Quantifying inequalities in the global burden of disease due to environmental factors: perspectives from the Global Burden of Disease Comparative Risk Assessment

Aaron Cohen

Health Effects Institute*

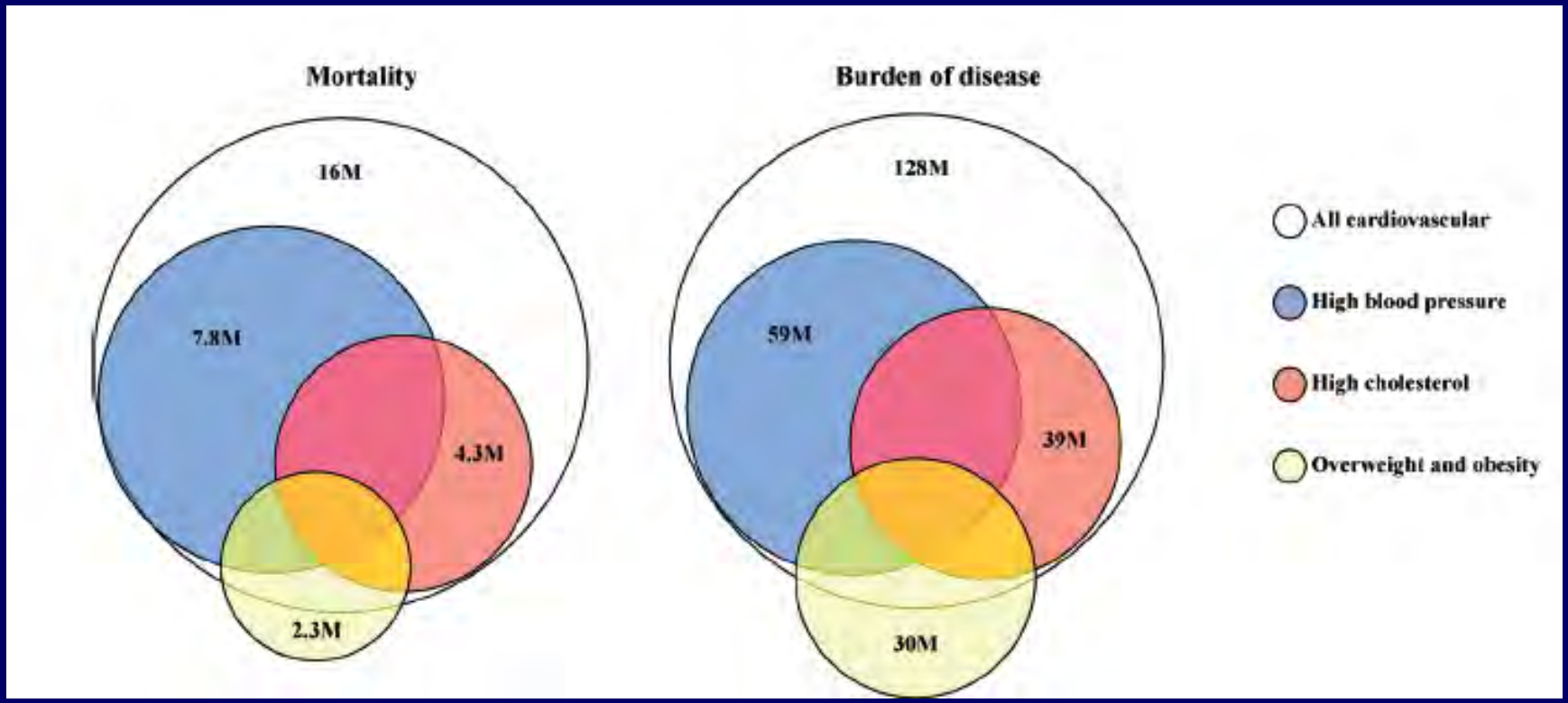
** The views expressed in this presentation are those of its author and do not necessarily reflect the views of the Health Effects Institute or its sponsors.*

What is the Global Burden of Disease Comparative Risk Assessment (GBD/CRA)?

- Conducted periodically by WHO since the early 1990s. Currently a collaborative effort of Gates-funded Institute for Health Metrics and Evaluation, WHO and leading academic centers
- Measure loss of health due to comprehensive set of disease, injury, and risk factor causes in a comparable way
- Burden estimated as Disability Adjusted Life-Years (DALYs), the sum of Years Lived with Disability and Years of Life Lost, as well as numbers of deaths
- GBD 2005, now in progress, will:
  - Produce disease, injury, and risk burden estimates for 1990 and 2005 using comparable methods for 21 regions which collectively span the global population
  - Quantify the role of >35 selected, potentially-modifiable risk factors in global and regional burden of disease from over 150 specific causes using comparable methods

