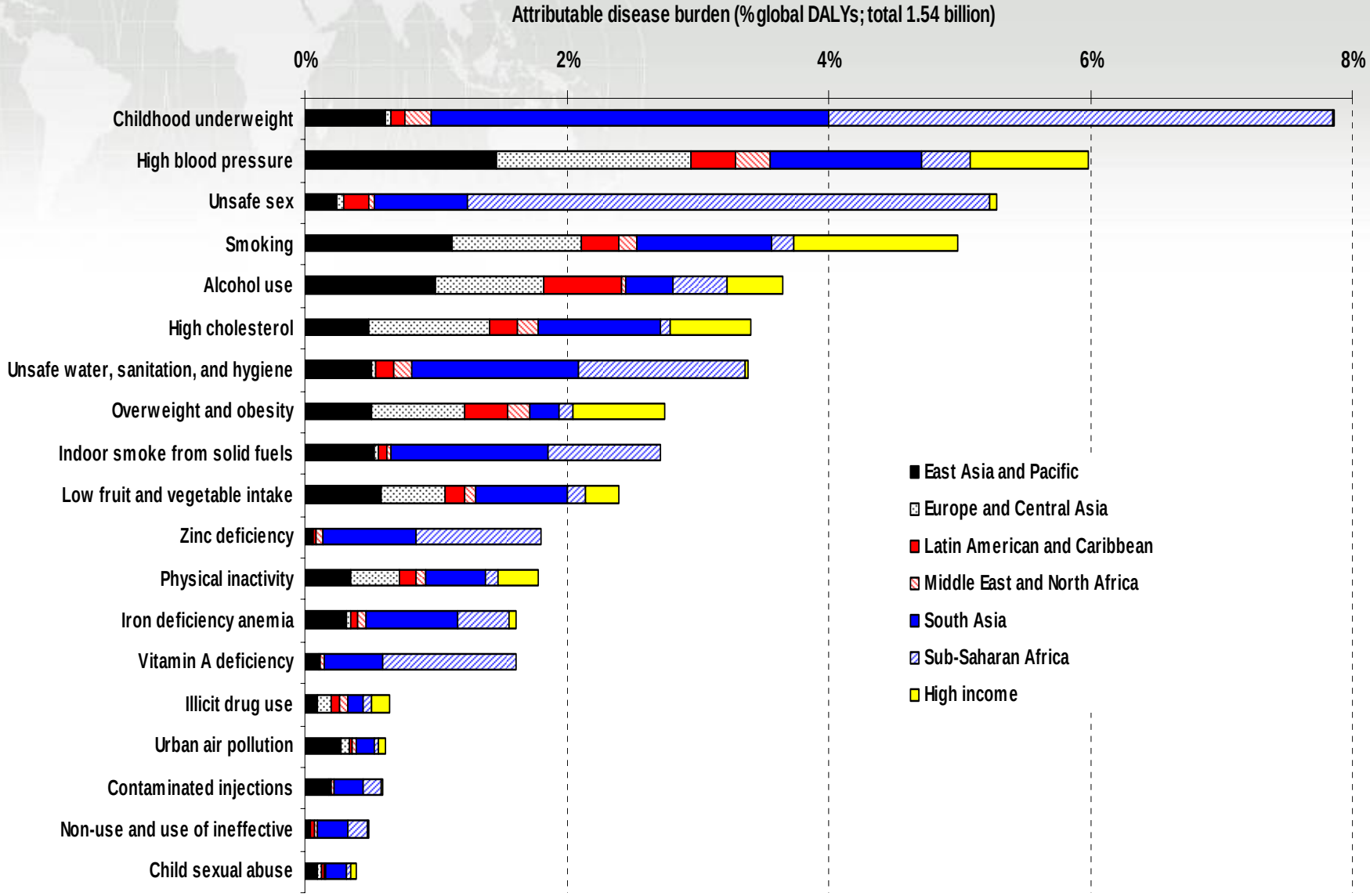
$$AB = \sum AF_j B_j$$

Results:

