A Global Perspective on Air Pollution and Health

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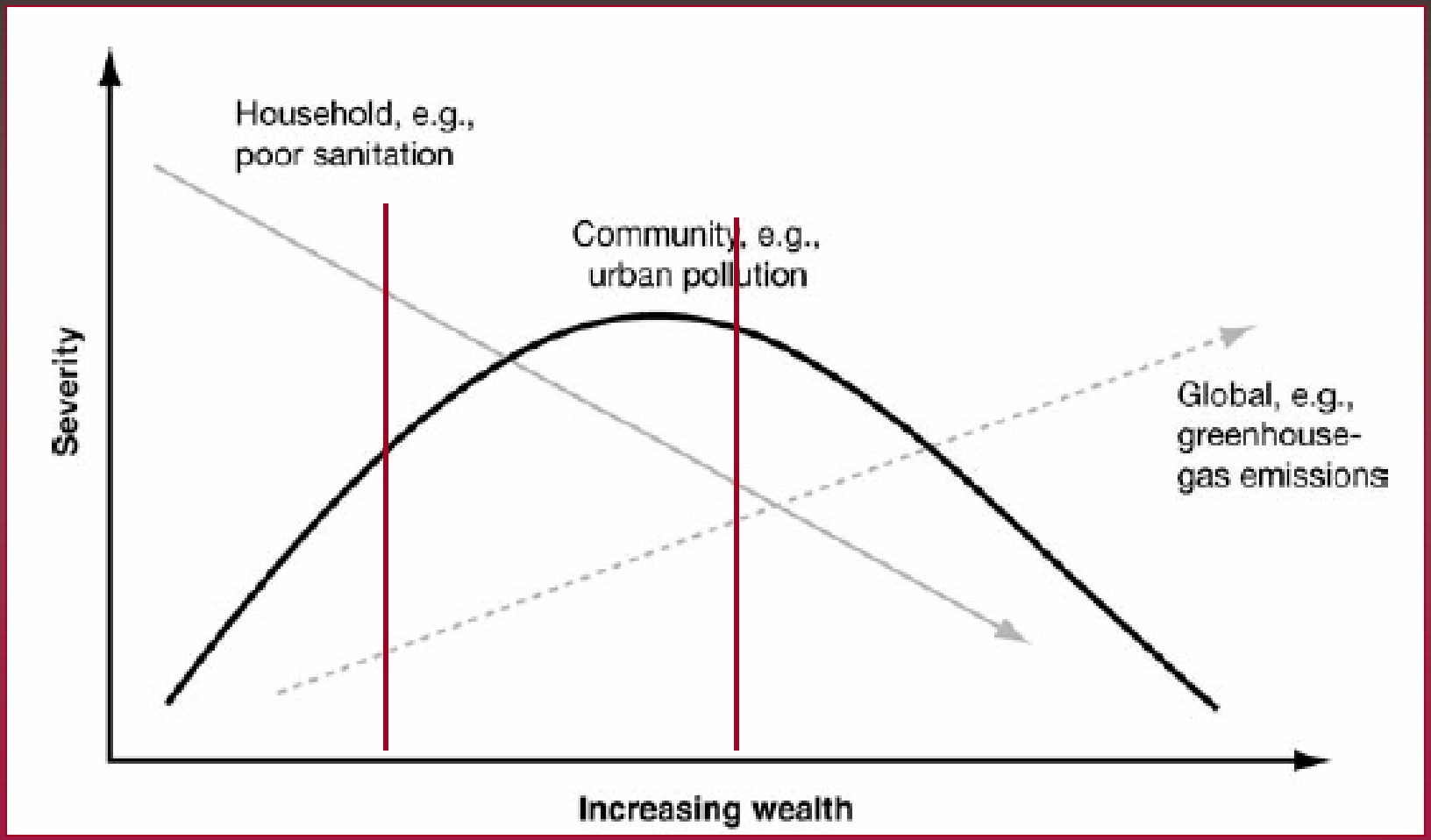
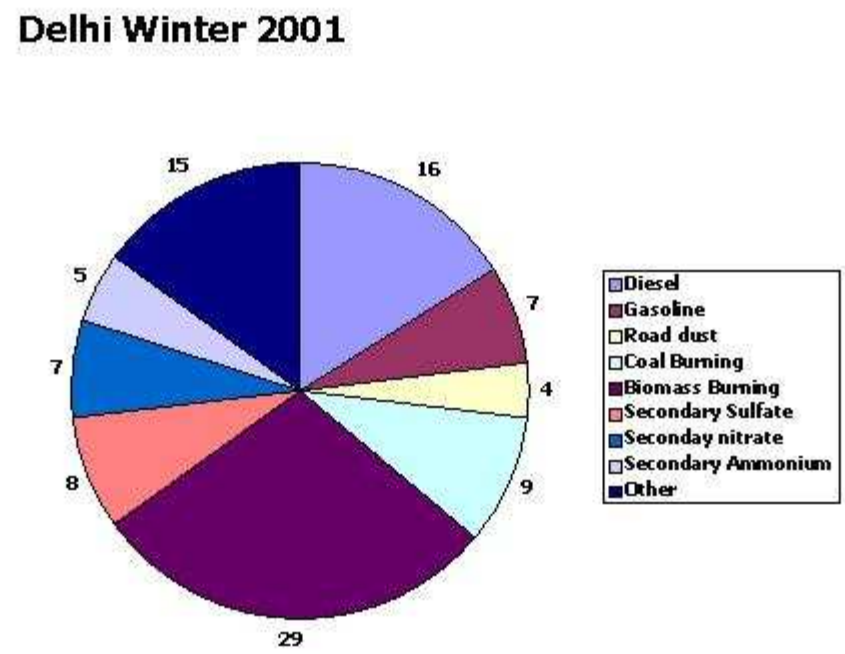
- What factors determine the health impacts of air pollution on a global scale?
- How large is the burden of disease due to air pollution on a global scale?
- What are the key uncertainties?
- Does reducing air pollution improve health?

The Environmental Risk Transition



Smith and Ezzati 2005

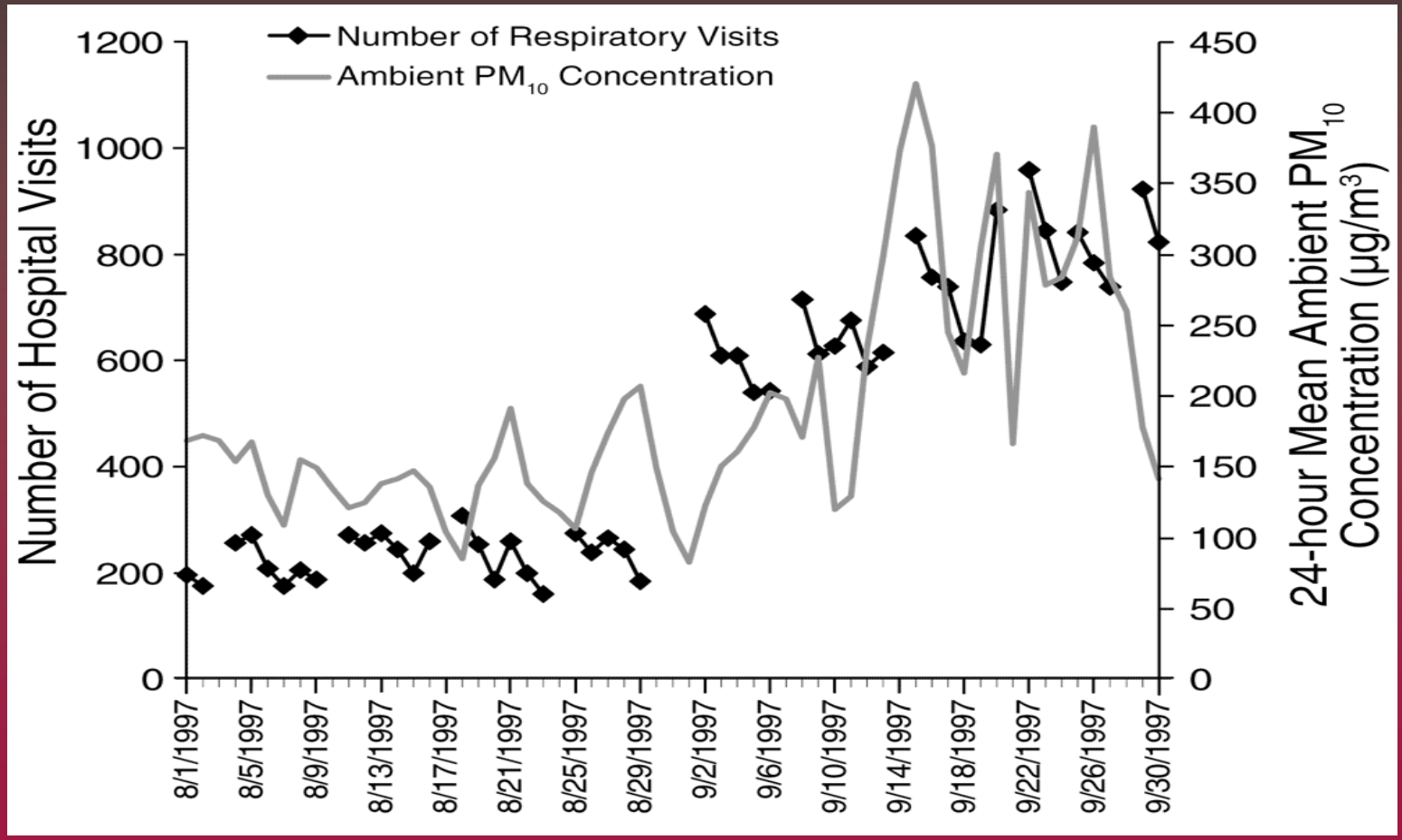
Sources of fine particulate air pollution vary worldwide