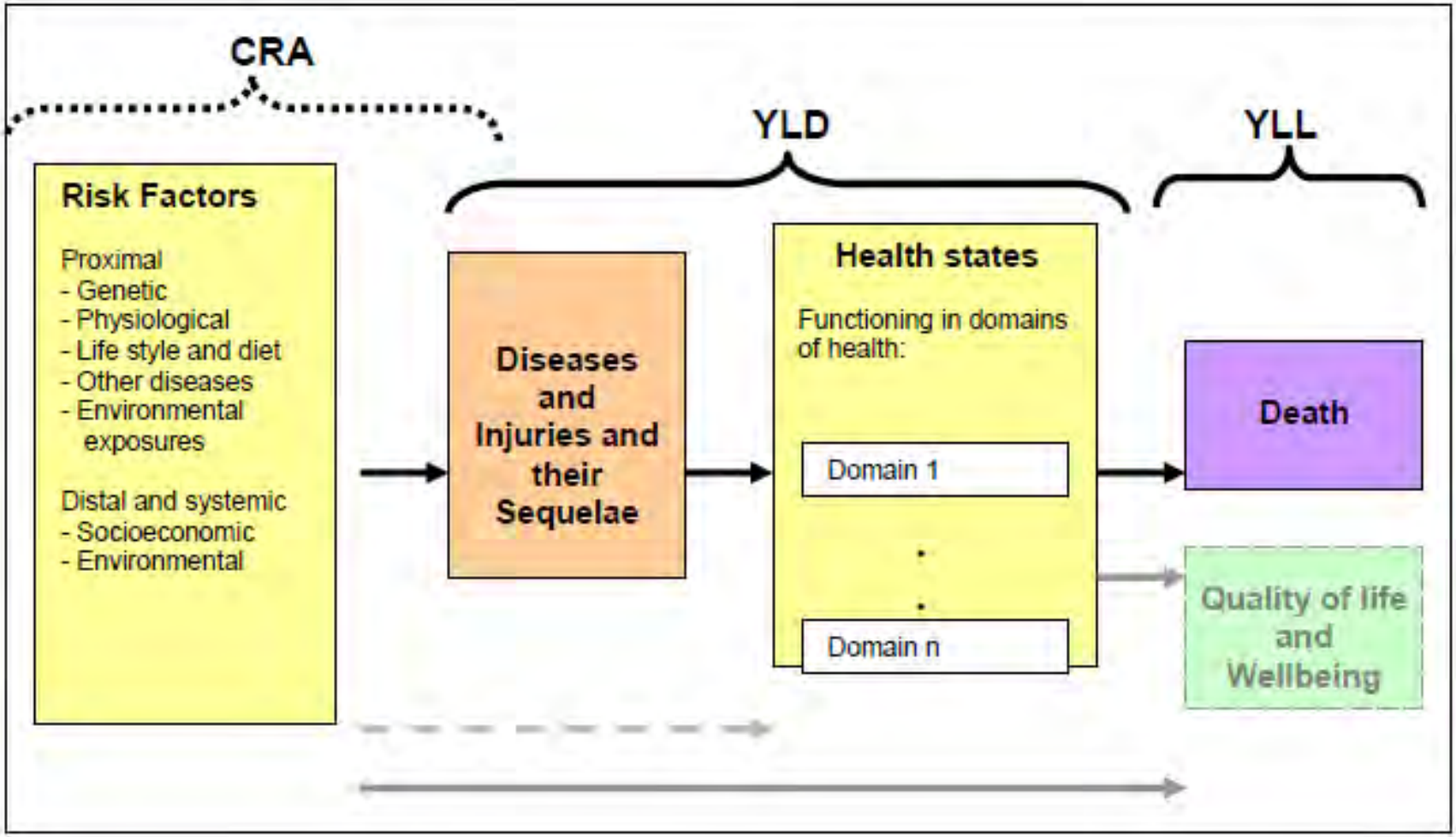
Attribution of disease burden and need for Comparative Risk Assessment

- Mortality and morbidity can be attributed to:
  - disease or injury outcomes
  - risk factors
- Focusing on risk factors is key to prevention



