Introduction to

Emergency data based Syndromic Surveillance in India (SEED)- A GVK EMRI-GEOMED collaborative project

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GVK EMRI brings the EMS system in India

Vision

- To respond to 30 million emergencies and save 1 million lives annually by 2015
- To deliver services at global standards through Leadership, Innovation, Technology and Research & Training

EMS system in India was shaped up with innovative Building Blocks of GVK EMRI

Three digit toll-free No. Accessible from Land lines and Mobile phones

Modern, spacious and open ERC

GIS / GPS to locate victim / ambulance and hospital

Cost effective ambulances to provide quality care for Indian emergencies with facilities for rescuing and balancing patient care with public safety and patients relatives comfort

Trained personnel for providing PHC

Launched on 15th Aug, '05 in Hyderabad and expanded to 11 other States

- One Center for 40 M population against one for every 0.05 M population in USA
- 372 M population covered in 11 States (increased reach of health care in rural , hilly and tribal areas)
- Trained 47,441 people (12,560 - EMTs, 10,956 – Pilots, 4,325 - Doctors, 5,000 - Nurses, 11,550 - First Responders and AHA/ ITLS Certification for - 3,050)
- ~11,100 emergencies handled per day
- 3125 Ambulances - 5 trips a day
- 16,374 + GVK EMRI Associates

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Innovative Process

- Developed detailed process understanding and well defined responsibilities through out the organization
- Maintained all information related to emergency in Patient Care Records (PCRs)
- Patient information is shared with the hospital on arrival
- 48 hour follow up with the patients admitted to hospital

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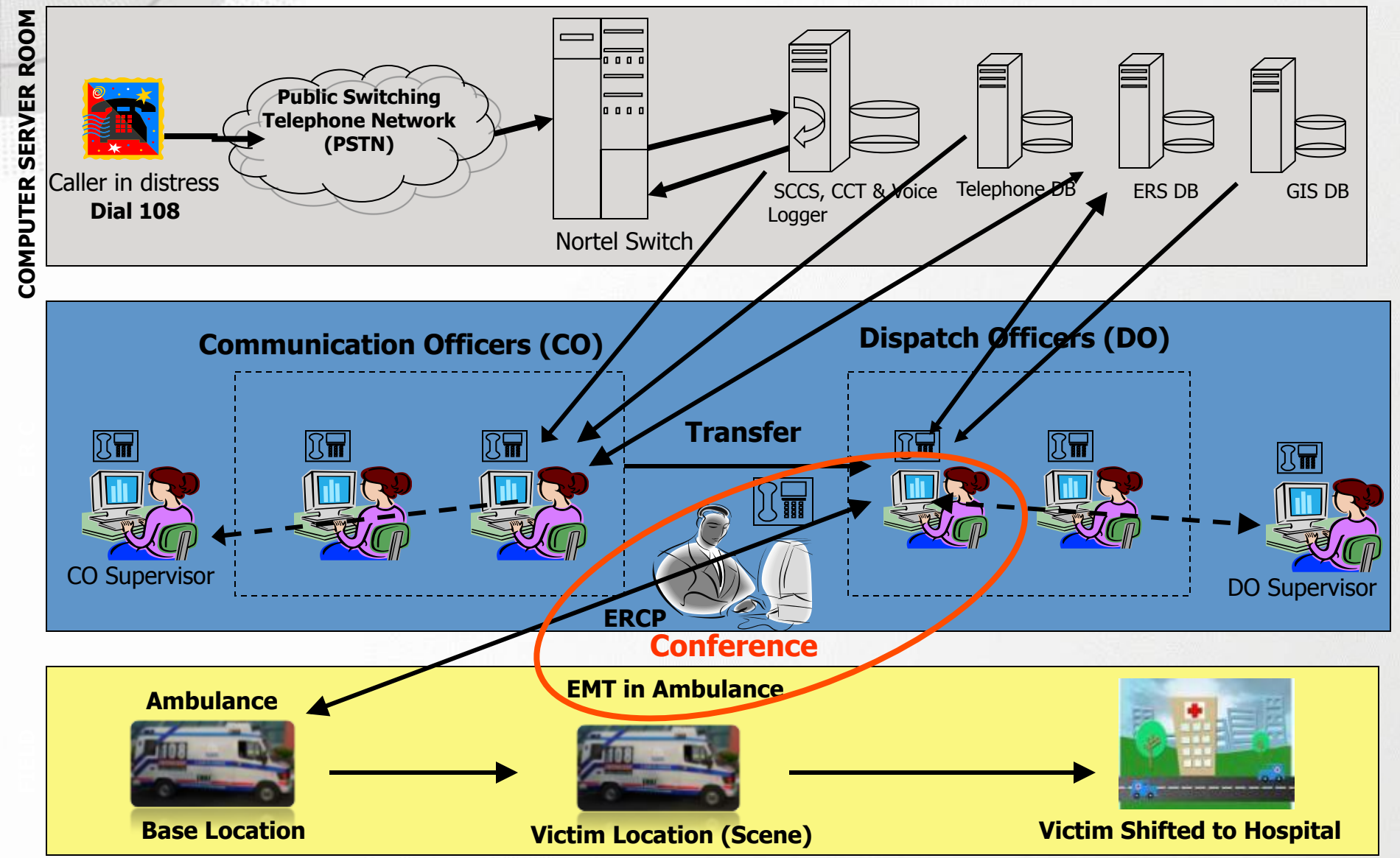
Innovative use of Technology

Mahindra Satyam



CCT: Communication Control Toolkit; **SCCS**: Symposium Call Centre Server; **ERCP**: Emergency Response Center Physician; **EMT**: Emergency Medical Technician

Does the system help in developing a local need based syndromic Surveillance???

