DISEASE CONTROL PRIORITIES PROJECT

Regional Burden of Disease and Risk Factors

Fariyal F. Fikree, Alan D. Lopez, Colin D. Mathers,
Majid Ezzati, Dean T. Jamison, Christopher J.L. Murray

Global Burden of Disease (GBD): Goals

- 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 with summary measure of population health and cost-effectiveness analysis

Attribution of Disease Burden:
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
  - research agenda

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 (example: DALY)
- Protective as well as hazardous factors
- Population-wide risks as well as high-risk individuals

Disability-Adjusted Life Years (DALYs)
Burden of Disease on a Defined Population

- Aggregate of **premature mortality, morbidity, and disability**
- Adjustments made for
  - **life expectancy**
  - long-term **disability** (weighted)
- Valid indicator of **population health**
- Tied to effectiveness of **interventions**

Disability-Adjusted Life Years (DALYs)

$$DALY = YLL + YLD$$

Time is used as the common metric for mortality and health status

YLL Years of life lost due to mortality

YLD Equivalent years of healthy life lost due to disability

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

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)

Risks Quantified in GBD 2001

Child & maternal under-nutrition

- Childhood and maternal underweight
- Iron deficiency
- Vitamin A deficiency
- Zinc deficiency

Addictive substances

- Smoking and oral tobacco
- Alcohol
- Illicit drugs

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

Risks Quantified in GBD 2001

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

Occupational risks

- Risk factors for injury
- Carcinogens
- Airborne particulates
- Ergonomic stressors
- Noise