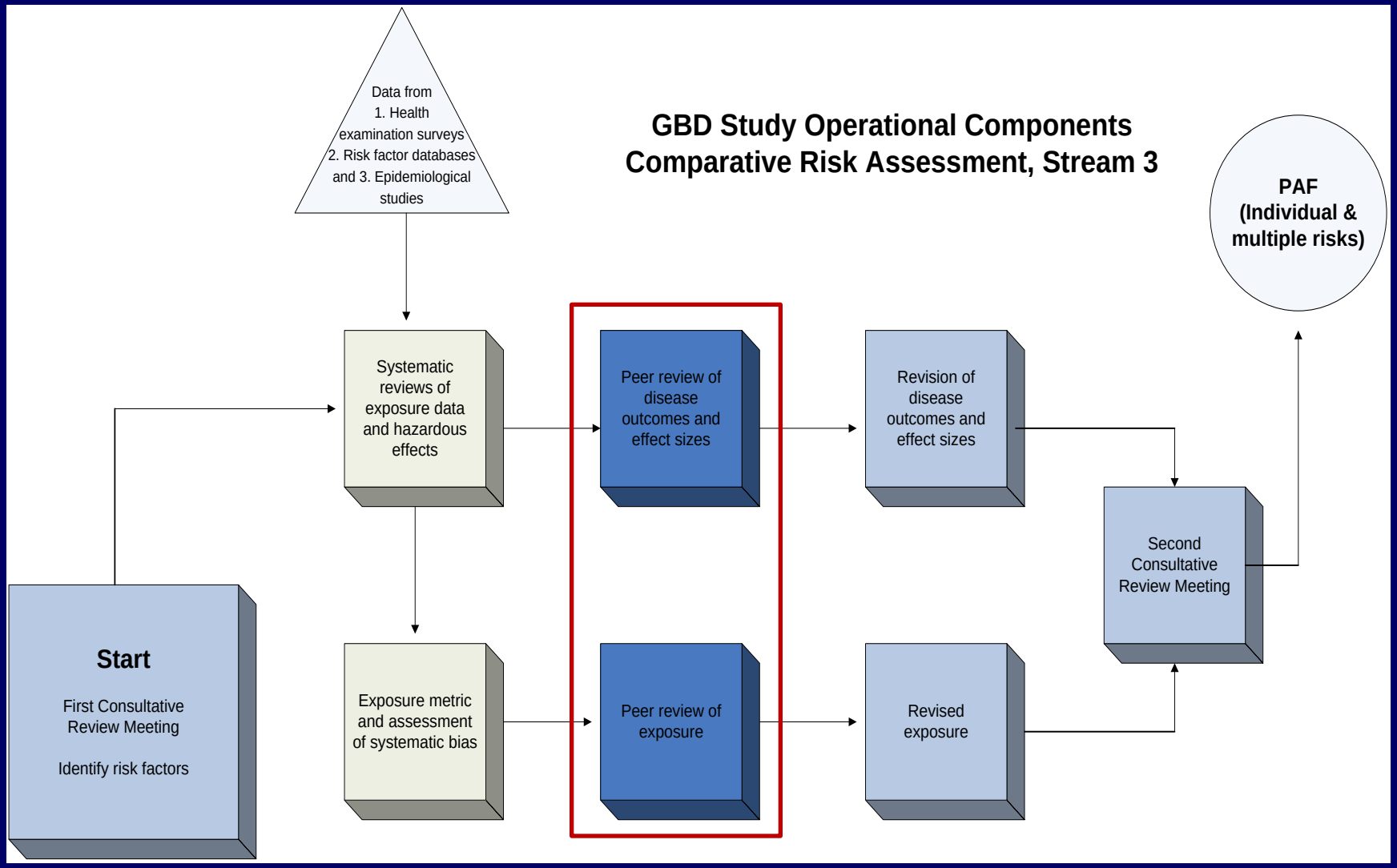
Ezzati et al. PLoS 2005

A Simplified Conceptual Framework for Burden of Disease Analysis

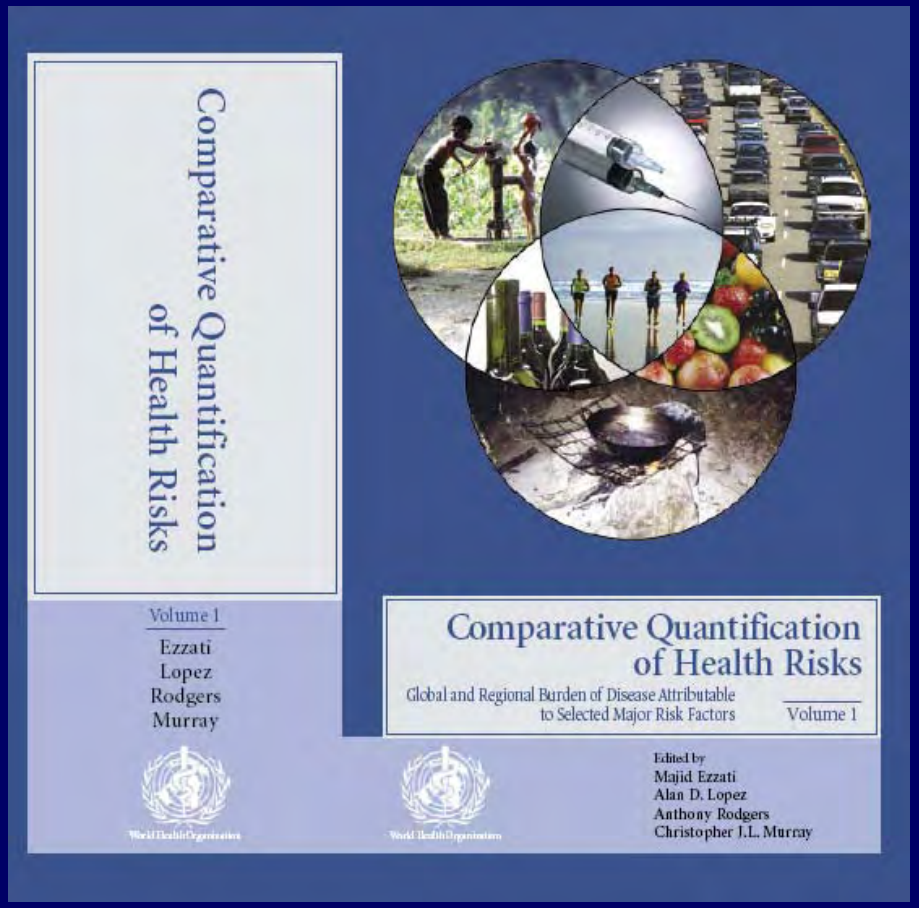


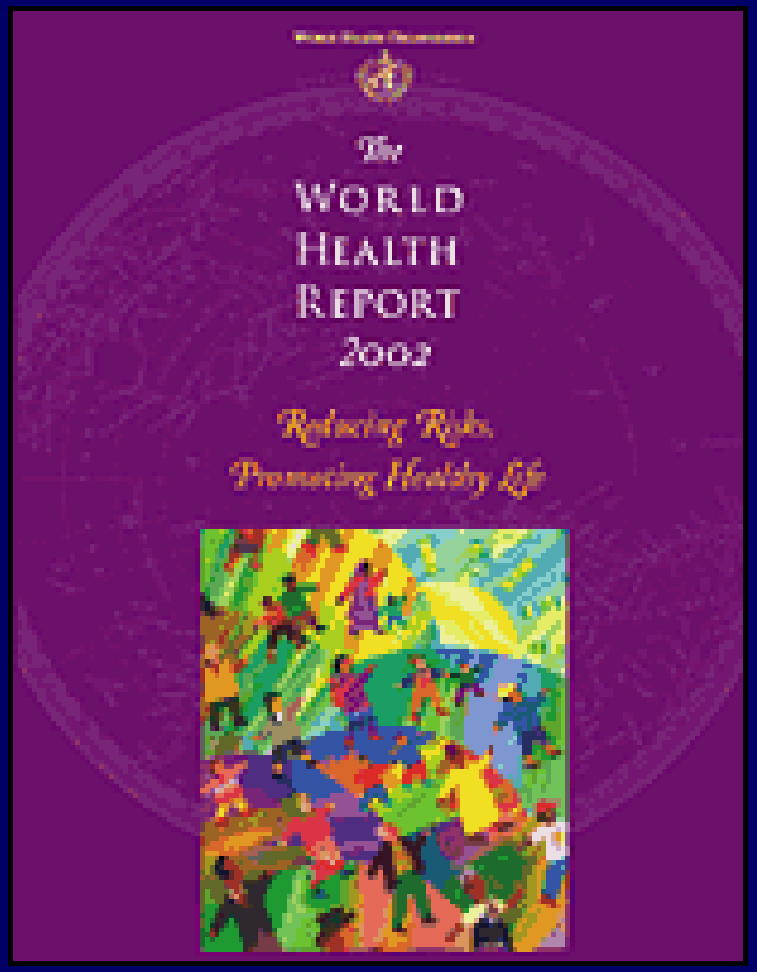
GBD 2005 Operations Manual January 2008 Draft

GBD 2005 – CRA Process



CRA project and WHO's World Health Report 2002





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

http://www.who.int/whr/2002/en/

Risks quantified in WHR 2002

Child & maternal under-nutrition
Underweight
Iron deficiency
Vitamin A deficiency
Zinc deficiency
Other diet-related risks & inactivity
Blood pressure
Cholesterol
High body mass index
Inadequate fruit and vegetable intake
Physical inactivity
Sexual and reproductive health risks
Unsafe sex
Lack 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
Occupational risks
Risk factors for injury
Carcinogens
Airborne particulates
Ergonomic stressors
Noise
Other selected risks to health
Unsafe health care injections
Childhood sexual abuse