Georgia Tech (USA) 2004

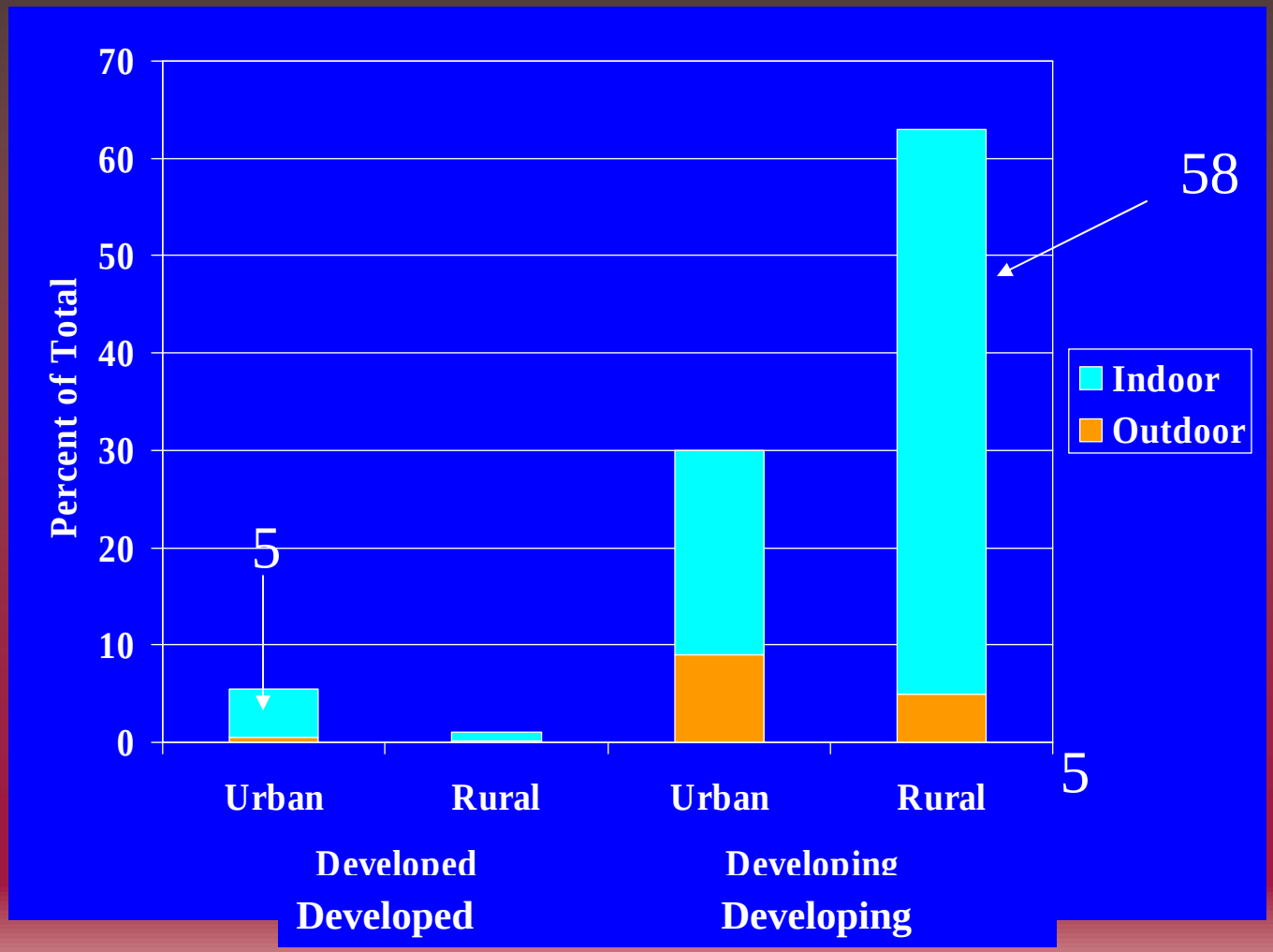
Biomass Burning and Respiratory Health in Kuala Lumpur 1997

(Data from M Brauer 1997)



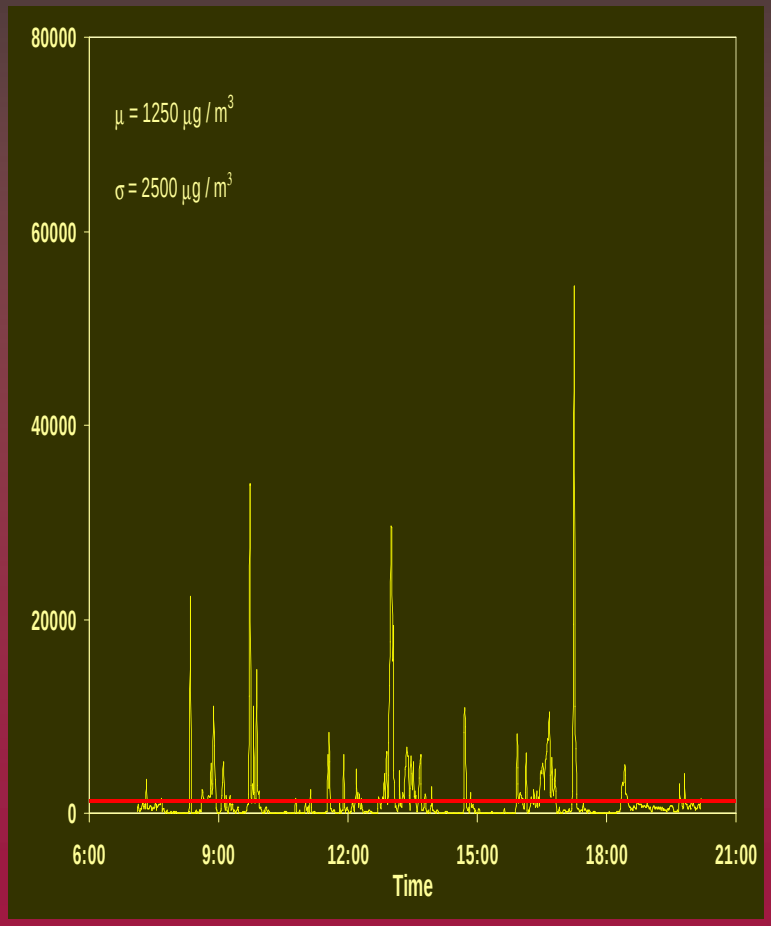
Global exposure to air particulate pollution

Exposure = Population × Time × Pollution



Data from KR Smith personal communication 2002

In developing countries poor women and children are exposed to high levels of pollution from indoor burning of solid fuels