Distributions of risks by poverty

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

Some Slides on Child Mortality Trends 1990 to 2001

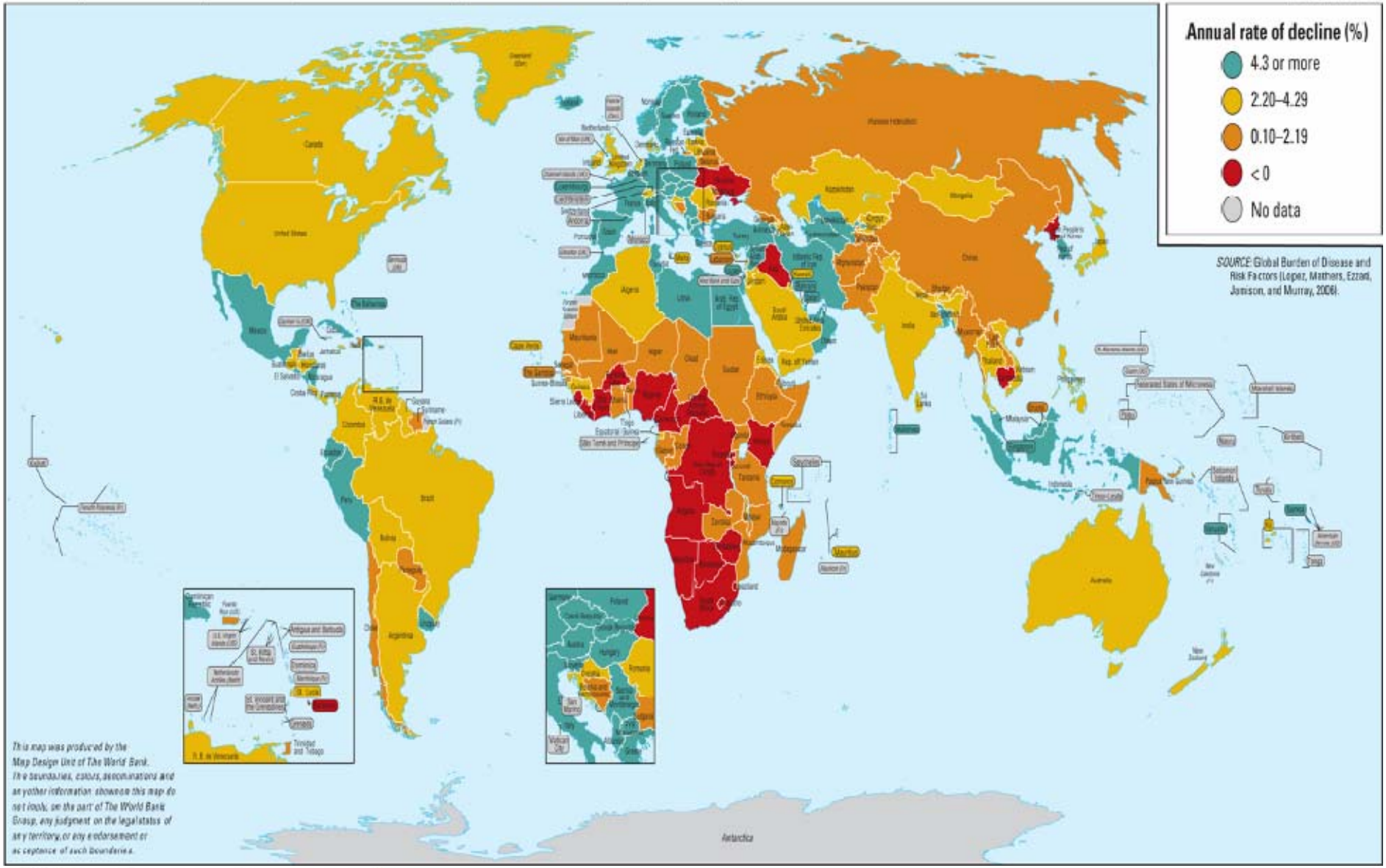
Child Mortality Under 5

- Child mortality (ages 0-4 years) declined between 1990 and 2001 in all regions of the world
- 5 causes responsible for more than 50% of child deaths: respiratory infections, measles, diarrhoea, malaria, and HIV/AIDS
- Death rates have risen for HIV/AIDS, malaria
- Death rates have fallen for respiratory infections, measles, and diarrhoea