Cardiovascular Disease Risk Factors and Economic Development

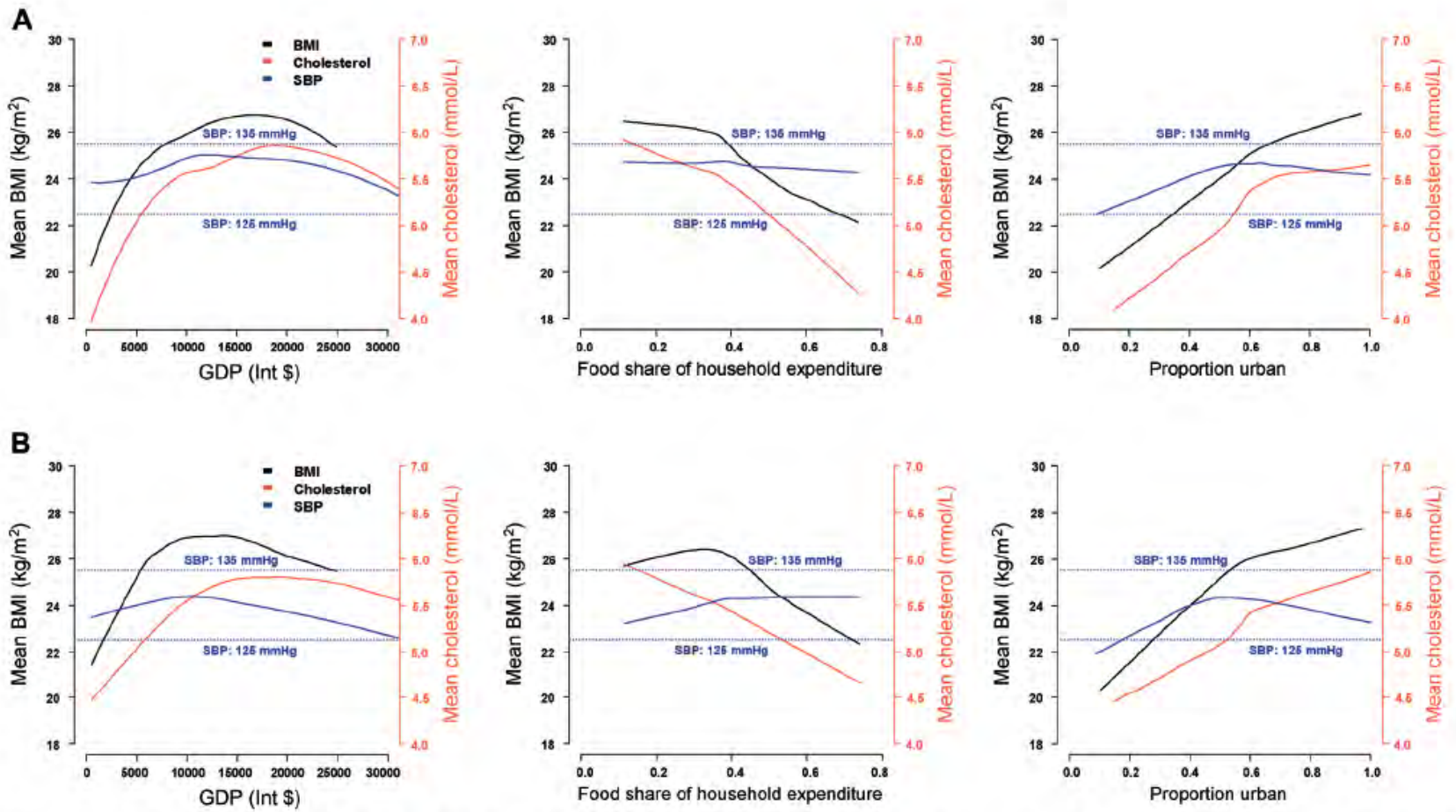
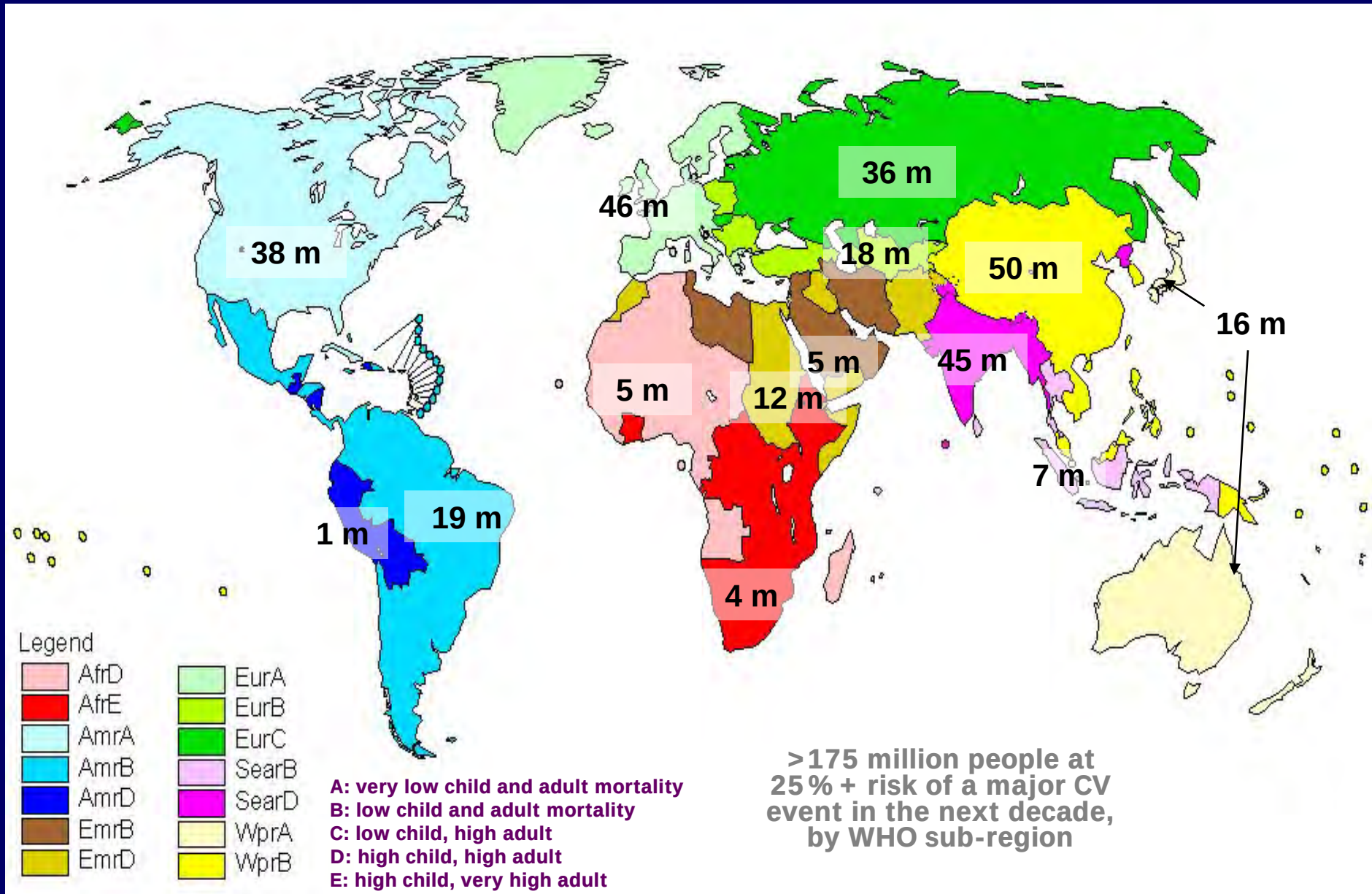