Human exposure to traffic-related air pollution

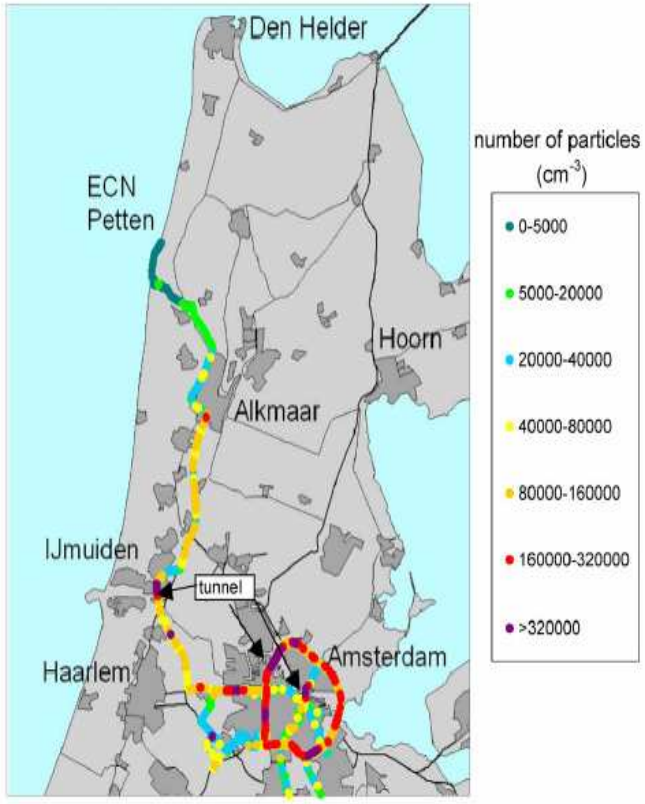
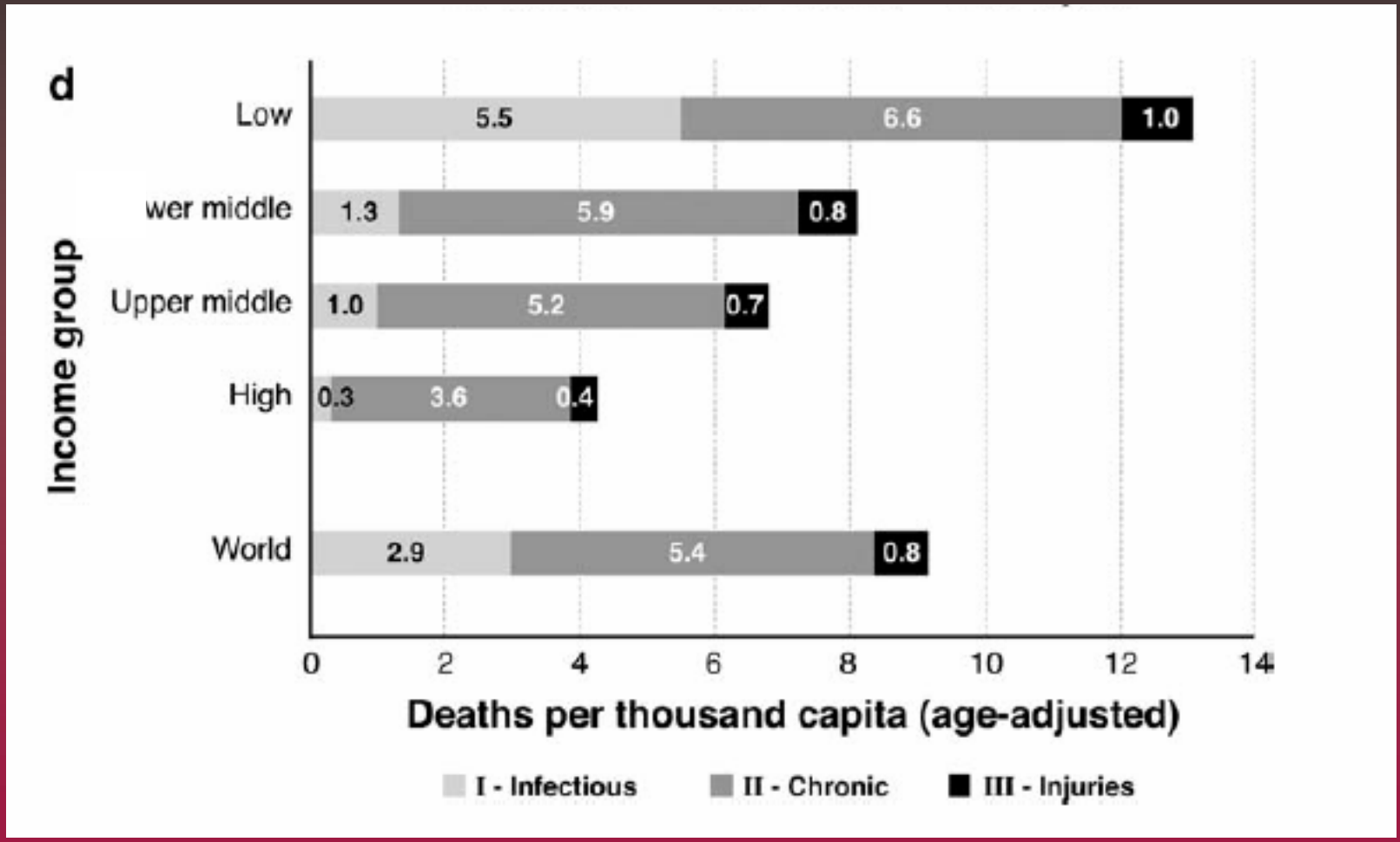


Fig. 2. Particle number concentrations along the way from the urban agglomeration of Amsterdam to the marine area near Petten (averages over 500 m; CPC-measurements).

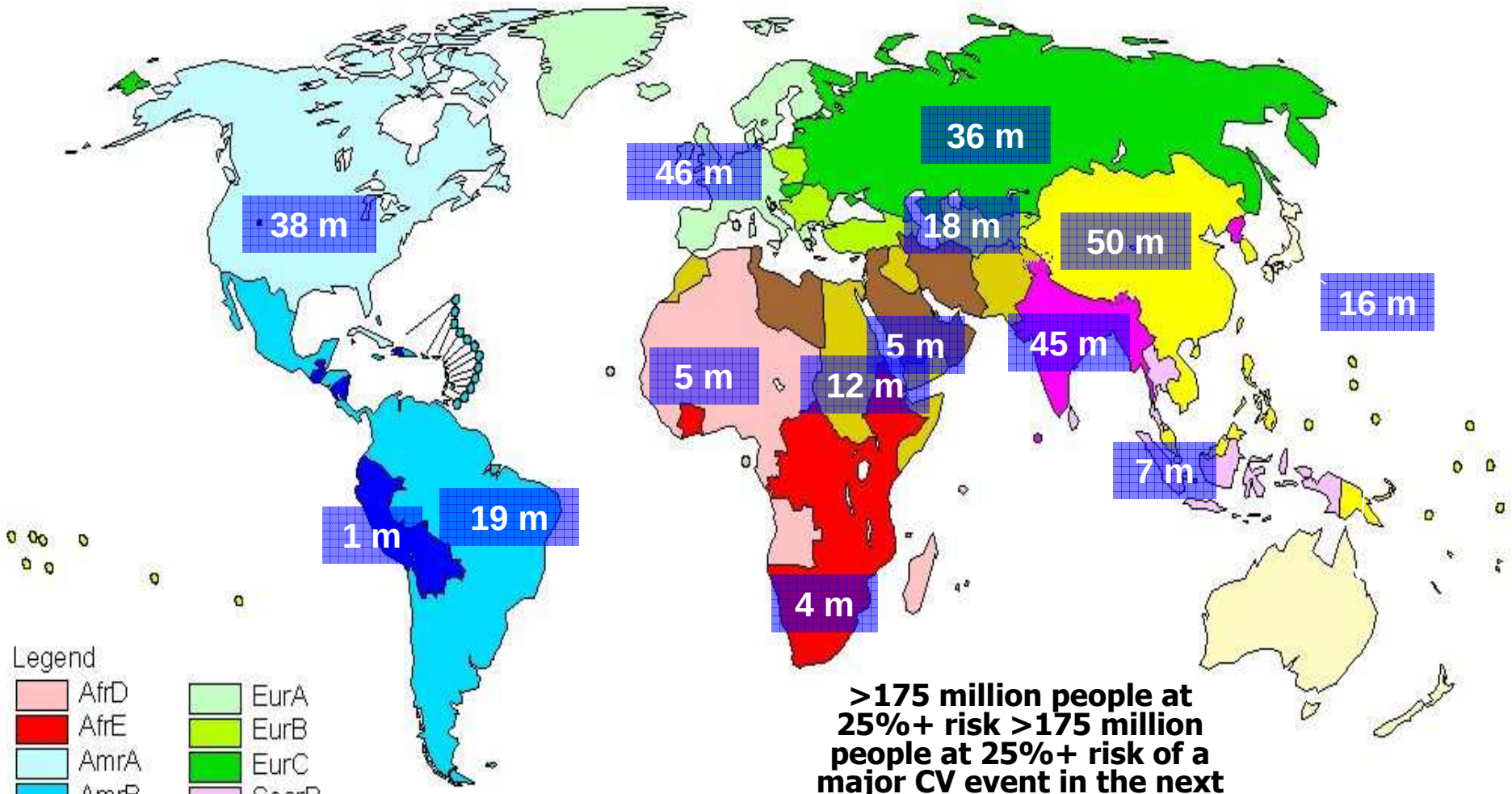
The Epidemiologic Transition



Smith and Ezzati 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 >175 million people at 25%+ risk of a major CV event in the next decade, by WHO subregion of a major CV event in the next decade, by WHO subregion

