Climate Change and Health

"An analysis of the impact of climate variables on selected diseases in Trinidad and Tobago, with economic implications"

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Outline

- **Literature review**
  - **Can changes in climate affect health?**

- **A framework for understanding the impact of climate change on the economy, in particular, on health outcomes**
  - **Exploring the factors affecting one country's vulnerability as well as its resilience in respect of the health impacts of climate change**

- **The study itself focuses on the vulnerability aspect of the framework**
  - **The impact of climate and non-climate variables on selected infectious diseases (dengue, leptospirosis, food-borne illnesses and gastroenteritis) in Trinidad and Tobago was examined using econometric analysis**

- **Economic Assessment and Policy recommendations**
  - **Directly linked to the results from the study**

…a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer) – IPCC

Health impacts of CC

Health impacts	Climate change influence – extreme events, sea level rise
Direct: •Loss of life •Injury •Temperature related illness *(respiratory illnesses for e.g. asthma)*	tropical cyclone activity, extended periods of drought, extensive and catastrophic flooding, heatwaves, cold spells
Indirect: •Disease Incidence: *Infectious Diseases: Water, Food, Vector and Rodent Borne*	excessive rainfall and flooding, temperature increases
•Malnutrition	destruction of agriculture, lack of adequate drinking water, loss of livelihoods from disruption of economic activity along coastal areas

IPCC (1995), McMichael et al. (2003), Taylor, Chen and Bailey (2009)

Climate and disease incidence

- In the C'bean, the outbreaks of Dengue have a well defined seasonality, occurring in the latter half of the year – warm and wet. *(Amarakoon et al. 2007)*

- The preliminary results of the incidences of the three most common diseases in Grenada - Influenza, viral conjunctivitis and gastroenteritis - show a close correlation with July and annual precipitation. Significant positive correlations are observed for August precipitation and the incidence of viral conjunctivitis and influenza. *(UNFCCC 2005)*

- An analysis of disease data in Barbados and St. Lucia revealed that most of the diseases *(Dengue, Asthma, Bronchitis, Respiratory Tract Infections, Diarrheal illnesses)* show seasonality patterns. Correlations with disease data show significant associations with temperature and rainfall and outbreaks of dengue and diarrheal illness. *(Amarakoon, Stennett and Chen 2004)*

The Model

- Model seeks to capture country's **vulnerability** as well as its **resilience** in confronting the health impacts of climate change

- It allows for a better understanding of the ability of the health system to respond to an increasing risk of infectious diseases induced by climate change

Risk of a country's status being adversely affected by climate change

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Vulnerability (exposure) – causes, manifestations

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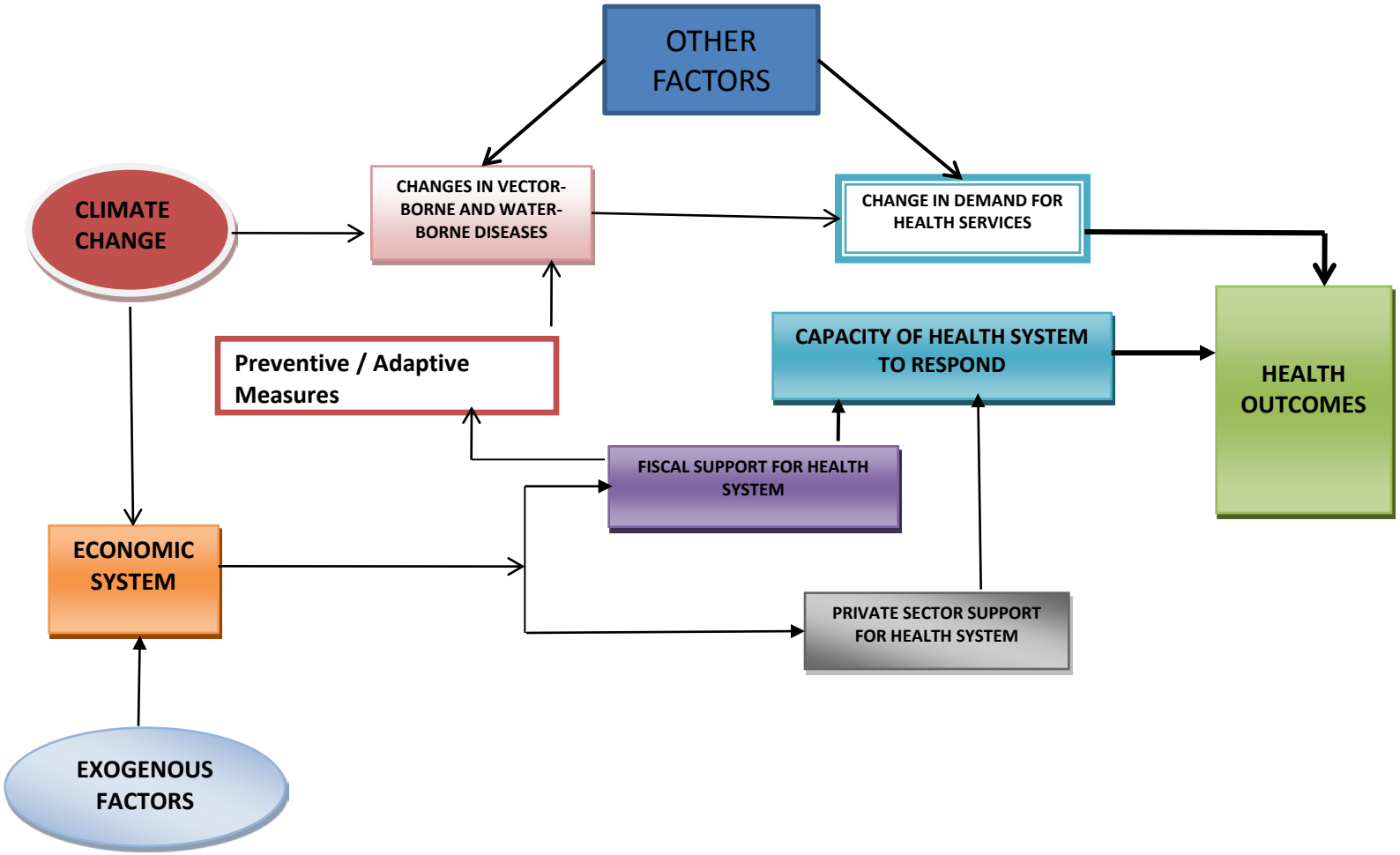
Resilience of the Health System: Policy instruments, and System capacity *(systems level, organizational level, community/individual level and personnel level)*