Figure 3. Relationship of Mean Population BMI, SBP, and Total Cholesterol with Average National Income, Food Share of Household Expenditure, and Proportion of Population in Urban Areas

Ezzati et al. PLoS 2005

Number of people at high CV risk globally in 2000

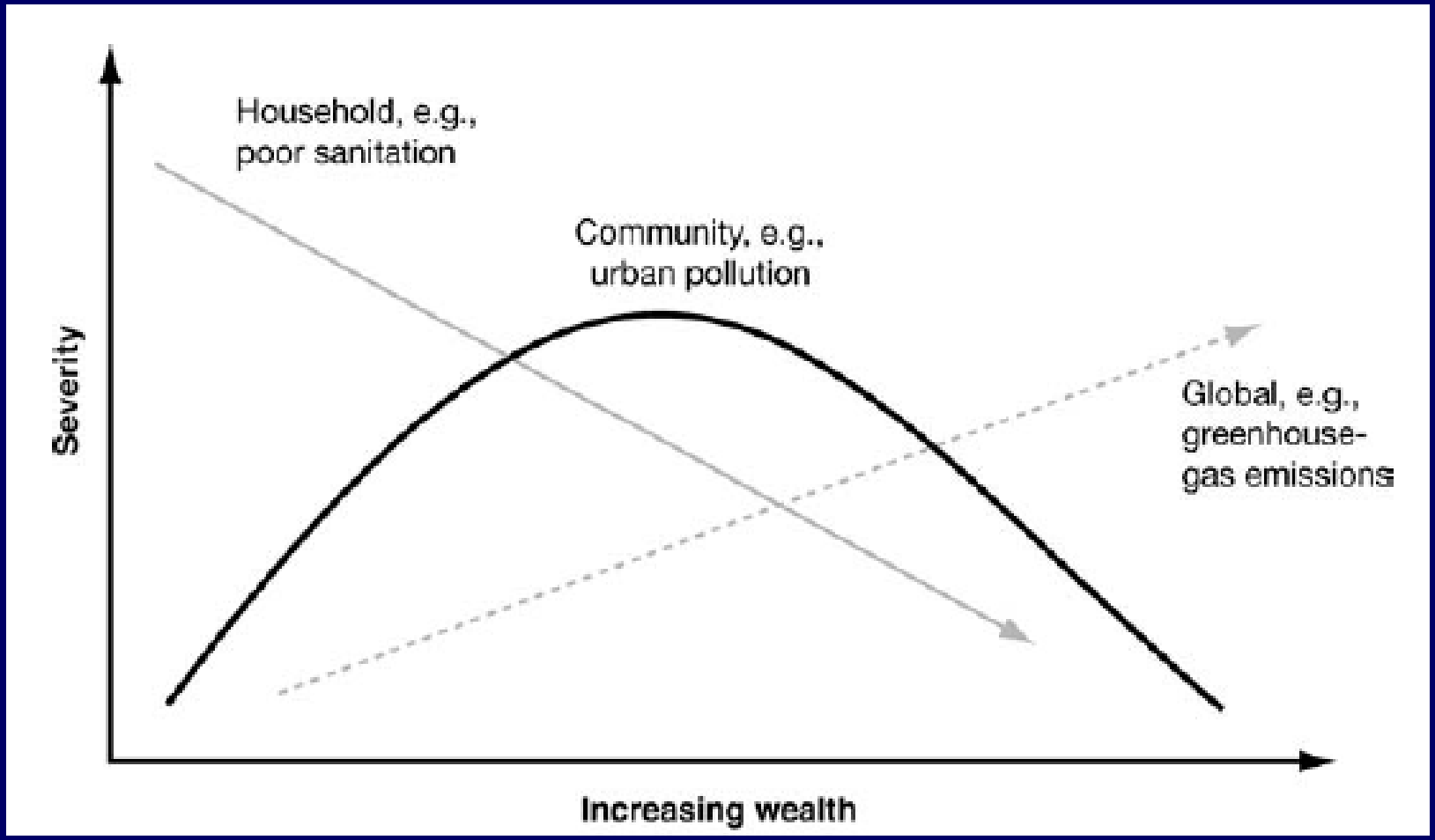
(A Rogers 2005)



A: very low child and adult mortality
B: low child and adult mortality
C: low child, high adult
D: high child, high adult
E: high child, very high adult

