Estimating the Economic Value of Health Impacts of Climate Change

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January 27th, 2011

The Task

- Given estimates of health impacts of climate change by region and time period, monetize value of health damages
- Should value damages after adaptation, plus costs of adaptation; presentation will focus on valuing health impacts per se
- Value changes in mortality risks
  - For children and adults
  - As a function of per capita income
- Value changes in morbidity

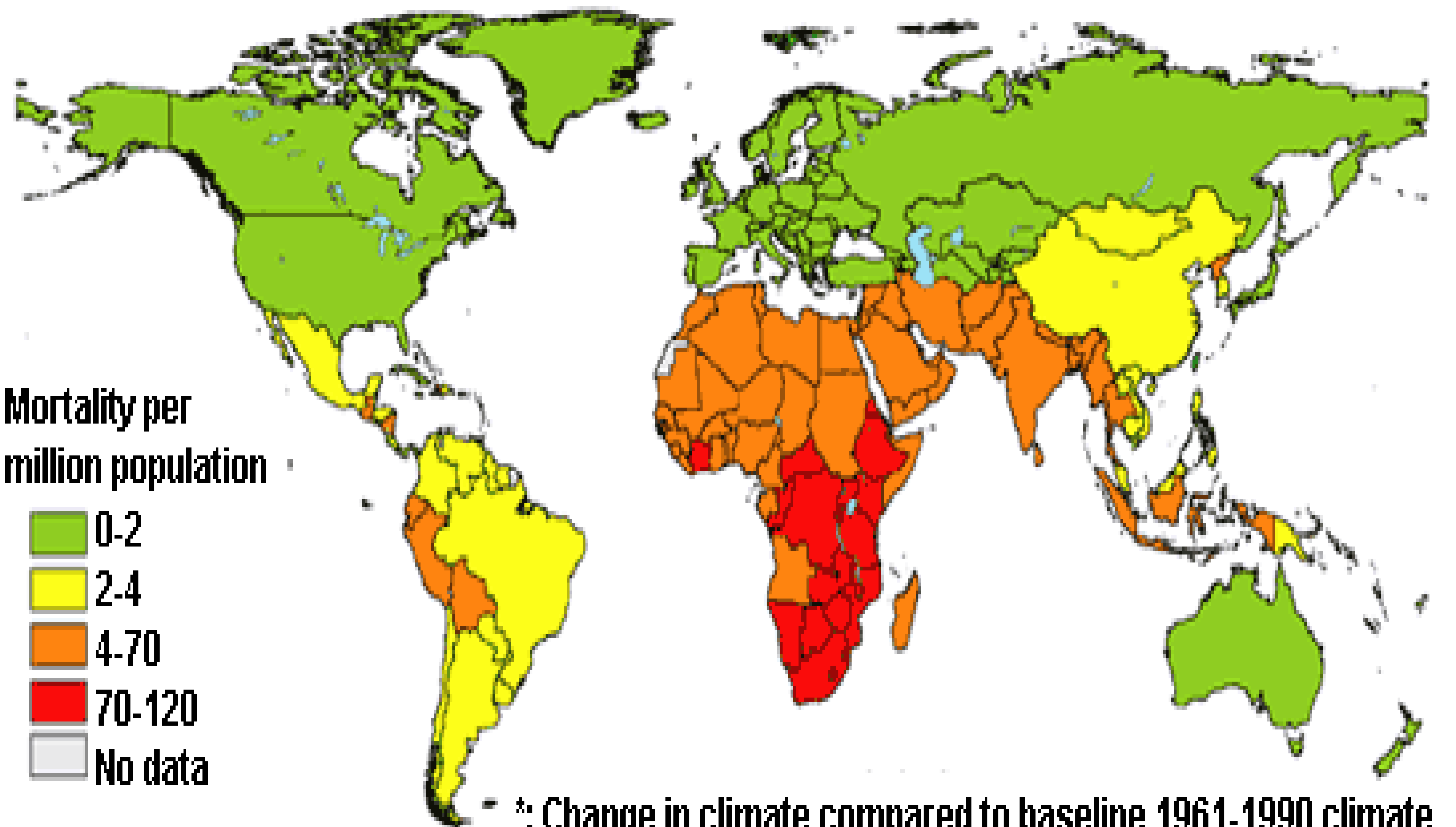
Presentation

- Main health impacts to be valued and countries in which they are likely to occur
- Valuation concepts
- Estimating the value of mortality risk reductions for adults in low income countries
- Estimating the value of mortality risk reductions for children in low income countries
- Valuing morbidity

Which Health Effects to Value?