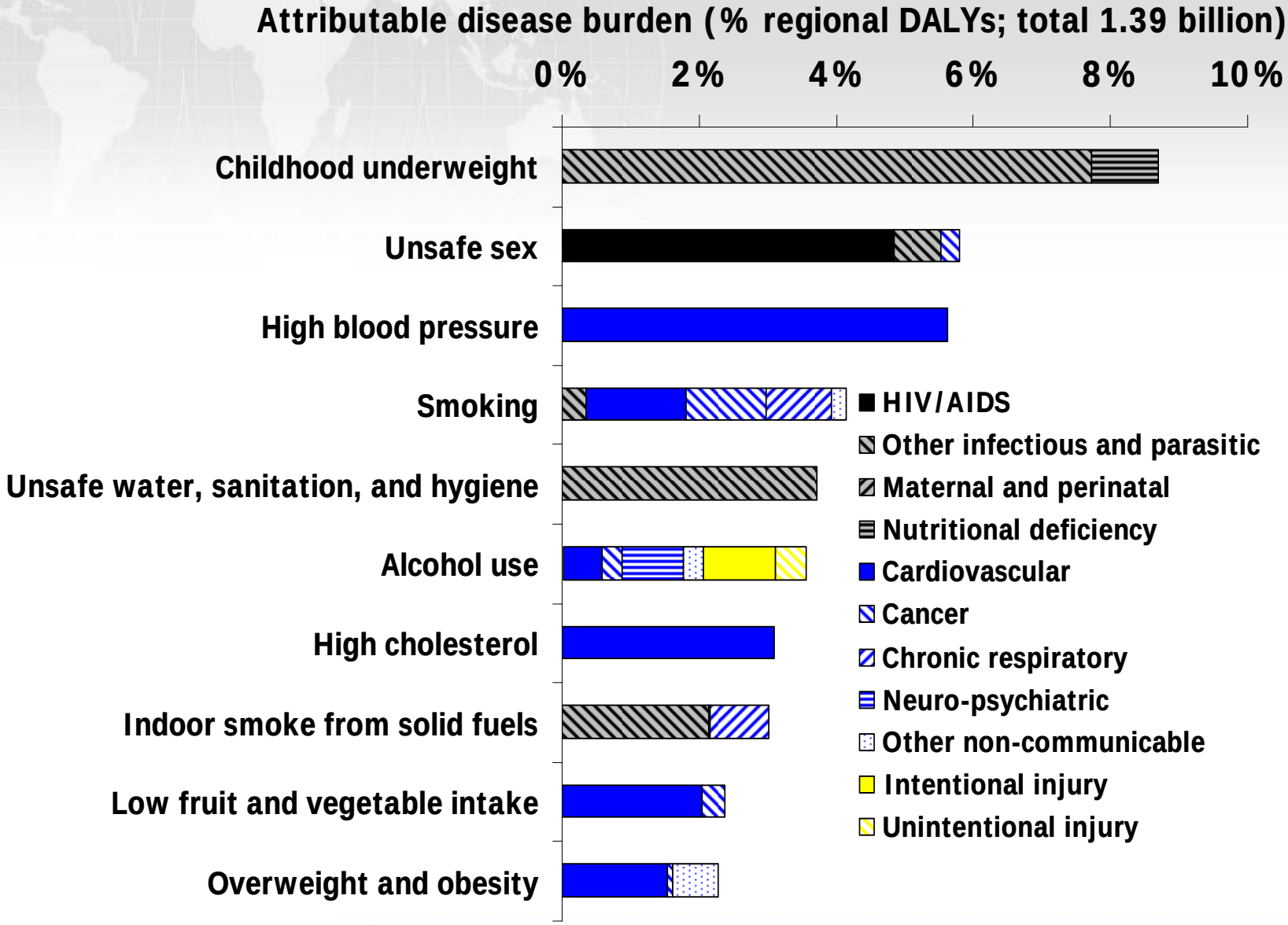
Burden attributable to individual risk factors


Global attributable deaths (thousands)
0
2000
4000
6000
8000
High blood pressure
Smoking
High cholesterol
Childhood underweight
Unsafe sex
Low fruit and vegetable intake
Overweight and obesity
Physical inactivity
Alcohol use
Indoor smoke from solid fuels
Unsafe water, sanitation, and hygiene
Zinc deficiency
Urban air pollution
Vitamin A deficiency
Iron deficiency anemia
Contaminated injections
Illicit drug use
Non-use and use of ineffective
Child sexual abuse
East Asia and Pacific
Europe and Central Asia
Latin American and Caribbean
Middle East and North Africa
South Asia
Sub-Saharan Africa
High income