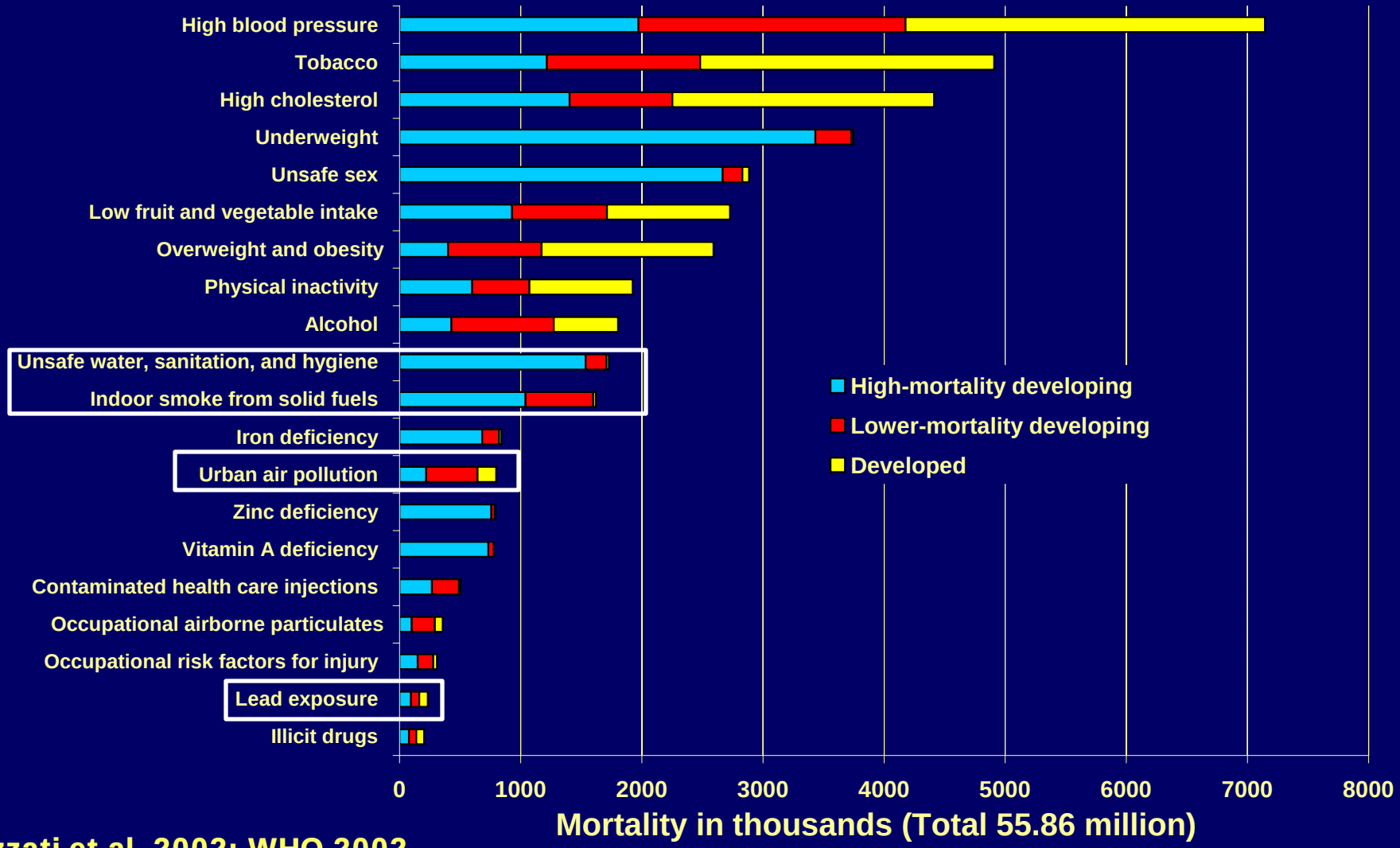
>175 million people at 25% + risk of a major CV event in the next decade, by WHO sub-region

The Environmental Risk Transition



Smith and Ezzati 2005

Mortality attributable to leading risk factors



Ezzati et al. 2002; WHO 2002

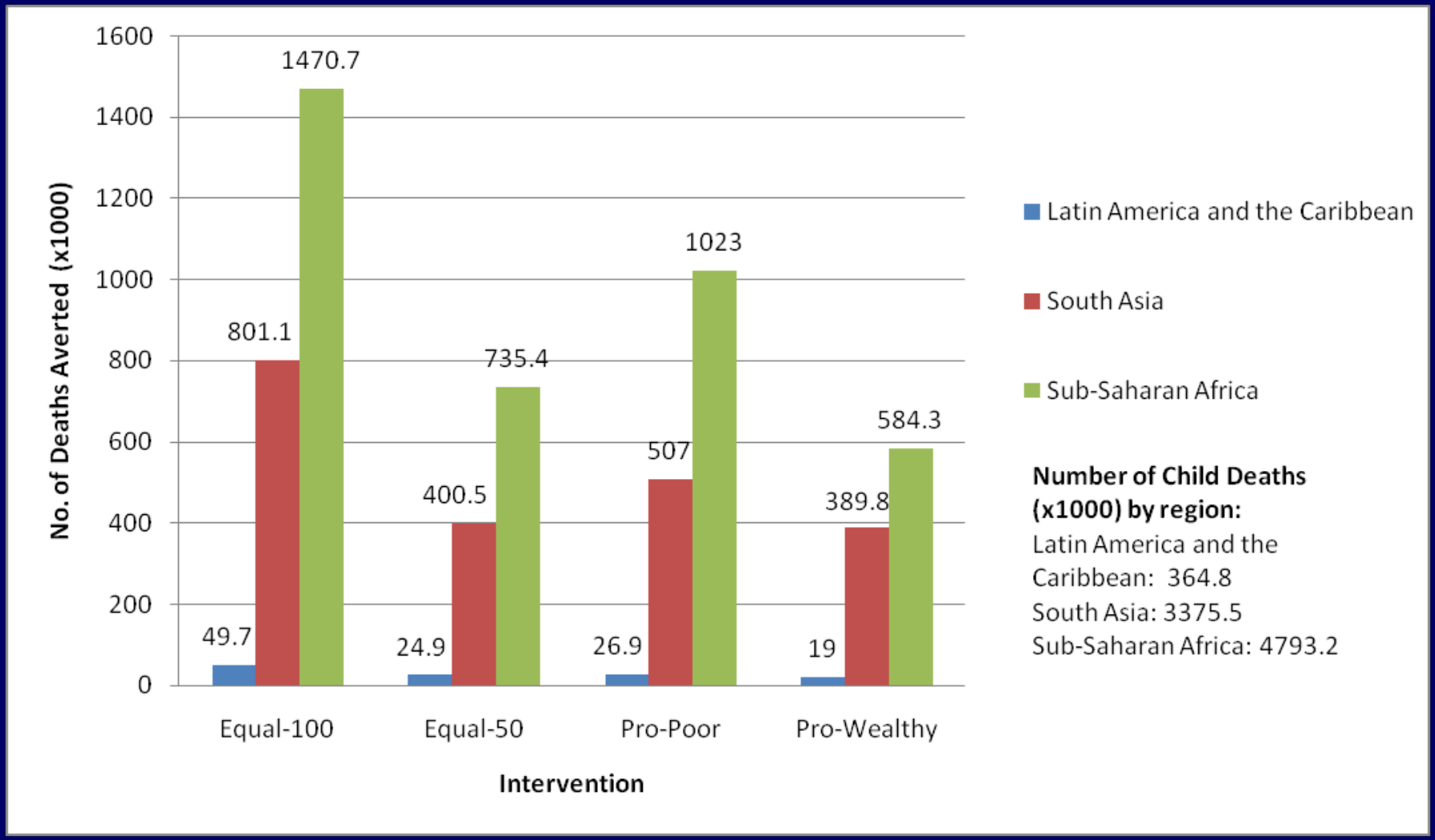
Improving Child Survival Through Environmental and Nutritional Interventions: : The Importance of Targeting Interventions Toward the Poor (Gakidou et al JAMA 2007)