Air Pollution and SARS Mortality in the PRC

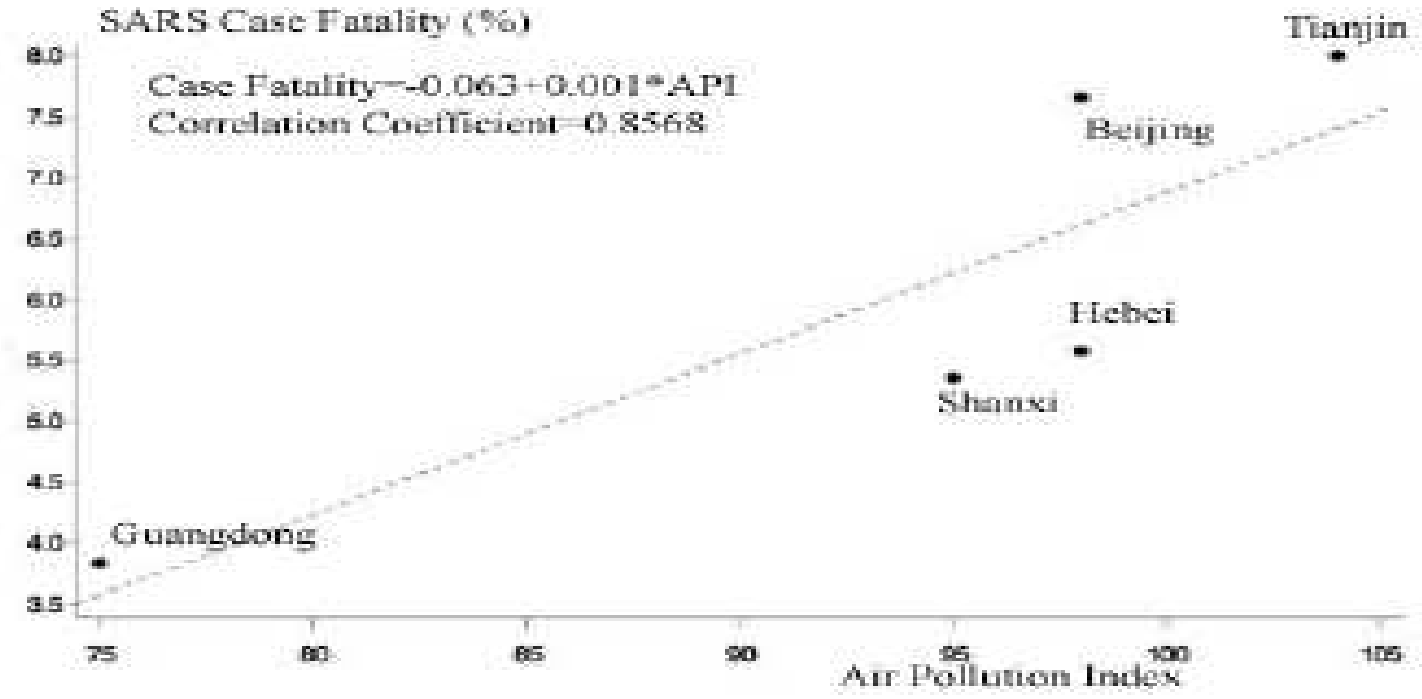
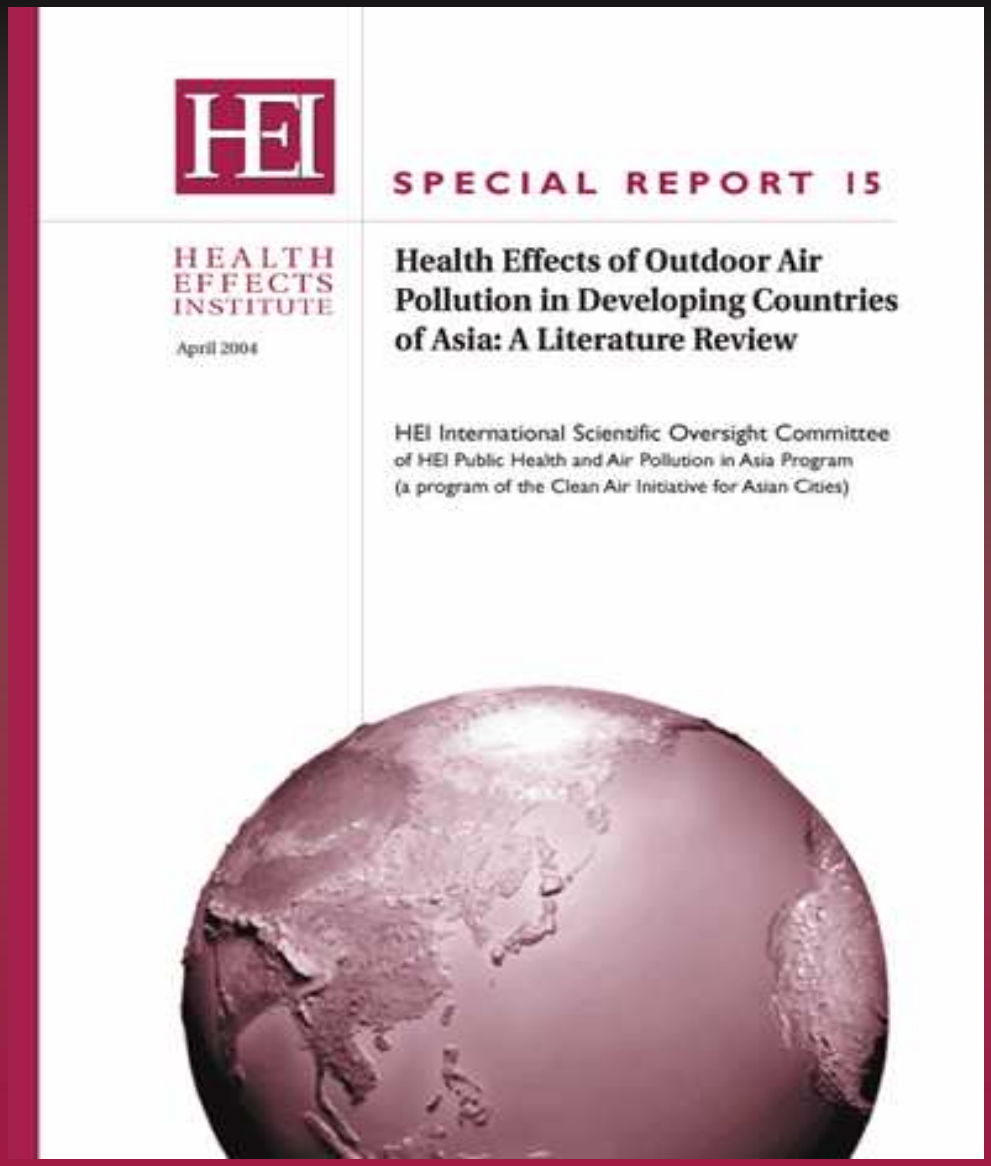


Figure 1
The Correlation and Association between Short-term Exposure to Ambient Air Pollution and Case Fatality of SARS in People's Republic of China.

Yan Cui et al 2003


HEI
SPECIAL REPORT 15
HEALTH EFFECTS INSTITUTE
April 2004
Health Effects of Outdoor Air Pollution in Developing Countries of Asia: A Literature Review
HEI International Scientific Oversight Committee
of HEI Public Health and Air Pollution in Asia Program
(a program of the Clean Air Initiative for Asian Cities)

Two epidemiologic methods to study air pollution and mortality: Time series and cohort studies

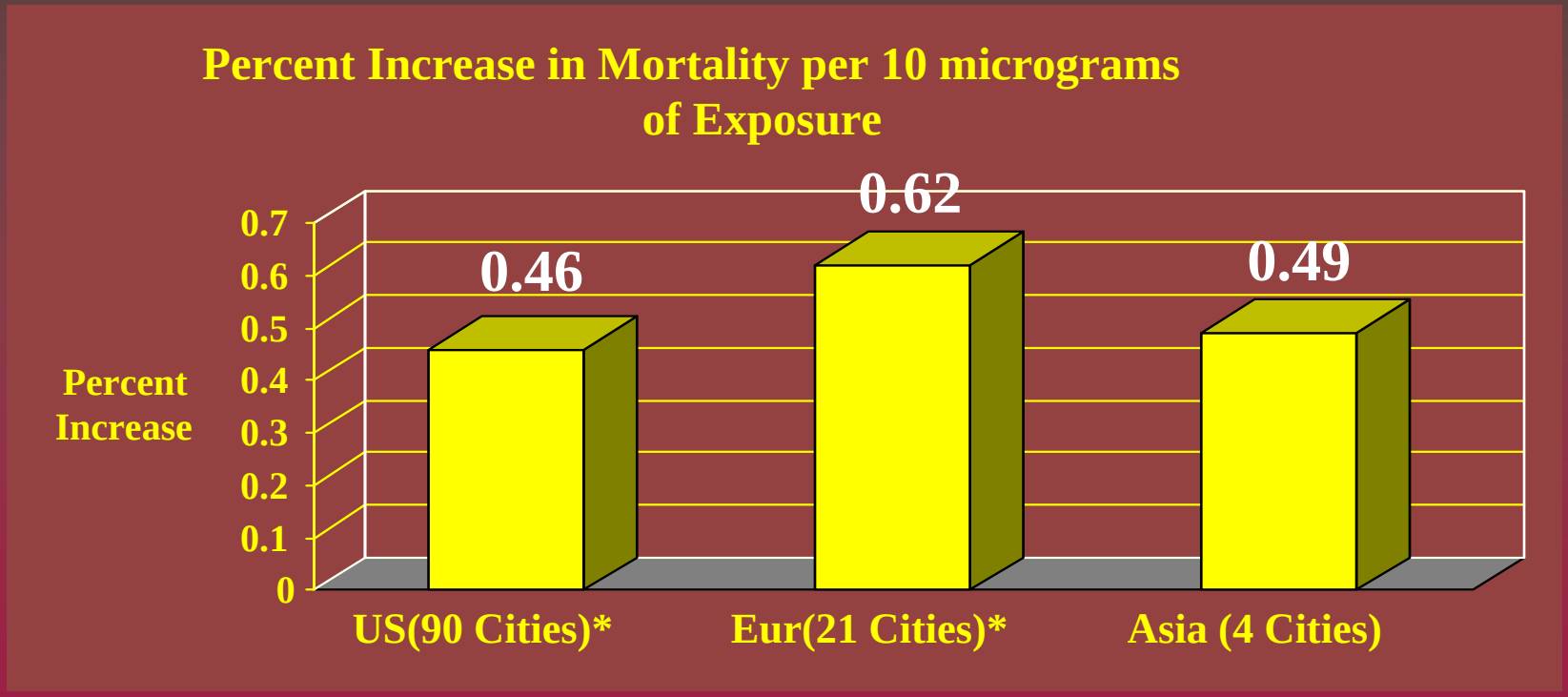
Time Series studies

- Exploit *temporal* differences in exposure
- Estimate the association between *daily mortality rates* and the level of air pollution *shortly* before death