Global attributable disease burden



Low and Middle income: Attributable DALY'S



Leading 10 selected risk factors and diseases or injuries

Developing high mortality Countries

Risk factor	% DALYs	Disease or injury	% DALYs
Underweight	14.9	HIV/AIDS	9.0
Unsafe sex	10.2	Lower respiratory infections	8.2
Unsafe water, S&H	5.5	Diarrhoeal diseases	6.3
Indoor smoke	3.7	Childhood cluster diseases	5.5
Zinc deficiency	3.2	Low birth weight	5.0
Iron deficiency	3.1	Malaria	4.9
Vitamin A deficiency	3.0	Unipolar depressive disorders	3.1
Blood pressure	2.5	Ischaemic heart disease	3.0
Tobacco	2.0	Tuberculosis	2.9
Cholesterol	1.9	Road traffic Injury	2.0

Leading 10 selected risk factors and diseases or injuries

Developing lower mortality Countries

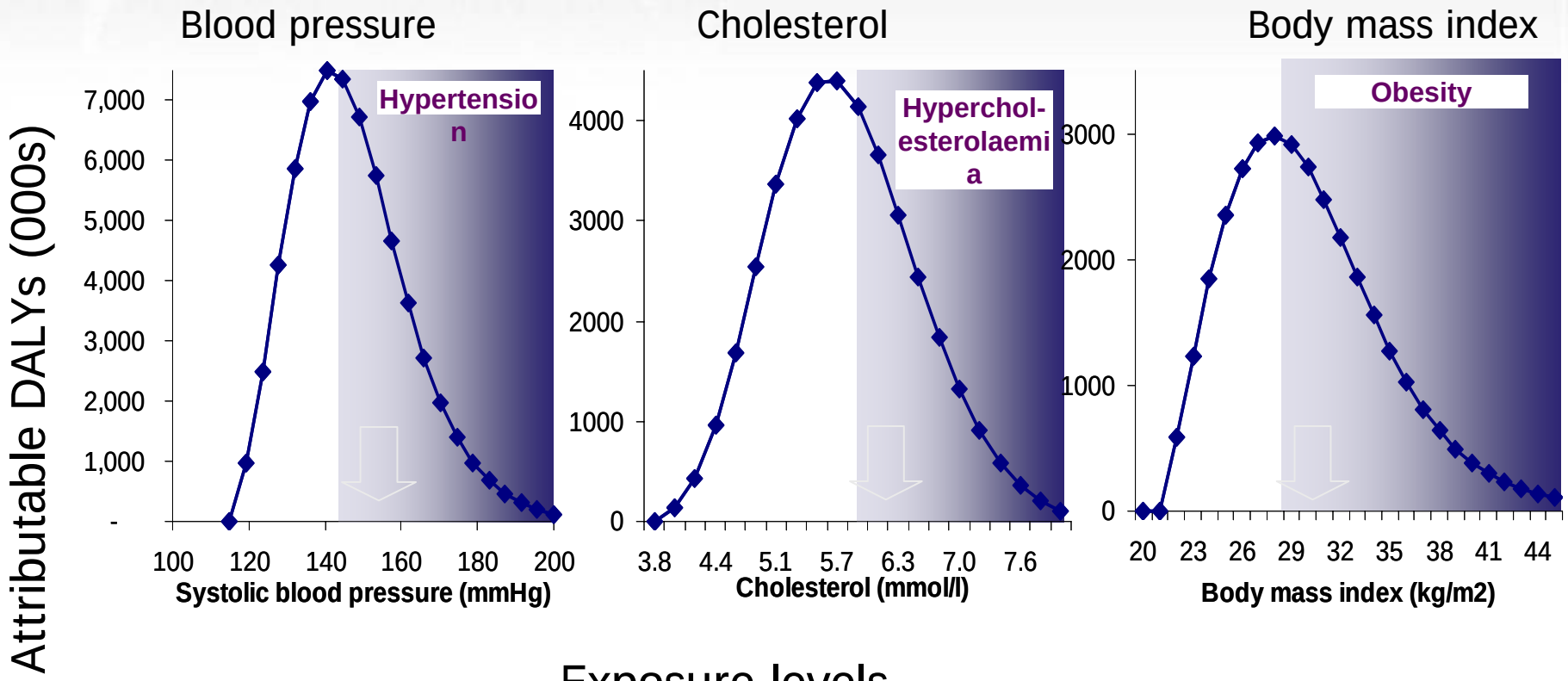
Risk factor	% DALYs	Disease or injury	% DALYs
Alcohol	6.2	Unipolar depressive disorders	5.9
Blood pressure	5.0	Cerebrovascular disease	4.7
Tobacco	4.0	Lower respiratory infections	4.1
Underweight	3.1	Road traffic injury	4.1
Overweight/obesity	2.7	COPD	3.8
Cholesterol	2.1	Ischaemic heart disease	3.2
Low fruit & vegetables	1.9	Birth asphyxia/trauma	2.6
Indoor smoke from solid fuels	1.9	Tuberculosis	2.4
Iron deficiency	1.8	Alcohol use disorders	2.3
Unsafe water, S&H	1.7	Deafness	2.2

