Burden of Disease and Climate Interactions: A Study of Surat City, India

Amrita Goldar

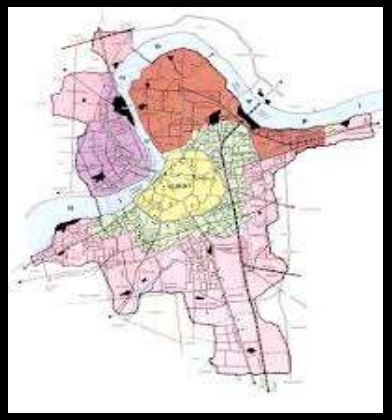
Fellow

ICRIER

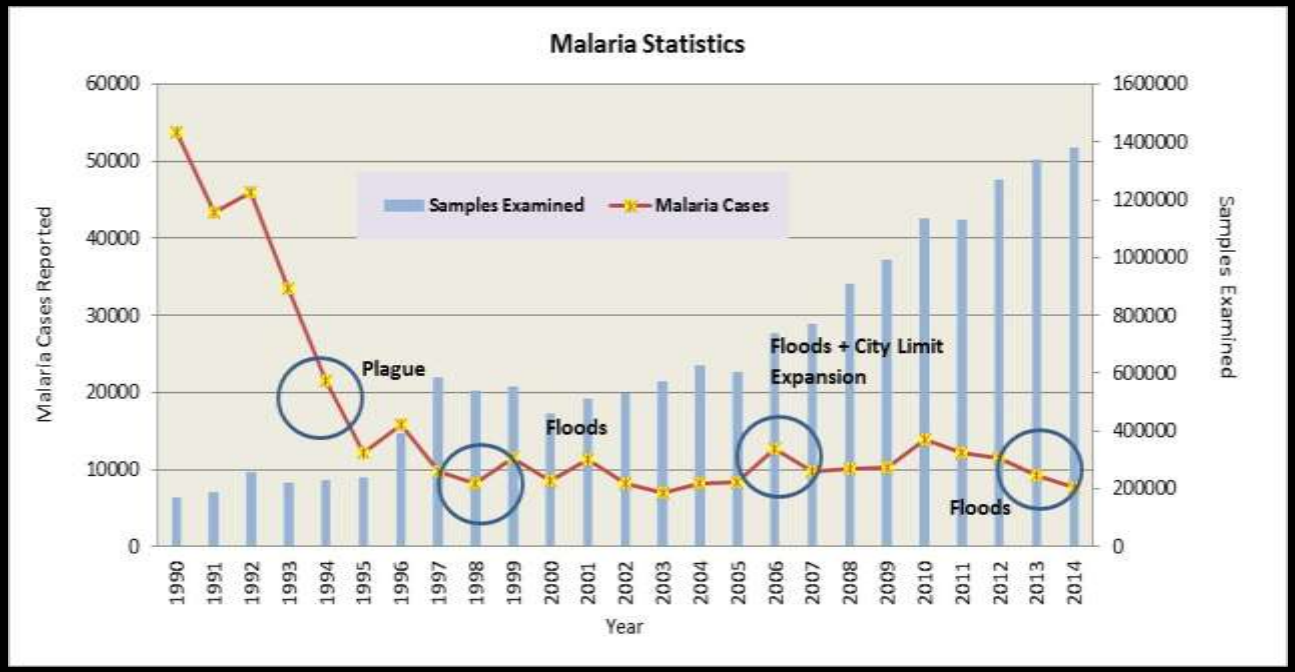
Overview of Presentation

- Surat Overview
- Climate Model Results for Surat
  - Overview of Climate Models used
- Econometric Model for Malaria Prediction
  - Results for Climate Normals and Future Projections
- Economic Impact Analysis of Public Health Interventions