Cohort studies

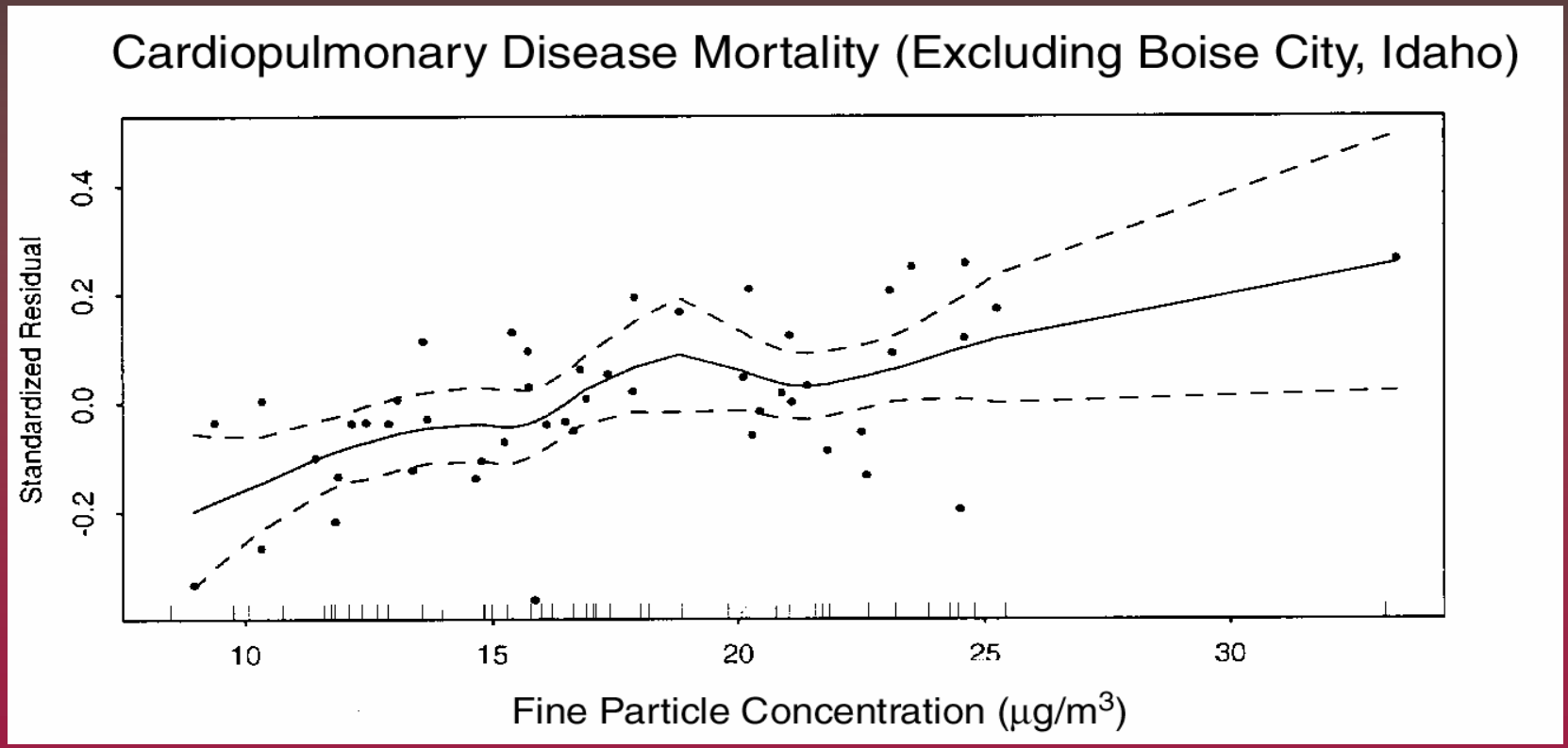
- Exploit *spatial* differences in exposure
- Estimate the association between *long –term average mortality rates* and *long-term* exposure to air pollution
- Estimate the association between *time-to-death* (e.g. YLL) and *long-term* exposure to air pollution

PAPA Meta Analysis Results:
Asian Risk Estimates Similar to West; Initial Support for Extrapolating from Western Studies



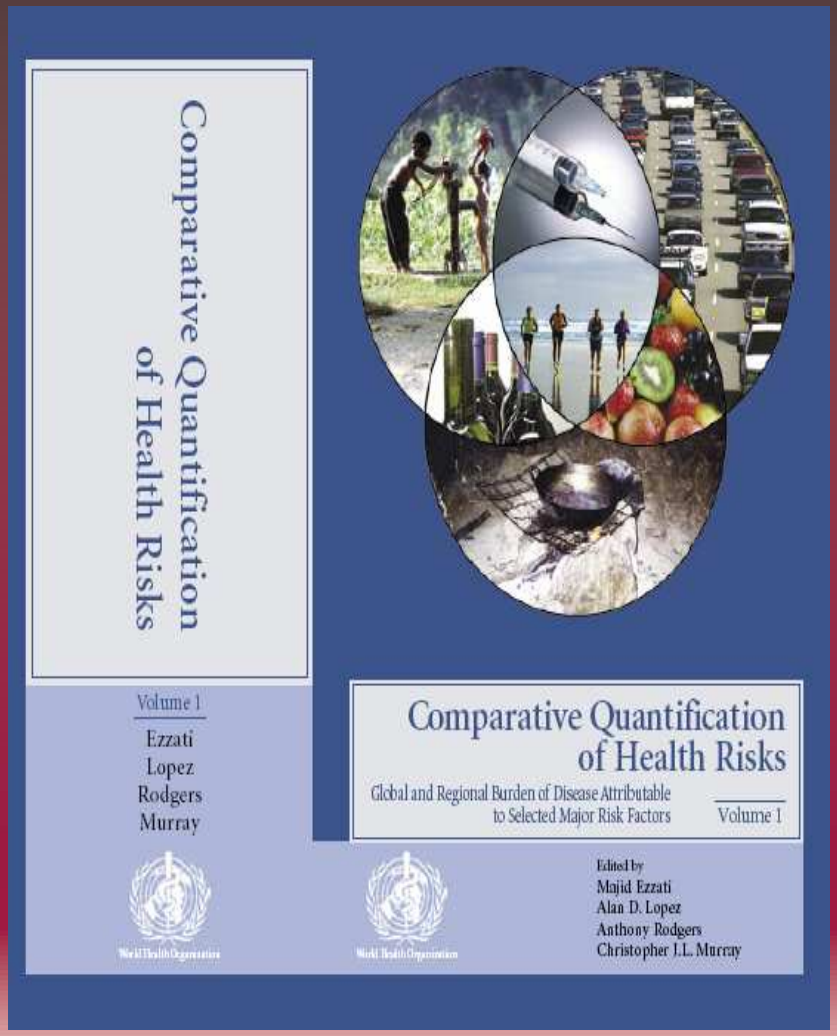
* Estimates Using Pre-GAM Results (without revision)

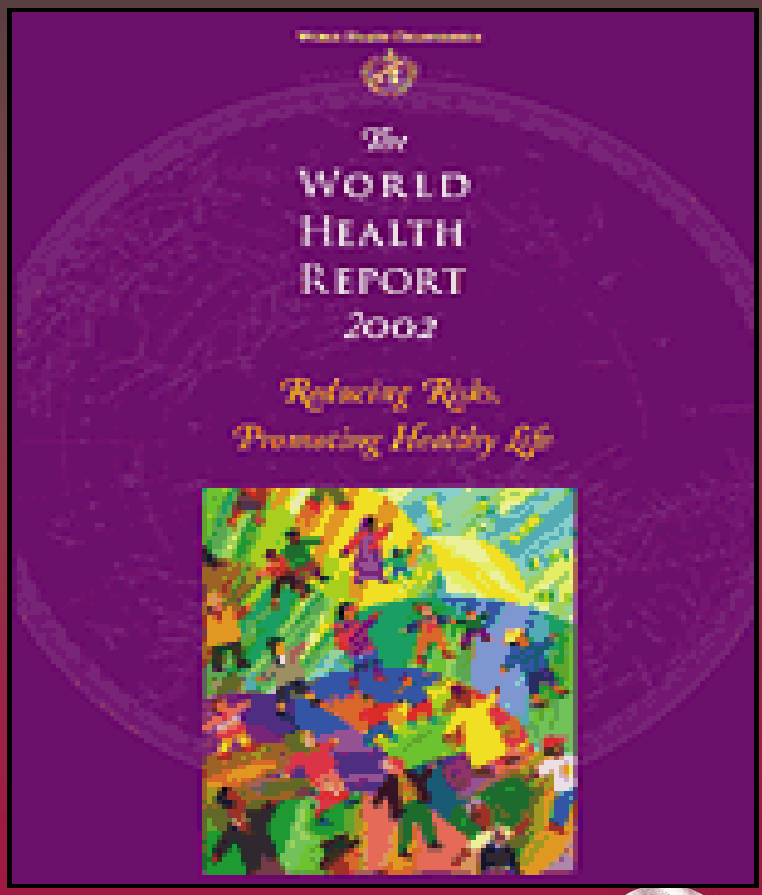
Long-term Exposure to Fine Particulate Air Pollution and Mortality from Chronic Cardiopulmonary Disease



Source: HEI Reanalysis of the American Cancer Society Study (Krewski 2000)