- How do interventions related to specific UN MDGs, reducing poverty and hunger and ensuring environmental sustainability, affect progress toward another key MDG, reducing child mortality?

- Estimate reductions in child mortality from interventions on environmental and nutritional MDGs (improved nutrition, clean water and sanitation, household fuels) and their distribution by SES

- Data on child mortality, risk factor effects and distributions, from 42 countries in LA, South Asia and Sub-Saharan Africa summarized, integrated, and analyzed using GBD/CRA methods

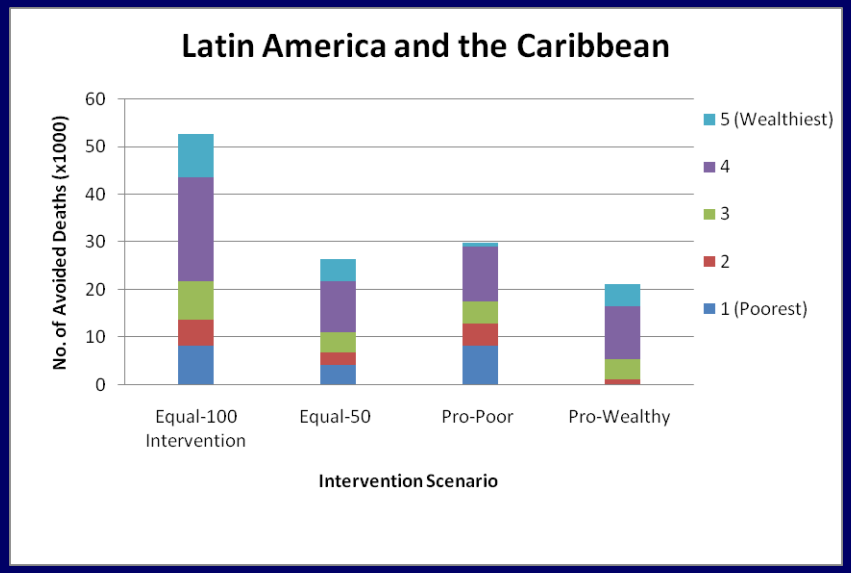
Estimated Reduction in Child Deaths in 3 Regions After Implementing Specific Intervention Scenarios