Surat City- Description



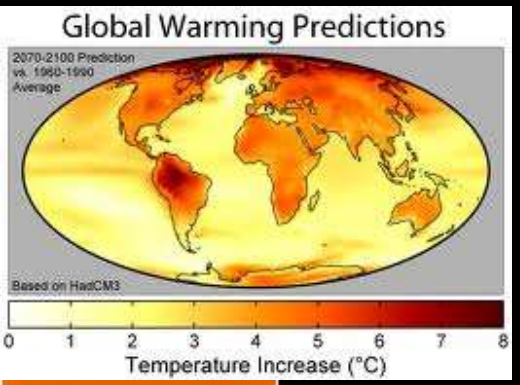
- Ideal Climatic Conditions for Malaria:
  - Mosquitogenic conditions (20–30 °C temperature and 60% relative humidity)
  - Settlement around Tapi River- breeding ground
- Past Cases of Malaria - 1990 onwards



Surat City- Description (contd.)

- Public Health Programmes in SMC
  - 100% household surveillance system: dispensation of ACTs anti-malarial drugs and follow up of each positive malaria case for next domiciliary visit
  - Inspection and treatment of probable breeding grounds- Ongoing construction sites, outdoors water bodies, underground tank, overhead tank, etc.
  - Fogging and Spraying by mounted vehicles
  - Biological techniques- larvivorous fishes bred and released in water bodies.

- Analysis Purpose-
  - to develop an urban climate impact assessment model with a focus on public health
    - To establish a disease incidence relationship for malaria within the city
    - Cost-benefit analysis of health interventions (adaptation action)



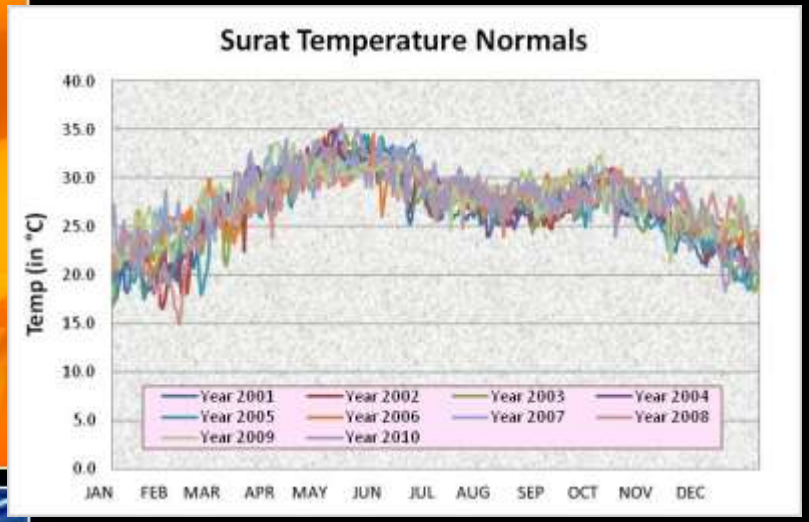
Climate Models

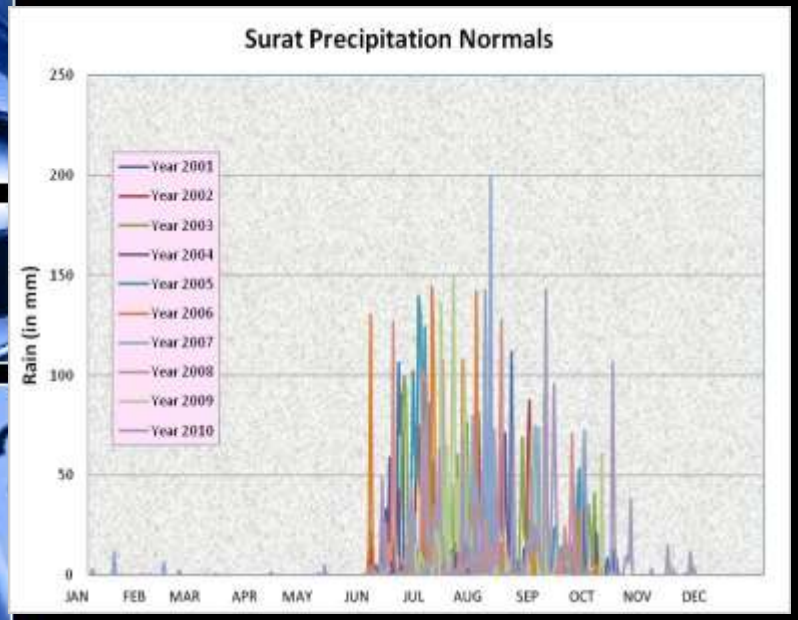
- City scope is to small for GCMs.
  - Grids (1° X 1°) ~ 111 Km X 111 Km
- Projections based on:
  - Empirical Downscaling (Self Organizing Maps Downscaling Technique)
  - SRES Scenario: A2 (Worst-Case Scenario)
  - Timeframe: 2046-2065
  - Model results for:

Acronym	Model	Source
IPSL	IPSL CM4	Institut Pierre Simon Laplace
ECHAM	MPI ECHAM5	Max Planck Institut für Meteorologie
CGCM	CCCMA CGCM3.1	Canadian Centre for Climate Modelling and Analysis
CNRM	CNRM CM3	aMétéo-France/Centre National de Recherches Météorologiques model
GFDL	GFDL CM	Geophysical Fluid Dynamics Laboratory
MIUB	MIUB ECHO-G	Meteorological Institute University of Bonn

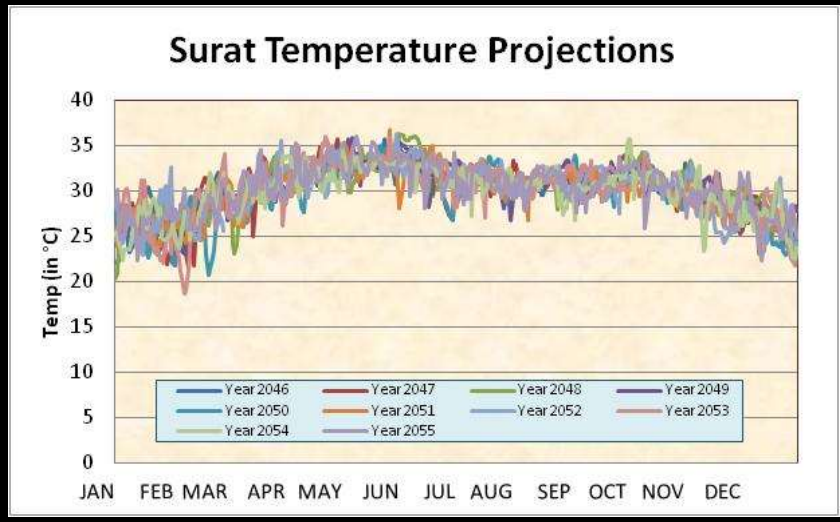