CRA project and WHR 2002



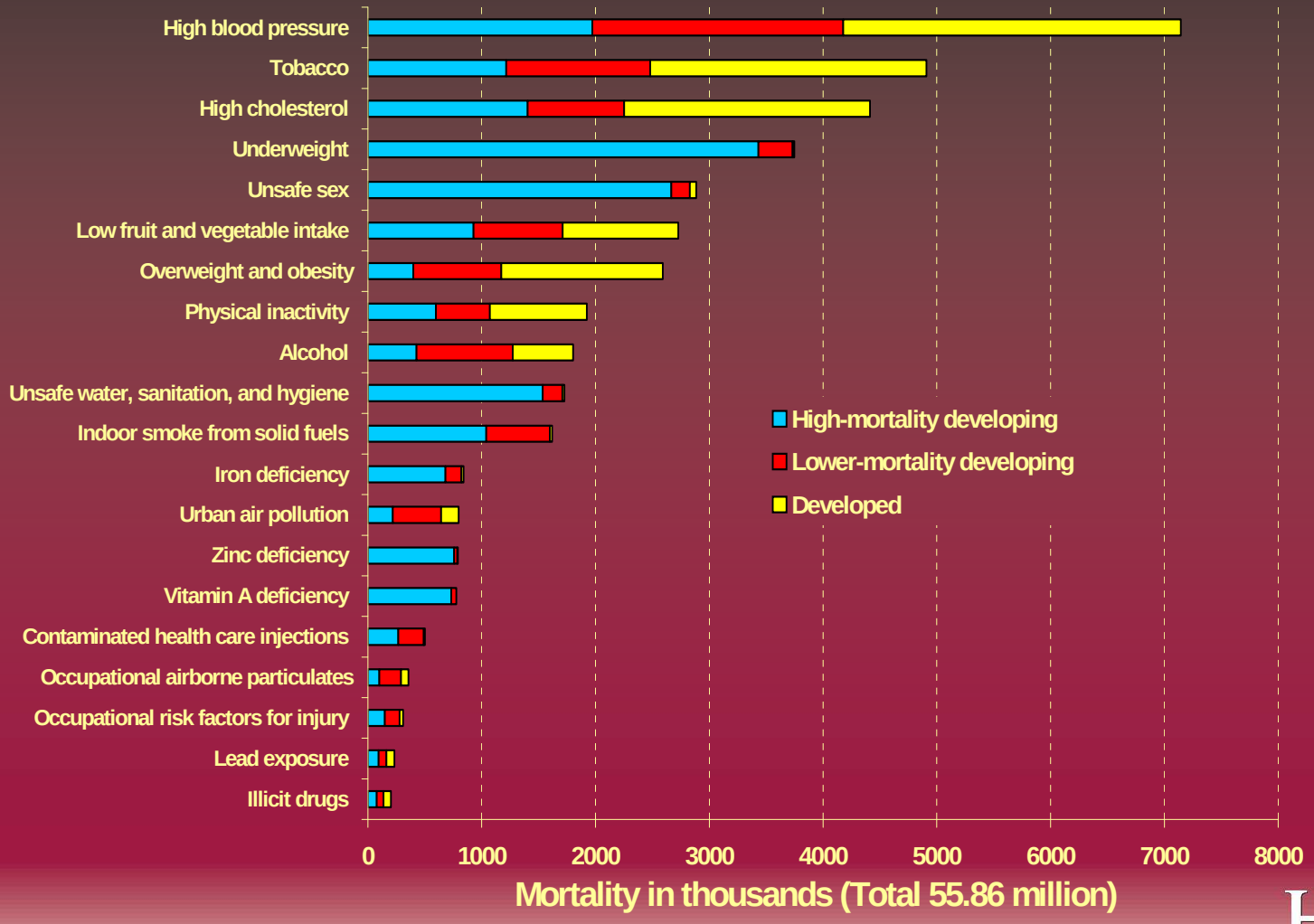


Estimated Impacts of Urban Air Pollution Worldwide
(95% confidence intervals)

	AF (%)	Deaths (x 10^3)	DALYs (x 10^3)
CPD	**3** (1, 6)	**712** (245, 1107)	**6360** (2140, 10129)
Lung Cancer	**5** (1, 9)	**62** (10, 114)	**588** (104, 1089)
ARI (0-5 yr.)	**1** (-1, 3)	**26** (-24, 66)	**913** (-846, 2358)

Cohen et al. 2004

Mortality attributable to leading risk factors

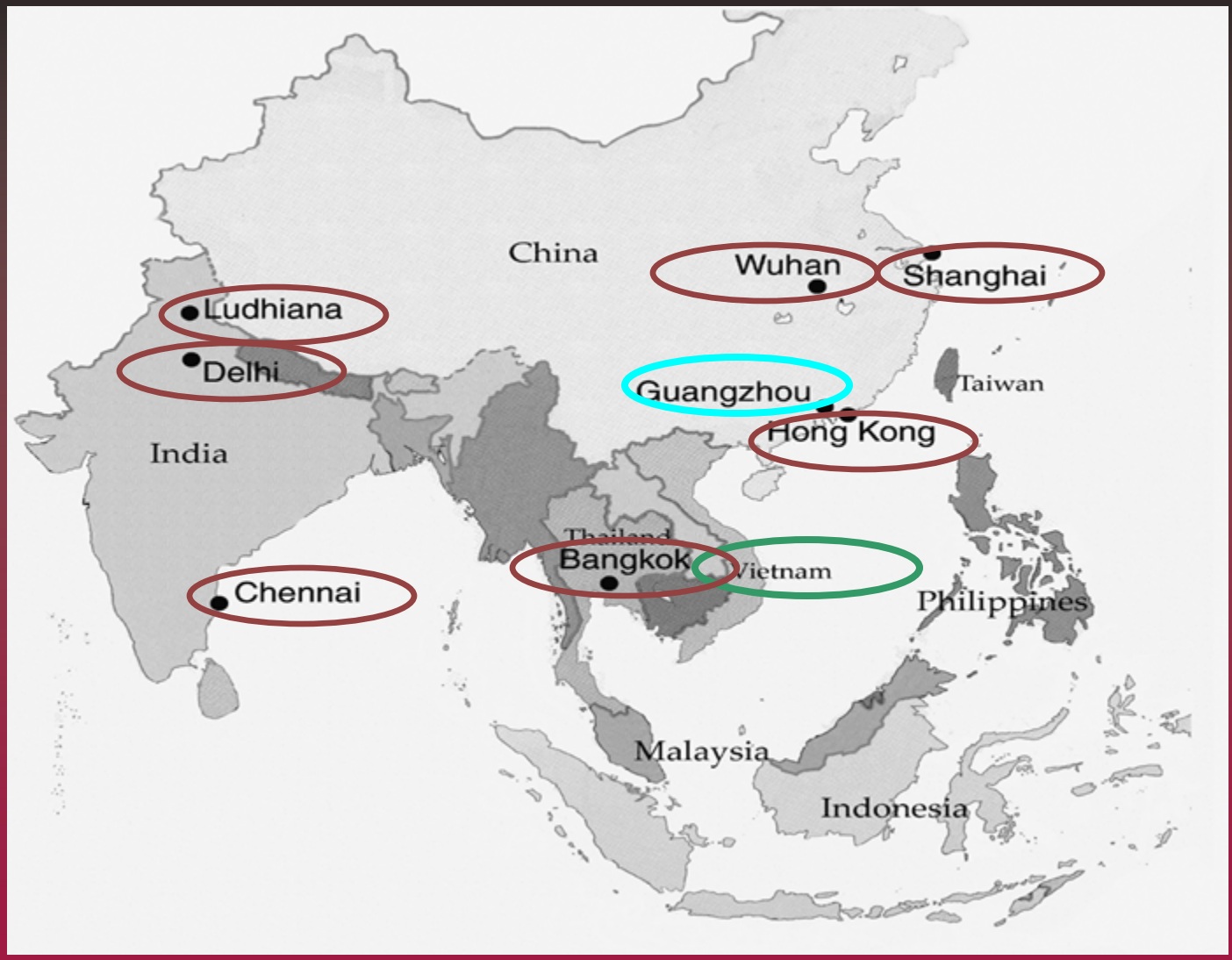


Ezzati et al. 2002; WHO 2002

Excess Deaths from Selected Environmental Factors

Environmental Risks	Global Estimate	Asian Estimate (S ,SE Asia + W Pacific)	Asia as a percent of Global
Unsafe Water	1,730,000	730,000	42%
Urban Outdoor Air	799,000	487,000	65%
Indoor Air	1,619,000	1,025,000	63%
Lead	234,000	88,000	37%

The PAPA Studies



PAPA - Public Health and Air Pollution in Asia

New Research in Asian Cities

- 9 new studies of air pollution and health in Asian Cities
- Acute Effects:
  - Bangkok, Hong Kong, Shanghai, Wuhan, Chennai, Delhi, Ludhiana
- Effects of Long Term Exposure
  - Guangzhou, China pilot study in elderly cohort
- Air Pollution, Poverty, and Health
  - Ho Chi Minh City

The poor may suffer more health effects from air pollution

- **Higher exposures**
  - ✓ Living close to traffic
  - ✓ Roadside occupations
  - ✓ Small and medium scale industries
  - ✓ Use of solid fuels for cooking
- **More susceptible**
  - ✓ Poor nutrition / immunosuppression
  - ✓ Higher incidence of 'diseases of poverty'
  - ✓ Lack of timely access to health care

Studying Air Pollution, Poverty, and Health in HCMC

Overall Objectives:

1. **Develop feasible approaches to studying air pollution, poverty, and health**
   - **Methods appropriate for HCMC context**
   - **Methods suitable for use in other cities - promote building an evidence base across Asian cities**
2. **Develop infrastructure for future studies of the health effects of air pollution in HCMC**
   - **Technical capacity (epidemiologic methods, exposure assessment, analysis)**
   - **Resources (data integration, equipment)**

Ho Chi Minh City Study of Air Pollution, Poverty, and Health

Hospital-based study

- Estimate the effect of short-term exposure to air pollution on hospital admissions for ALRI in young children (<5 years) in HCMC
- Compare the magnitude of the effect of air pollution on poor children vs. other children

Household-based study

- Estimate personal exposures to air pollution among the poor and the non-poor
  - ambient air pollution
  - other sources (cooking with solid fuels, cottage industries)
- Estimate prevalence of respiratory symptoms in HCMC
- Survey of perceptions and economic costs

Does reducing air pollution improve health??