- Possible health endpoints include:
  - Malnutrition
  - Diarrheal disease
  - Vector-borne diseases (malaria, dengue fever)
  - Deaths associated with temperature extremes, air pollution
  - Deaths associated with climate-related disasters
- According to McMichael et al. (2004) most DALYs lost due to:
  - Malnutrition
  - Diarrhea
  - Vector-borne disease

Estimated Deaths due to Climate Change* in 2000, by WHO subregion



Source: Map created by SAGE using data from McMichael et al. (2004

Overview of Approaches to Valuing Death and Injury

- Human Capital - Cost of Illness (COI)
  - Values a life by the PDV of forgone earnings
  - Values an injury by medical costs and lost productivity
- Value of Statistical Life - Willingness to Pay
  - Values a life by sum of what people will pay for reductions in risk of death
  - For injuries, adds WTP for pain and discomfort to COI
- VSL – WTP approach is theoretically correct

Valuing Reductions in Risk of Death

- Goal is to estimate what an individual is willing and *able* to pay for a ***small reduction*** in his risk of death
  - It does NOT measure the amount an individual would pay to avoid death with certainty
- Suppose a person is willing to pay $500 to reduce his risk of dying by 1 in 10,000 over the coming year:
  - If 10,000 people will each pay $500 for a 1 in 10,000 risk reduction, together they will pay $5,000,000 for risk reductions that sum to 1 statistical life saved
  - We say that $5,000,000 is the ***Value of a Statistical Life***.

Approaches to Valuing Mortality Risk Reductions

- Revealed Preference Studies
  - Use compensating wage (CW) differentials to value risk of death (most common approach)
  - Use data on purchase of safer vehicles or safety equipment (e.g., bicycle helmets)

- Stated Preference Studies
  - Ask people directly what they would pay for a change in risk of death (e.g., Contingent valuation (CV) studies)

Overview of VSL Estimates in the Literature

High-income OECD countries

- Approximately 4 dozen CW studies (30 in USA)
- Over 4 dozen CV studies
- 6 published meta-analyses of these studies since 2000

Middle-income countries

- Fewer than a dozen CW studies
- About two dozen stated preference studies

Low-income countries

- 1 study for Bangladesh; none for Africa

How Is VSL Transferred from One Country to Another?

- Most common approach is:

$$VSL_{India} = VSL_{USA} * (Y_{India} / Y_{USA})^{\varepsilon}$$

where ε is the income elasticity of the VSL. Usual assumption is that $\varepsilon = 1$.

- This implies:

$$VSL_{USA} / Y_{USA} = VSL_{India} / Y_{India}$$

Is the Conventional Approach Correct?

- In High Income Countries VSL/Y ratio ≈ 140
  - Ratio of VSL/Y is about 140 in Miller (2000) based on studies in 13 high income countries
- In Middle Income Countries VSL/Y ratio ≈ 80
  - Review of 17 VSL studies in middle income developing countries by Robinson and Hammitt (2009) implies a ratio of 80 (using better studies)
- This suggests that $\varepsilon > 1$.
- US labor market studies suggest that ε increases as incomes fall

How to Estimate the VSL for Developing Countries?

- Hammitt and Robinson (2010) suggest using an income elasticity of 1.5
  - Supported by studies by Costa and Kahn (2004) and Hammit, Liu and Liu (2000)
- Cropper and Sahin (2009) also suggest $\varepsilon = 1.5$ based on a life-cycle consumption model
- Using a US VSL of $6.3 million (2007 USD) and Y_{US} = $46,000 implies:
  - $VSL_{India} = (Y_{India})^{1.5} * (.64)$

How to Estimate the VSL for Children?

- Studies of parents' willingness to pay to reduce risks to children used to estimate the VSL
- Studies in high income countries suggest child VSL ≈ 2 x adult VSL
- However . . . .
  - Parents' WTP may be different in countries where 1 out of 5 children die before age 5
  - USEPA uses same value for adults and children
  - Many World Bank studies have used Human Capital approach for children

Valuing Morbidity

Want to capture:

- Value of lost productivity
- Cost of medical treatment
- Value of discomfort, inconvenience and pain

Cost of Illness (COI) = Value of lost work time + Cost of medical treatment

Could add value of Quality-Adjusted Life Years (QALYs) lost to COI to capture pain and suffering since few direct WTP estimate available

Valuing Morbidity

- In US studies of health effects of air pollution, value of avoided morbidity is small relative to premature mortality
  - Case of chronic bronchitis ≈ .05 VSL
- Back-of-the-envelope calculations should be done before refining estimates
- Other impacts that may be relevant are:
  - Macroeconomic impacts of malaria (Gallup and Sachs, 2001; Tol, 2008)
  - Impacts of malnutrition on human capital formation (Alderman, Hoddinott and Kinsey, 2003)

Conclusions

- Greatest disease burden from climate change likely to be in Sub-Saharan Africa, South Asia and the Middle East
- Much of the disease burden will fall on children
- Value associated with health impacts depends crucially on:
  - How value of morality risks varies with income
  - How risks to children are valued v. risks to adults
- Most of the disease burden likely to come from mortality
  - But, link between diseases and economic growth could be important