Results for Surat

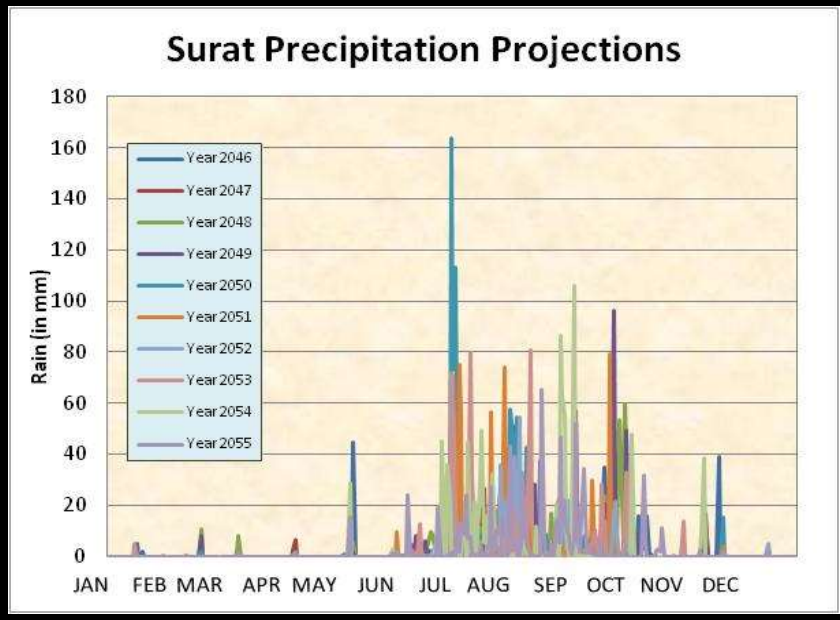
Climate Normal





Future Predictions





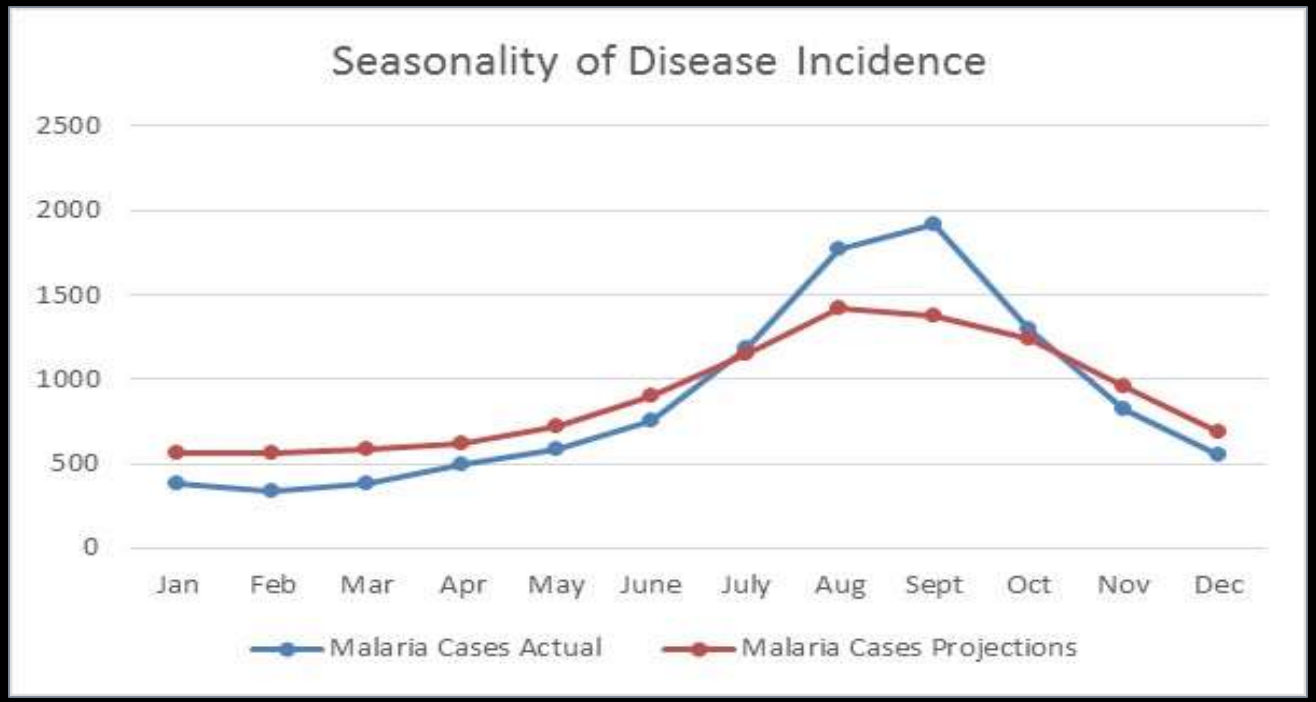
Econometric Model

- Auto-regressive Integrated Moving Average (ARIMA) to forecast plausiable Malaria incidence
- $Y_t = \varphi_1 Y_{t-1} + \varphi_2 Y_{t-2} + \cdots + \varphi_p Y_{t-p} - e_t - \theta_1 e_{t-1} - \theta_2 e_{t-2} - \cdots - -\theta_q e_{t-q}$