Is it worth the cost??

UK SO_2 Emissions and Electricity Generation 1970-1995

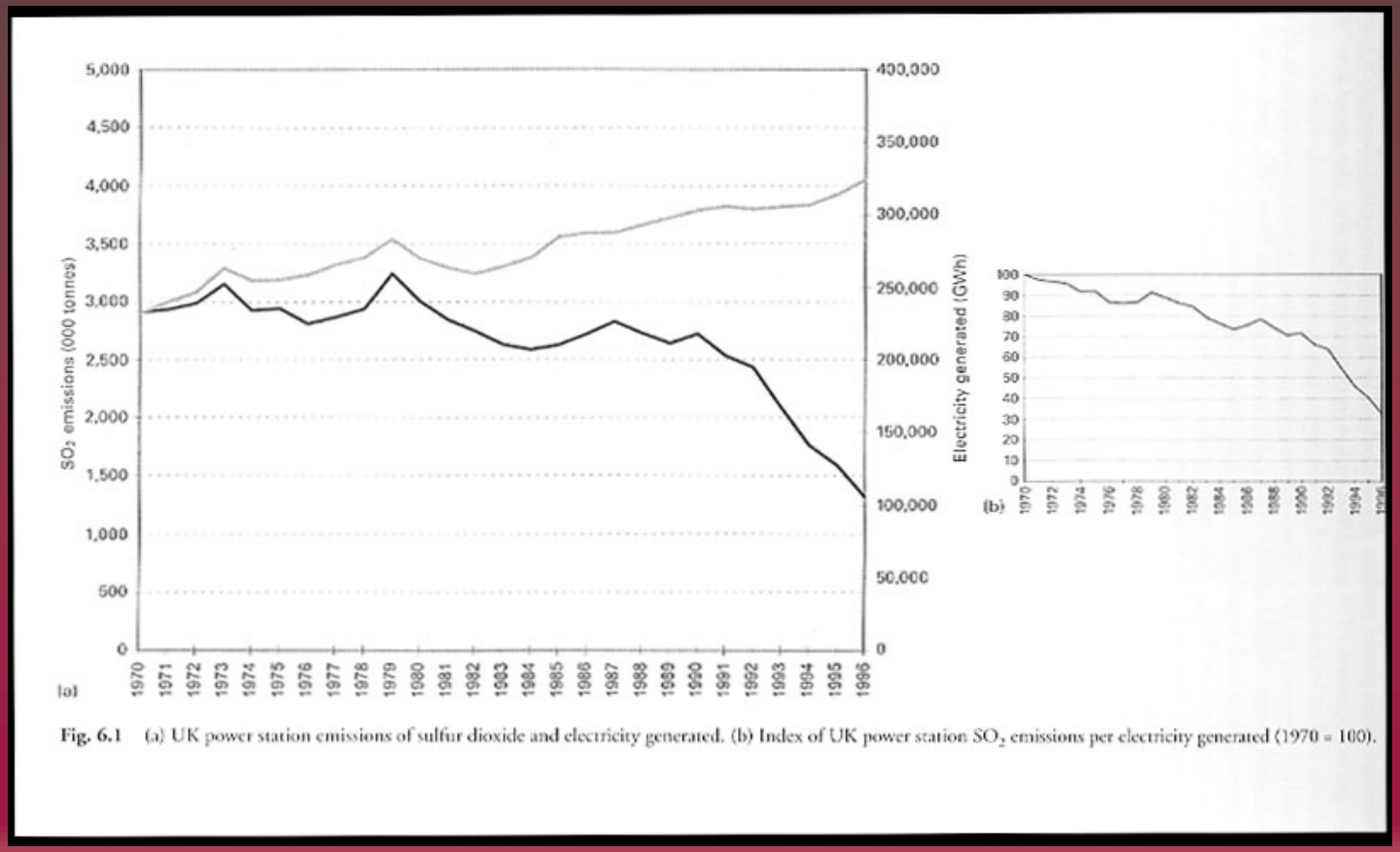


Fig. 6.1 (a) UK power station emissions of sulfur dioxide and electricity generated. (b) Index of UK power station SO_2 emissions per electricity generated (1970 = 100).