MODELLING THE IMPACT OF CLIMATE CHANGE ON HEALTH OUTCOMES

Monitoring Vulnerability and Resilience



Variables

- VWFD : vector and water borne diseases
- CC: climate change
- AM: adaptation measures
- FS: fiscal support for health sector
- EEF – Endogenous and Exogenous Factors
- DH: demand for health services
- OF: other determinants of health needs
- GDP: Gross domestic product
- XF: exogenous determinants of income
- PI : level of personal incomes, private sector support for health system
- HSCAP: capacity of the health system
- HOUT: population health outcomes

- VWFD = V(CC,MM,OF) $V_1>0, V_2<0, V_3$
- AM = A(FS) $A_1>0$
- DH = D(VWFD, OF) $D_1>0, D_2$
- GDP = G(CC, EEF) $G_1<0, G_2>0$
- FS = F(GDP) $F_1>0$
- PI = P(GDP) $P_1>0$
- HSCAP= S(FS, PI) $S_1>0,S_2>0$
- HOUT = H(HSCAP/DH) $H_1>0$

A number of points need to be noted:

- With relevant substitutions, the *capacity equation* can be rewritten as
  HSCAP = S{FS(GDP(CC, EEF)), P(GDP(CC,EEF))}

- The health system capacity depends on the negative and positive influences on the national income of the country.

- Highlighted is the link between health outcomes and the quantum of fiscal support on the one hand, as well as the quality (S_1) of the fiscal support, on the other.

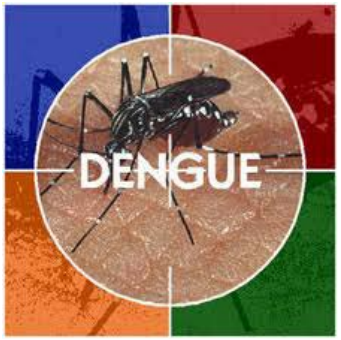
- The second main capacity determinant in the system would be the level of private incomes, which can be taken as a spending or standard of living indicator.

- The model seeks to capture the joint responsibility of the public and private sectors in the adaptation to climate change.

- The ratio of *capacity* to *demand for services* as the determinant of health outcomes highlights the service quality challenge facing the health system.

- Improvement therefore requires that capacity changes continue to outstrip utilization demands.

Results from empirical analysis - climate and disease incidence in T&T (1)



- Above average rainfall levels can lead to an outbreak of cases
- Temperature and relative humidity also positively influences the number of dengue fever cases
- Increasing access to improved sanitation facilities and water sources showed inverse relationships with dengue fever incidence
- Population size was also found to be positively related to dengue incidence

Results from empirical analysis - climate and disease incidence in T&T (2)

- Positive relationship between rainfall (lagged) and leptospirosis incidence
- Temperature and leptospirosis incidence also positively related
- Increases in access to improved sanitation facilities decreases the incidence of leptospirosis
- Negative relationship between forest area and leptospirosis incidence

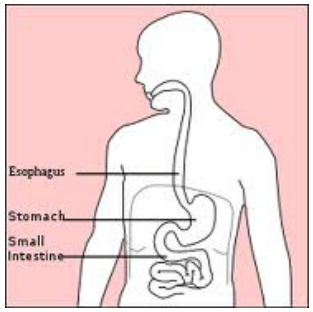
Results from empirical analysis - climate and disease incidence in T&T (3)