- ARIMA (2,0,0) seen to best represent the Surat Malaria incidence data.
- The modeling results show a strong positive relation between precipitation and minimum temperature and malaria incidence in the time period 1995-2012.

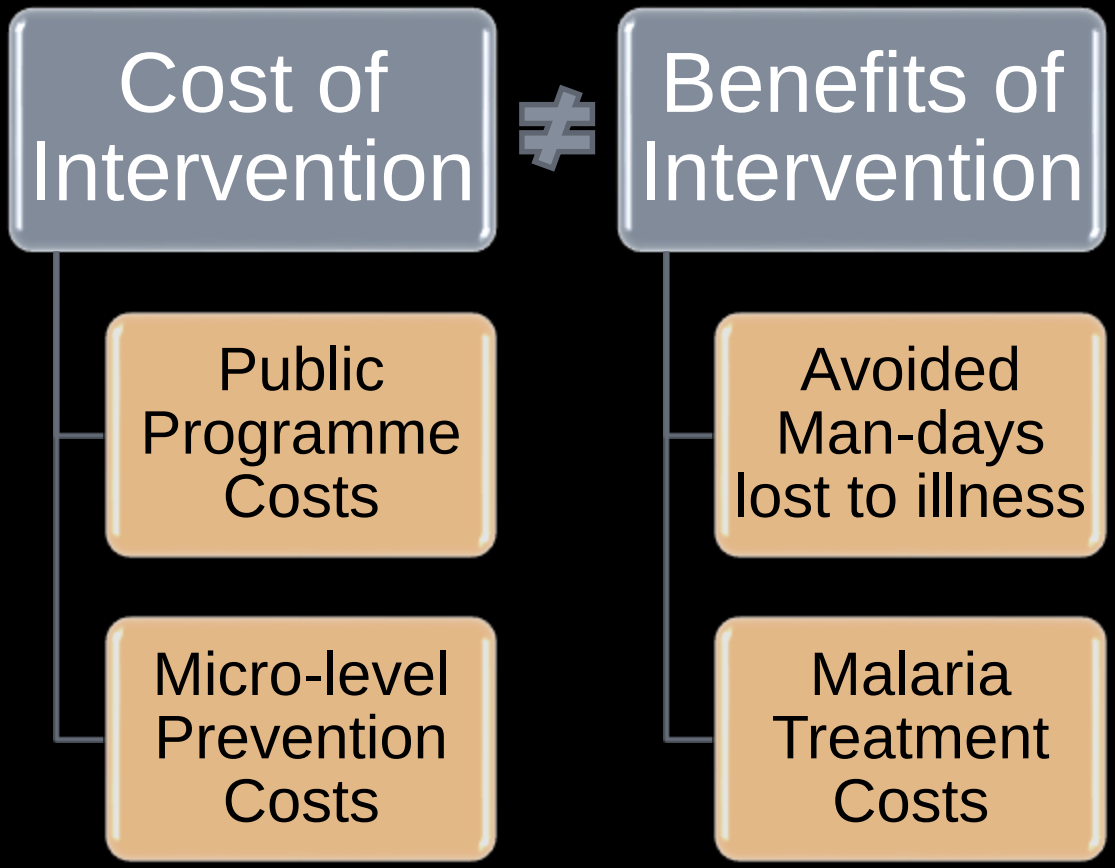
Model Results

- Changed seasonality of incidence
- Lower cases projected in the typical malaria months