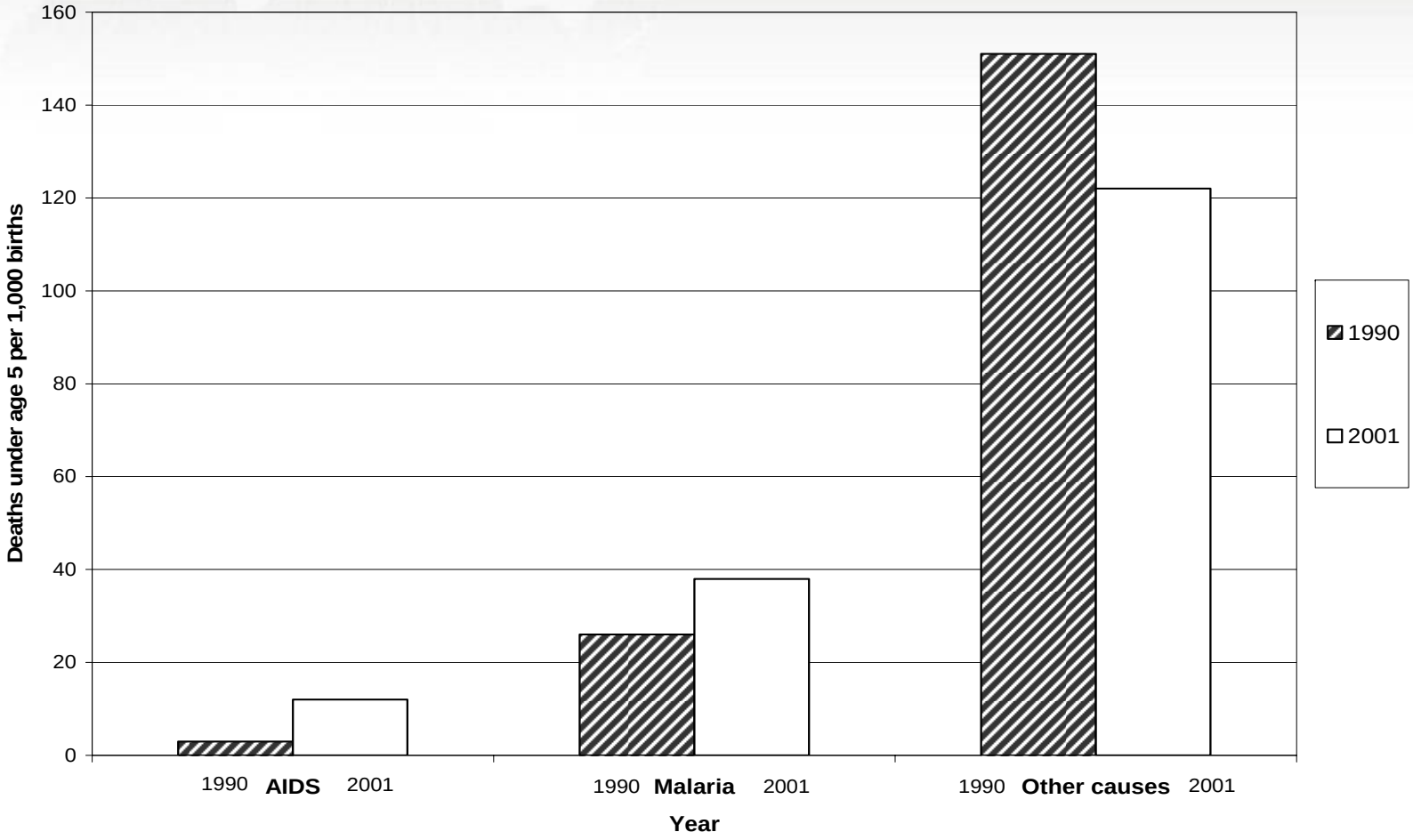
Rate of Decline in Under-Five Mortality, 1990-2001

Note: Meeting the Millenium Development Goal No.4, to reduce under-5 mortality by 2/3 between 1990 and 2015, requires an average annual rate of decline of 4.3%.