Leading 10 selected risk factors and diseases or injuries

High income countries

Risk factor	% DALYs	Disease or injury	% DALYs
Tobacco	12.2	Ischaemic heart disease	9.4
Blood pressure	10.9	Unipolar depressive disorders	7.2
Alcohol	9.2	Cerebrovascular disease	6.0
Cholesterol	7.6	Alcohol use disorders	3.5
Overweight/obesity	7.4	Dementia & other CNS disorders	3.0
Low fruit & vegetables	3.9	Deafness	2.8
Physical inactivity	3.3	COPD	2.6
Illicit drugs	1.8	Road traffic injury	2.5
Unsafe sex	0.8	Osteoarthritis	2.5
Iron deficiency	0.7	Trachea bronchus & lung cancers	2.4

Distribution of attributable burden by exposure levels



Contributions of Risk Factors to CVD Mortality, Low- and Middle-Income Countries, 2001

Risk factor	Ischaemic heart disease (PAF, %)	Stroke (PAF, %)
1. High blood pressure	47 %	54 %
2. High cholesterol	43	12
3. Smoking	11	8
4. Overweight and obesity	14	7
5. Alcohol use	4	5
6. Physical inactivity	20	6
7. Low fruit and vegetable intake	27	10
8. Urban air pollution	4	4
Joint PAF	79	61

Source: Ezzati, et. al., DCPP BOD volume, 2006.

Distribution of attributable burden by age

- Most or all among children 0-4 years
  - Underweight and micronutrient deficiencies
  - Unsafe water, indoor smoke, lead, climate change
- Most or all among adults 15-59 years
  - Unsafe sex
  - Tobacco, alcohol, illicit drugs
  - Occupational injuries, unsafe health care injections, and childhood sexual abuse sequelae
- About half under 60 years, about half over 60 years
  - Diet-related CVD risks and physical inactivity
  - Urban air pollution
  - Occupational carcinogens and airborne particulates

Distribution of attributable burden by sex

- Burden from most risks borne about equally by men and women, except:
- Women suffer all burden attributable to lack of contraception and ~2/3 childhood sexual abuse
- Men suffer 75%+ of burden from addictive substances and most occupational risks

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
Joint effects	*31%*		*25%*	

Global disease burden due to leading 10 vs 20 risks

	Leading 10	Leading 20
Attributable deaths	42%	46%
Attributable DALYs	33%	39%
Attributable HALE	8.4 yrs	9.2 yrs

Conclusions

- Role of established risk factors greater than commonly thought
- In many world regions, the leading 5 risk factors account for more than one-third of mortality and one-quarter of DALYs
- Risks are widespread – all risk factors have global impact, and the burden of many occurs almost exclusively in developing countries

Conclusions

- Large and often unrecognized potential for prevention
  - Full impact of risks often undermeasured, and hence under-appreciated
  - Risks often occur as a continuum throughout the population:
    - many more at risk eg. more than three quarters of adults would be in better health if they had lower blood pressure
    - large potential gains from shifting population distributions of exposure