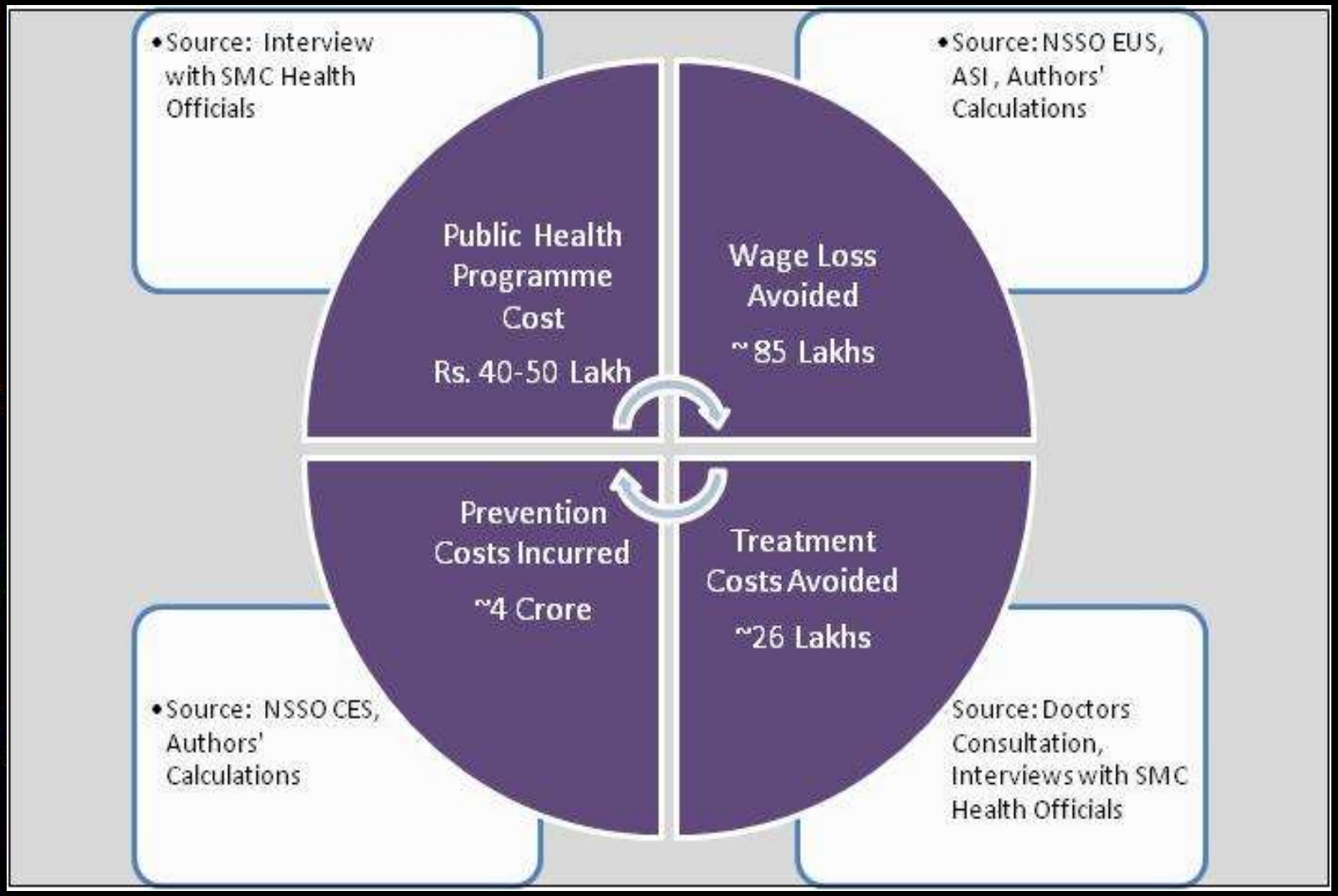


Economic Impact Analysis of Public Health Interventions

- Burden of Disease



Quantifying Impacts in Surat City



Thank you for your attention!!