IBRD 33953
JANUARY 2006

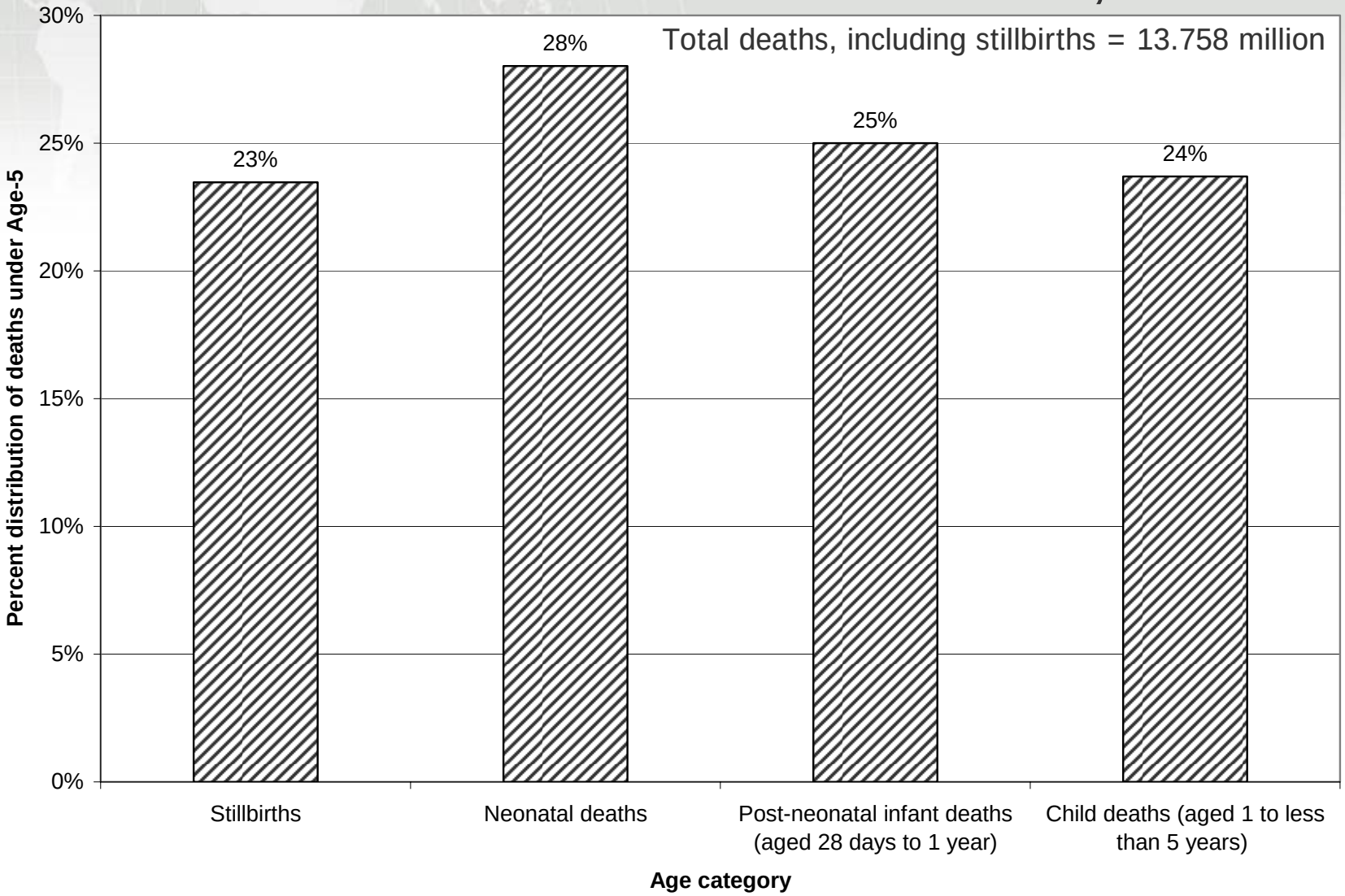


Child Deaths from AIDS, Malaria and Other Causes, per Thousand Births, 1990 and 2001, Sub-Saharan Africa



Source: Lopez, Begg and Bos (2006, Table 4)

The Age Distribution of Deaths Under Age-5, Low- and Middle-Income Countries, 2001



Source: Jamison, Shahid-Salles, Jamison, Lawn and Zupan, Burden of Disease Volume, 2006.

Some Slides on Mortality and Burden of Disease, 2001

Leading Causes of DALYs, Globally, 2001 (n = 1.54 billion)

Cause	% total
1. Perinatal conditions	5.9
2. Lower respiratory infection	5.6
3. Ischaemic heart disease	5.5
4. Cerebrovascular disease	4.7
5. HIV/AIDS	4.7
6. Diarrhoeal diseases	3.9
7. Unipolar depressive disorders	3.4
8. Malaria	2.6
9. Chronic obstructive pulmonary disease	2.5
10. Tuberculosis	2.3
Total	**41.1**

Mathers et al, 2006 in Lopez et al, *Global Burden of Disease and Risk Factors*

Ten Leading Causes of Mortality in low- and middle-income countries, 2001

	%
Ischaemic heart disease	**11.8**
Cerebrovascular disease	**9.5**
Lower respiratory infections	**7.0**
HIV/AIDS	**5.3**
Perinatal conditions	**5.1**
Chronic obstructive lung disease	**4.9**
Diarrhoeal diseases	**3.7**
Tuberculosis	**3.3**
Malaria	**2.5**
Road traffic accidents	**2.2**

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

Ten Leading Causes of Burden of Disease in low- and middle-income countries, 2001

