The health impacts of climate change: a study of cholera in Tanzania

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Background and Rationale

- **Cholera is primarily waterborne and epidemics may be boosted by extreme climate conditions. Both droughts and floods increase the risk of spread of cholera**

- **Little information from the literature on the costs of health adaptation**

Overview of study

1. **Quantification of impacts**

2. **Estimation of costs associated with residual cholera impacts attributed to climate change by year 2030**

Data

- Cholera incidences, MoH in Dar es Salaam
  - monthly and annual,1977 – 2004
- Climate variables
  - rainfall and temperatures, 19 weather stations, Tanzania Met Agency, 1977 - 2004
  - IPCC projections for future scenarios
- Socio-economic data
  - population growth, GDP, water and sanitation, literacy rate and cassava prod. per capita

1. Quantification of impacts: Econometric analysis - results

- **Association of temperatures and cholera cases remains significant also when controlling for socioeconomic factors.**
- **1 degree Celsius increase in temperature increases the risk ratio for cholera cases by 23 – 51 %** (initial risk ratio is 0.0019)
- **Risk ratio showed to increase with rising temperatures, while the case fatality rate is more related to socioeconomic health conditions than to climate variables.**
- **Case fatality rate 0.08**

1. Quantification of health impacts-scenarios

Scenarios for year 2030:

Scenario C0 : baseline, WHO Global Burden of Disease study (2008)

Scenario C1 : scenario with cc, 1 and 2 degree increase in temperatures

$N_{2030CC} = Scenario_{C1} - Scenario_{C0}$,

where N_{2030CC} is the additional number of incidences by year 2030

Projected and estimated burden of cholera

	Scenario $_{C0}$ 2030	Scenario $_{C1}$ (1ºC 2030)		Scenario $_{C1}$ (2ºC 2030)	
		Lower	**Upper**	**Lower**	**Upper**
cholera cases	145,174	178,564	219,213	219,634	331,011
additional cases		**33,390**	**74,039**	**74,460**	**185,837**
cholera deaths	11,759	14,464	17,756	17,790	26,812
additional deaths		**2,705**	**5,997**	**6,031**	**15,053**
DALYs	554,691	682,275	837,590	839,199	1,264,761
additional DALYs		**127,584**	**282,899**	**284,507**	**710,070**

2. Estimation of costs

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Cost of adaptation

- **Preventive measures: hygiene, water and sanitation programmes**
- **Reactive measures: treatment**
  - **total cost per case 98$**

    (medical treatment, cost of bed, personnel, outpatient surveillance)

Cost of lost short term productivity

- **wages and days out of work**

Cost of mortality

- **Value of statistical life (VOSL) based on the adjusted ratio of real per capita GDP**

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Total cost of cholera attributed to cc by 2030, US$(2006)

Scenario	Total cost of reactive measures	Total cost of prod. loss	Total costs of residual deaths	Total cost of cholera attributed to cc	Total cost of cholera attributed to cc/GDP, %
Scenario $_{C1}$ (1°C 2030)					
Lower	**3,272,221**	**325,264**	**279,503,272**	**283,100,757**	**1.40**
Upper	**7,255,795**	**721,241**	**619,768,124**	**627,745,160**	**3.10**
Scenario $_{C1}$ (2°C 2030)					
Lower	**7,297,054**	**725,342**	**623,292,296**	**631,314,692**	**3.12**
Upper	**18,212,046**	**1,810,307**	**1,555,617,991**	**1,575,640,344**	**7.78**

Costs of preventive adaptation measures in terms of DALYs averted (US$ 2006)

Scenario	Additional number of DALYs	Cost per DALY averted*	Total cost range to avoided DALY
Scenario $_{C1}$ (1°C 2030)			
Lower	**127,584**	**59 – 137**	**7,544,042 – 17,507,706**
Upper	**282,899**	**59 - 137**	**16,727,818 – 38,819,401**
Scenario $_{C1}$ (2°C 2030)			
Lower	**284,507**	**59 - 137**	**16,822,899 – 39,040,051**
Upper	**710,070**	**59 - 137**	**41,986,439 – 97,435,805**

* 59 US$ is for household chlorination, 137 US$ water source such as dug wells, boreholes and stand posts.

Implications of the study results

- **Climate change will cause large additional economic burdens related to health to societies and to households.**
- **The magnitude of the cost estimates of additional cases of illness are substantial, and considerably higher than the current budgets allocated for diarrheal diseases in most developing countries.**
- **Vital to quantify the burden of disease attributable to climate change at national and local levels.**
- **More and improved projections of future risks are necessary for local (national) decision making in addition to further efforts to refine national costs of preventive and reactive adaptation measures in the health sector.**

General conclusion

It would turn out very beneficial to improve socioeconomic indicators, including access to water and sanitation, even more quickly than originally planned.

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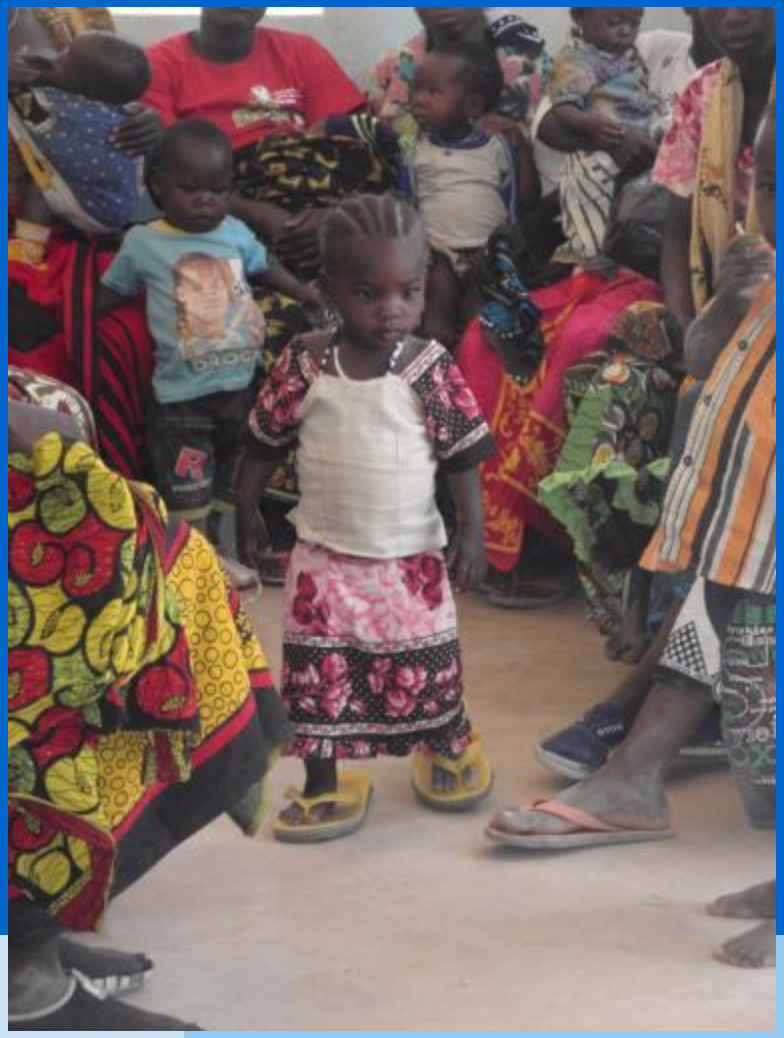
Thank you..



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