Figure from Williams ML 1999

The Hong Kong Air Quality Intervention 1990

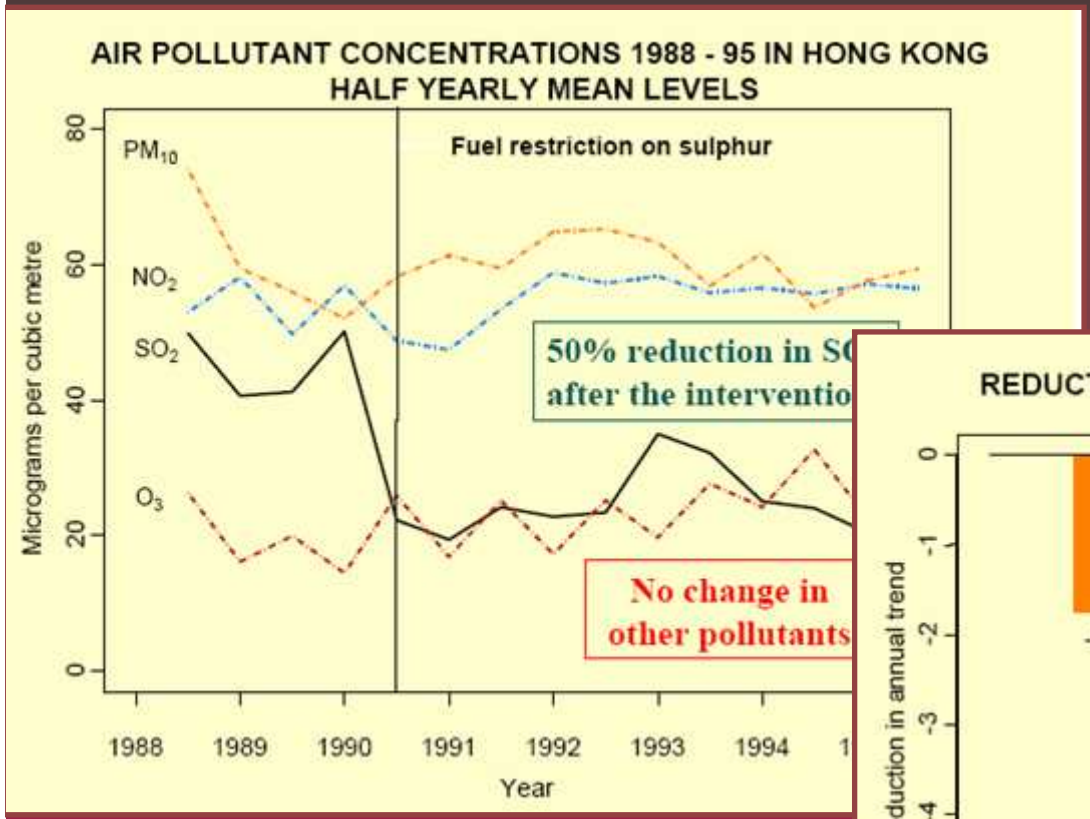
Before

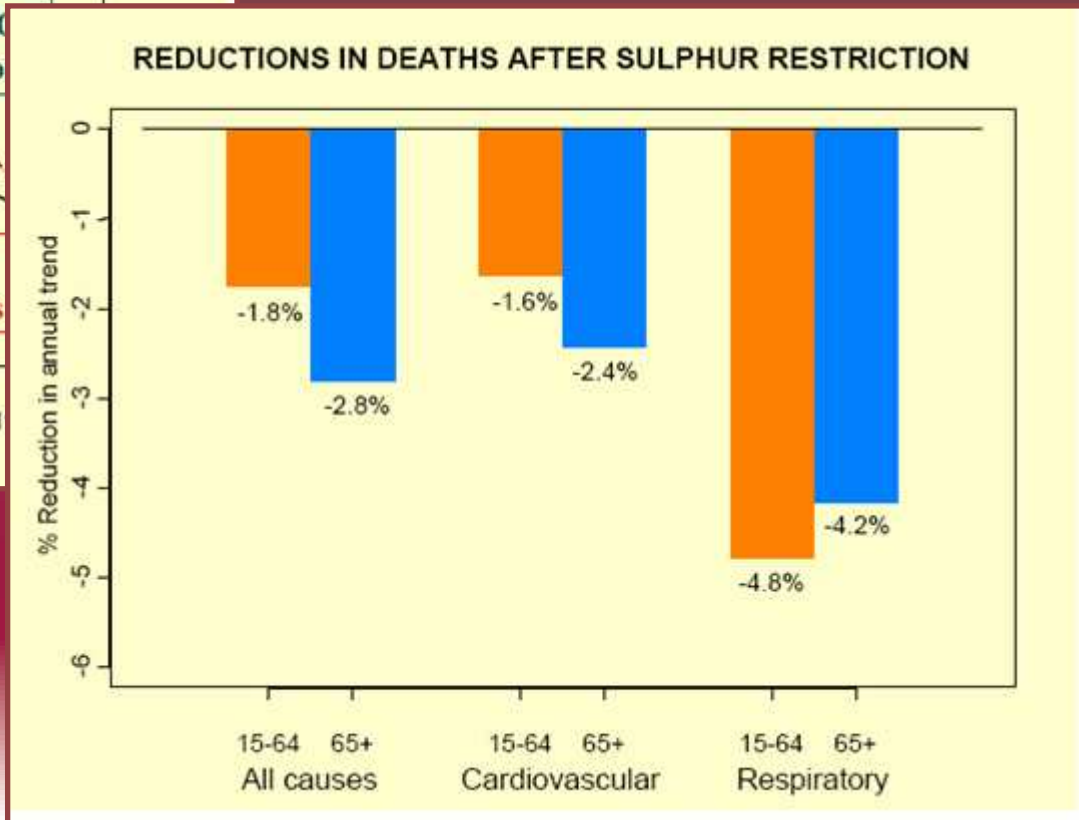
After

July 1st 1990: Environmental Protection Department restricted sulphur content of fuel to 0.5% by weight

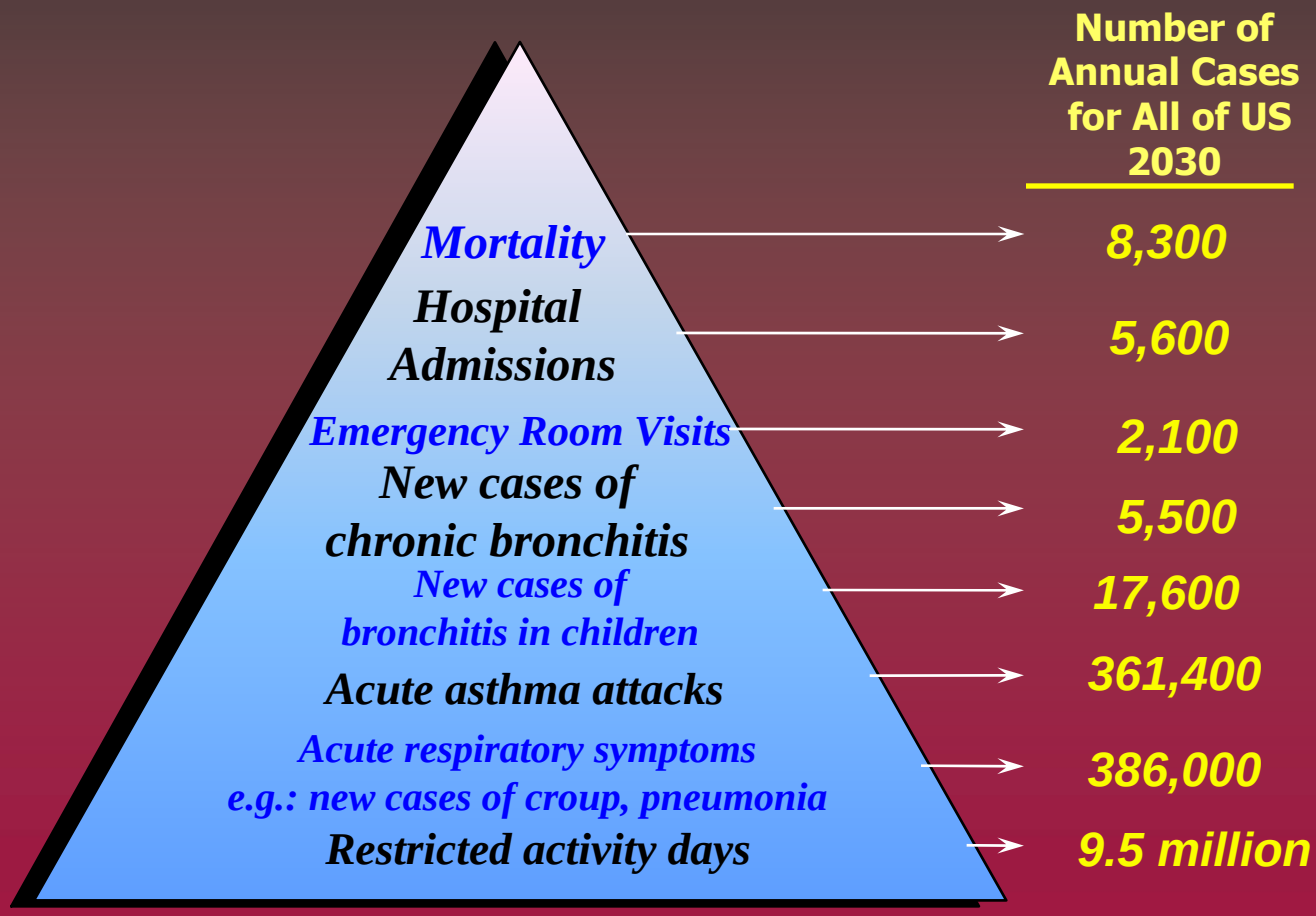
Courtesy AJ Hedley

Assessing Benefits of Fuel Sulfur Reduction in Asia: Hong Kong





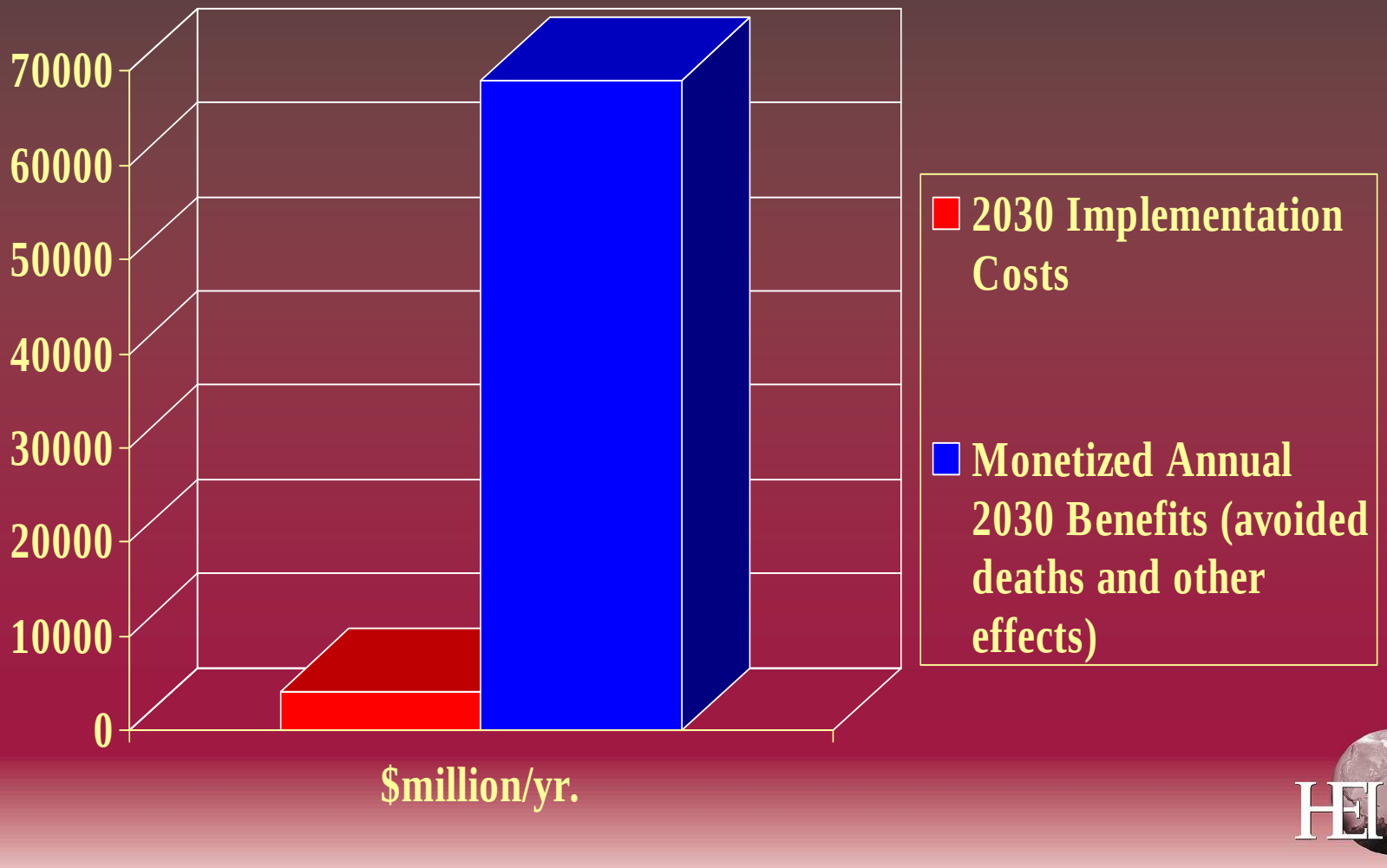
Estimates of Benefits US Highway Diesel Rule



US EPA RIA, 2000

Comparing Costs and Benefits US Highway Diesel Rule

(Source: US EPA RIA 2000)



Thank You

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