	%
Perinatal conditions	**6.4**
Lower respiratory infections	**6.0**
Ischaemic heart disease	**5.2**
HIV/AIDS	**5.1**
Cerebrovascular disease	**4.5**
Diarrhoeal diseases	**4.2**
Unipolar depressive disorders	**3.1**
Malaria	**2.9**
Tuberculosis	**2.6**
Chronic obstructive lung disease	**2.4**

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

Leading Causes of DALYs in Sub-Saharan Africa, 2001

	Total DALYs	%
1.	HIV/AIDS	17.8
2.	Malaria	10.3
3.	Lower respiratory infections	8.4
4.	Perinatal conditions	6.3
5.	Diarrheal diseases	6.1
6.	Measles	4.6
7.	Tuberculosis	2.4
8.	Whooping cough	1.9
9.	Road traffic accidents	1.8
10.	Protein-energy malnutrition	1.6
Total		**61.2**

Mathers et al. in Global Burden of Disease and Risk Factors, 2006

Three Leading Causes of Mortality and Burden of Disease: Mauritius, 2001

Mortality		DALYs	
	% total deaths		% total DALYs
Ischaemic heart disease	25.9	Ischaemic heart disease	11.6
Cerebrovascular disease	15.8	Cataracts	7.1
Diabetes mellitus	4.9	Cerebrovascular diseases	6.8

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

Mortality and Burden of Disease Due to Selected Risk Factors: Mauritius, 2001

Mortality		DALYs	
	% total deaths		% total DALYs
High blood pressure	28.6	High blood pressure	12.3
High cholesterol	11.3	High cholesterol	5.5
Physical inactivity	6.8	Alcohol	3.8

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

Three Leading Causes of Mortality and Burden of Disease: United Republic of Tanzania, 2001

Mortality		DALYs	
	% total deaths		% total DALYs
HIV/AIDS	24.3	HIV/AIDS	20.7
Malaria	11.1	Malaria	11.4
Lower respiratory infections	5.2	Lower respiratory infections	9.7

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

Mortality and Burden of Disease Due to Selected Risk Factors: United Republic of Tanzania, 2001

Mortality

	% total deaths
Unsafe sex	27.1
Child / maternal underweight	16.8
Vitamin A deficiency	5.1

DALYs

	% total DALYs
Unsafe sex	23.3
Child / maternal underweight	17.0
Zinc deficiency	5.2

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

Three Leading Causes of Mortality and Burden of Disease: Zimbabwe, 2001

Mortality		DALYs	
	% total deaths		% total DALYs
HIV/AIDS	62.9	HIV/AIDS	59.7
Lower respiratory infections	3.8	Diarrhoeal diseases	3.5
Diarrhoeal diseases	3.2	Perinatal conditions	3.0

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

Mortality and Burden of Disease Due to Selected Risk Factors: Zimbabwe, 2001

Mortality		DALYs	
	% total deaths		% total DALYs
Unsafe sex	63.3	Unsafe sex	60.3
Child/maternal underweight	3.7	Child/maternal underweight	4.2
Unsafe water/sanitation	2.8	Unsafe water/sanitation	3.1

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

Conclusions

- Role of established risk factors greater than commonly thought
- In sub-Saharan Africa, a little over half of DALYs are due to infectious diseases
- Risks are widespread – all risk factors have global impact, and the burden of many occurs almost exclusively in developing countries
- ECSA region noted for high infectious disease countries as well as high non-communicable disease – dual burden

Conclusions

- Large and often unrecognized potential for prevention
  - Full impact of risks often undermeasured, and hence under-appreciated
  - Many more at risk:
    - nearly one-quarter of children and mothers in the United Republic of Tanzania would be in better health if they were well nourished
    - nearly one-third of adults in Mauritius would be in better health if they had lower blood pressure
    - nearly two-thirds of adults in Zimbabwe would be in better health if they avoided unsafe sex