Food-borne illnesses

- The relative humidity variable has an increasing effect on food-borne illnesses
- For rainfall, the result has been a combined diminishing effect on food-borne incidence

Results from empirical analysis - climate and disease incidence in T&T (4)

Gastroenteritis



- The cumulative outcome of humidity also showed that humidity had a positive relationship as expected with gastroenteritis

- Although an increase in access to water sources coincides with an increase in gastroenteritis cases, the effects of increases in access to improvements in water sources was found to be diminishing

Adaptation (1)

- **Policy Level** –
  - **Recognition** by those in authority of the projected impacts of climate change and a conscious effort to mitigate future climate change as well as adapt so that the impacts can be minimized - *(National Communication on Climate Change (2001) and the Draft National Policy on Climate Change (2009).*
  - Perhaps, an important aspect of this recognition stage is the acknowledgment of the need and commitment to **collect relevant data** as it relates to the issues surrounding climate change and its impacts.
  - **Mainstreaming** of climate change into national policies and sectoral plans may be considered a pillar of any response to climate change; in particular, those of the health sector, as they pertain to this study.
- **Infrastructure –**
  - From the empirical analysis, water and sanitation have been identified as significant explanatory variables in determining disease incidence in Trinidad and Tobago.
  - Any successful adaptation to climate change in Trinidad and Tobago that is aimed at minimizing the health impacts of climate change, in particular disease incidence, should be linked to the quality of population access to water resources and sanitation facilities.

Adaptation (2)

- **Water Resources:**

  Water Storage Practices

  A programme on *'safe water storage practices'* that seeks to build awareness and influence behaviour of those, particularly in rural and semi-rural areas, can help in reducing the incidence of vector and water-borne illnesses.

  A significant percentage of the population engages in water storage practices due to lack of access to pipe-borne water and/or due to limited supplies of piped water

  Water Supply Schedules in Semi-rural and Rural Areas

  Bearing in mind the scarcity of water resources and the need for scheduling, our suggestion is that, changes to water supply schedules for semi-rural and rural areas of Trinidad may help to do two things:

  - reduce the extent of water storage in these areas, thereby reducing habitats for vectors especially the aedes egypti mosquito and the risk of other water-borne illnesses such as leptospirosis; and

  - increase the number of times barrels and other storage containers are washed and re-filled thus interrupting the life-cycle of mosquitoes.

    For example, assuming that areas get a 3-day water supply per week, a change to the scheduling may be to provide a 24 hour supply every 2 days rather than an uninterrupted 3-day water supply.

Adaptation (3)

- **Water Resources:**

  Water Supply: Quantity and Quality

  Trinidad and Tobago's main source of water supply is from rivers (surface water), although ground water sources exist throughout the country.

  Demand for water has increased considerably over the last few decades on both islands with domestic demand being the major driving force. In Trinidad, estimates for 2000 show that demand for water in Trinidad had outstripped production (CSO).

  Supply side policies: Increase storage capacity by building reservoirs and dams, Desalination of sea water, Reduce pollutants in water sources

  Demand side policies: Promote water conservation

Costing Adaptation

- The study revealed that a
  - 1% increase in the percentage of the population with access to improved water sources is expected to reduce dengue incidence by 308 cases and
  - a 1% increase in the percentage of population with access to improved sanitation facilities is expected to decrease the incidence of dengue by 453 cases and leptospirosis by 10 cases

- If it is assumed that there is a unit elastic relationship between an increase in *total expenditure* on improved water sources and sanitation facilities and an increase in access then

  Small increases in expenditure in these areas can prove to be quite effective in reducing disease incidence

- Our adaptation measures in most cases represent a 1 percent change in expenditure allocated to improving access to improved sanitation facilities and improved water sources in different contexts

Adaptation Measures	*Cost per annum (2008)*	*Cost to 2050*	*Cost to 2050 @ 1 percent DR*	*Cost to 2050 @ 2 percent DR*	*Cost to 2050 @ 4 percent DR*
Replace sanitation facilities[1]	0.2	8.4	5.53	3.66	1.62
Strengthening the sanitation drive of the Municipal Corporations[2]	1.85	77.2	50.83	33.61	14.87
Expanding CEPEP[3]	0.46	19.32	12.72	8.41	3.72
Enhancing capacity of the Solid Waste Management Company (SWMCOL)[4]	0.11	4.62	3.04	2.01	0.89
Improving water supply, especially to the rural area[5]	2.06	86.52	56.97	37.66	16.66
Enhancing Environmental Awareness[6]	0.43	18.06	11.89	7.86	3.48
Health Promotion - to reduce risky behaviour[7]	2.06	86.52	56.97	37.66	16.66
Strengthening the work of the Environmental Management Agency[8]	0.10	4.2	2.77	1.83	0.81
Forestry preservation[9]	0.10	4.2	2.77	1.83	0.81
TOTAL	7.17	309.04	203.48	134.53	59.51

Thank You