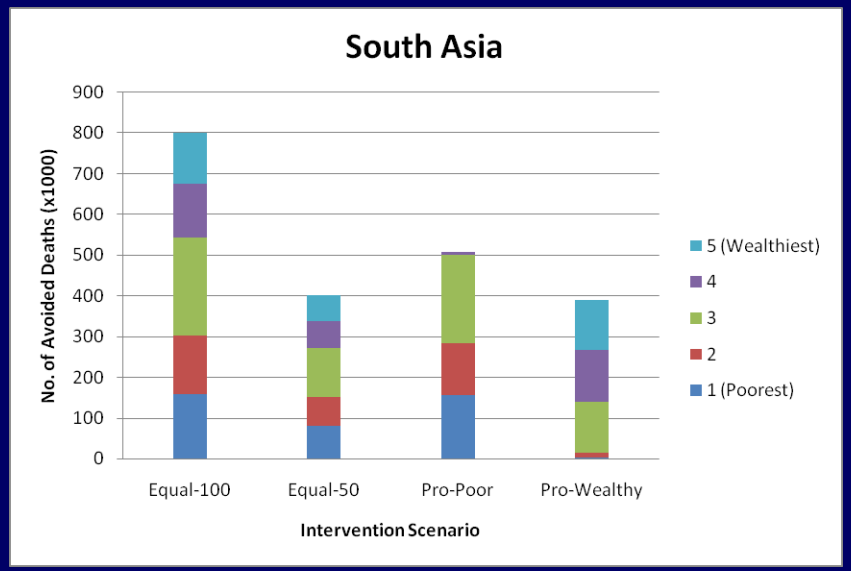


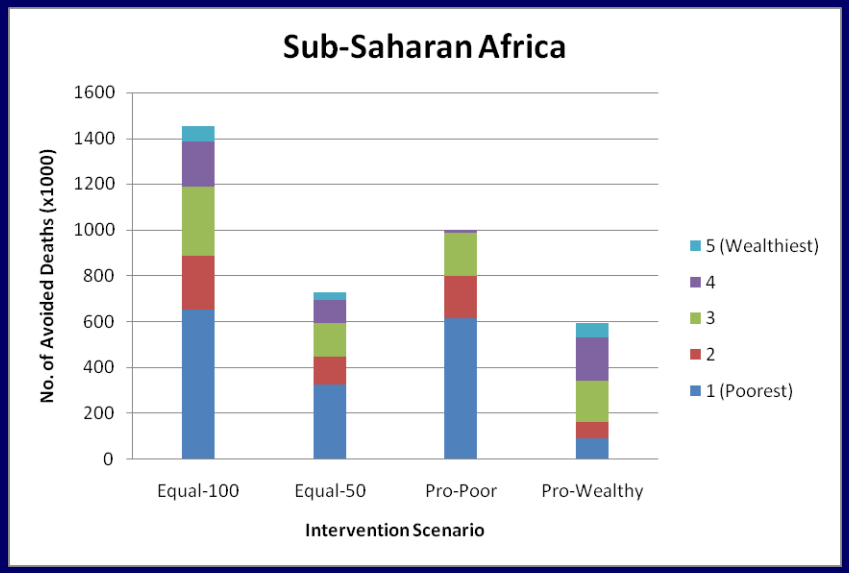
Data from Gakidou et al JAMA 2007

Estimated Reduction in Child Deaths by Wealth Quintiles[1] in 3 Regions After Implementing Specific Intervention Scenarios

(Gakidou et al 2007)







[1] Sum of individual quintiles may not equal results for all quintiles combined because of rounding

The Effects of 3 Environmental Risk Factors on Mortality Disparities Across Mexican Communities

Stevens G et al. PNAS 2008

- CRA methods used to calculate mortality effects of unsafe water and sanitation, household solid fuel use and urban PM air pollution, and disparities in mortality due to each factor across muncipios (counties)and by municipio-level SES

- During 2001-2005 unsafe water and sanitation, indoor air pollution, and urban air quality accounted for 3,000, 3,600 and 7,600 child deaths, respectively

- Collectively, these factors caused 10.6 % of deaths in lowest SES municipios vs. 4 % in the highest SES municipios

- Recommended that the disparities in attributable mortality "...should form the basis of interventions and environmental monitoring programs."

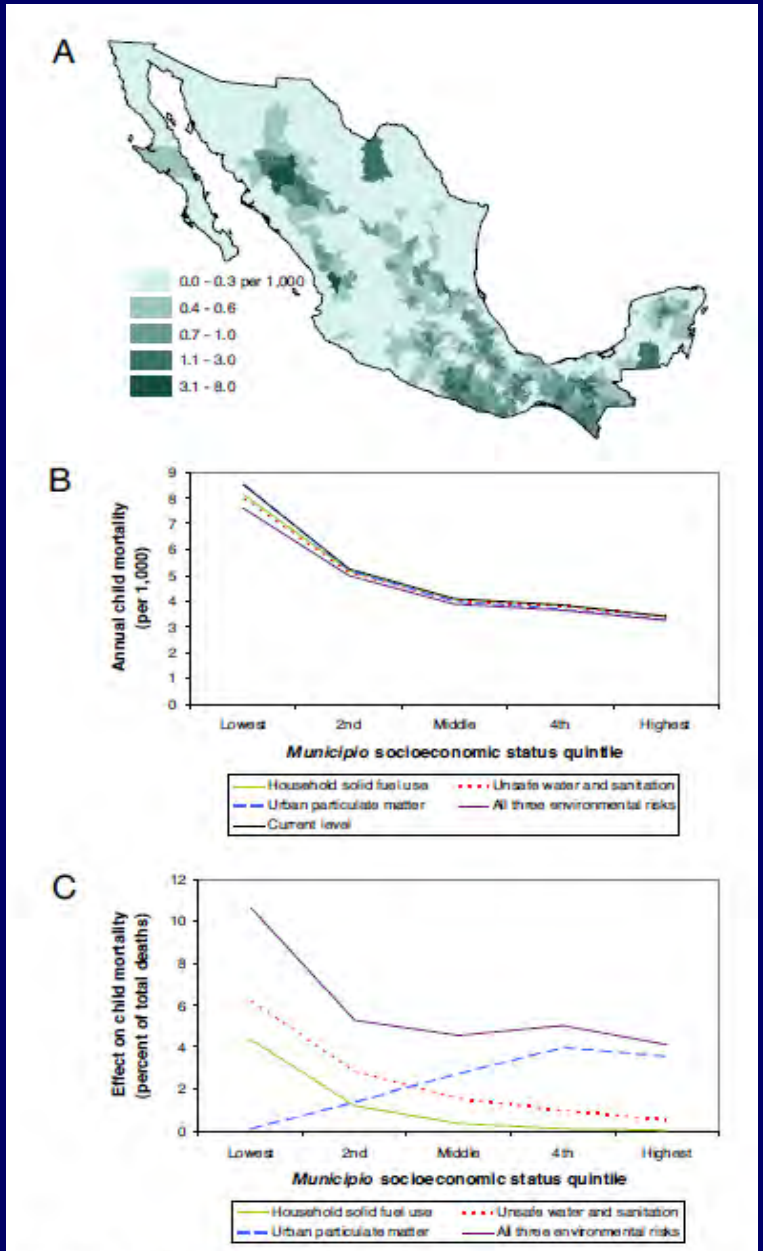


Fig. 2. Effects of 3 environmental risk factors on child mortality, by *municipio* of residence and by *municipio* SES quintile. (*A*) Child mortality rate attributable to all 3 risks by *municipio* of residence. (*B*) Current and expected child mortality rate if individual or multiple risk factors were removed. (*C*) Proportion of child deaths attributable to the 3 risk factors.

Summary

- GBD/CRA provides an example of the insights that may be gained from using consistent and comparable methods for evaluations of the impacts of multiple environmental risk factors
- The GBD/CRA approach can be used to describe the distribution of the burden of disease due to environmental and other factors according to other broad determinants of health such as level of economic development and SES
- Analyses at the global, regional or national level may conceal within-country inequalities in attributable burden
- The GBD/CRA approach can also be used to combine data on exposures and health outcomes at the local level to identify where the need for intervention is greatest
- Interventions should focus on those areas where attributable burden (not just exposure) is the largest
- Comparative risk assessment should be a key input to prioritisation for:
  - health systems faced with many and varied health problems
  - research agendas

For more information on the Global Burden of Disease Comparative Risk Assessment:

http://www.globalburden.org/

acohen@healtheffects.org