IDSP is ideal, but has a constraint of quality and timely data

STRUCTURE

NATIONAL SURVEILLANCE COMMITTEE
CENTRAL SURVEILLANCE UNIT

↓

STATE SURVEILLANCE COMMITTEE
STATE SURVEILLANCE UNIT

↓

DISTRICT SURVEILLANCE COMMITTEE
DISTRICT SURVEILLANCE UNIT

-Early detection has scope for improvement
- Quality of data needs a validation especially at Form S level
- Regular flow of data needs to be ensured

OBJECTIVES

- Early detection of outbreaks
- Early institution of containment measures
- Reduction in morbidity & mortality
- Minimize economic loss

Reporting Mechanism

- Form S (Suspect Cases) by health workers(sub centers)
- Form P (Probable Cases) by doctors (PHC,CHC,Hospitals)
- Form L(lab confirmed cases) from laboratories
- **Frequency of reporting weekly**
- Data compilation/analysis and response at all levels

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Agenda….

- The Preparation for SEED project
- Initial approach of SEED
- Testing and validation of Model Algorithms
- Model Implementation phase
- Further improvement on project SEED

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GVK EMRI views on the Holistic approach for the syndromic Surveillance

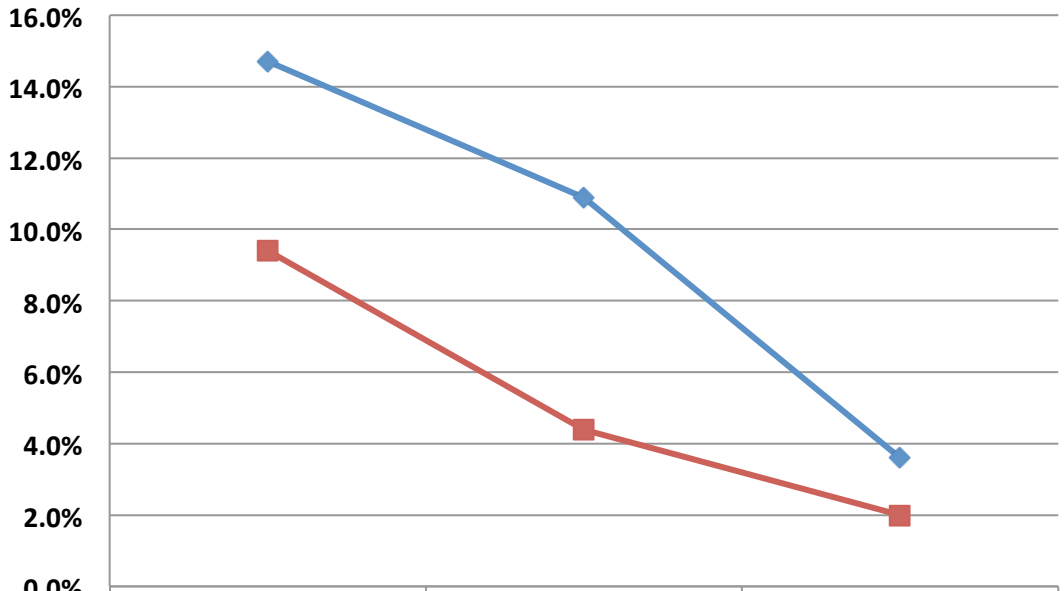
- Pilot in three districts (may be considered to represent the state)
- Total Prevalence (to understand the total market size)
- Pattern of reported cases to EMRI (Major database for the project)
- Health seeking behavior in the community
- Data Sourcing Options (to strengthen EMRI data base)
- Temporal & Spatial analysis options

The reporting system and pattern was scrutinized properly to make it appropriate for use in the " SYNDROMIC SURVEILLANCE"

Districts/ State	All Medical Emergencies	Emergencies Pertaining to Fevers (all types)	Percentage Share of fever (all types) in all medical emergencies	District share within Fevers (all types)
Srikakulam	45492	4257	9.4	9.8
Anantapur	50391	2196	4.4	5.1
Guntur	47233	941	2.0	2.2
Andhra Pradesh	988680	43389	4.5	

The pattern of the estimated prevalence rate and the reported cases of fever to EMRI are the same across the three districts

Estimated prevalence rate of Fever and reported cases at EMRI



	Srikakulam	Anantapur	Guntur
Estimated prevalence of fever, 2008	14.7%	10.9%	3.6%
Reported cases of fever to EMRI in total emergencies, 2008	9.4%	4.4%	2.0%

Presentation on data validity

Demand pattern of Medical Emergency Services for Infectious Diseases in Andhra Pradesh- A Geo-spatial Temporal Analysis of Fever cases

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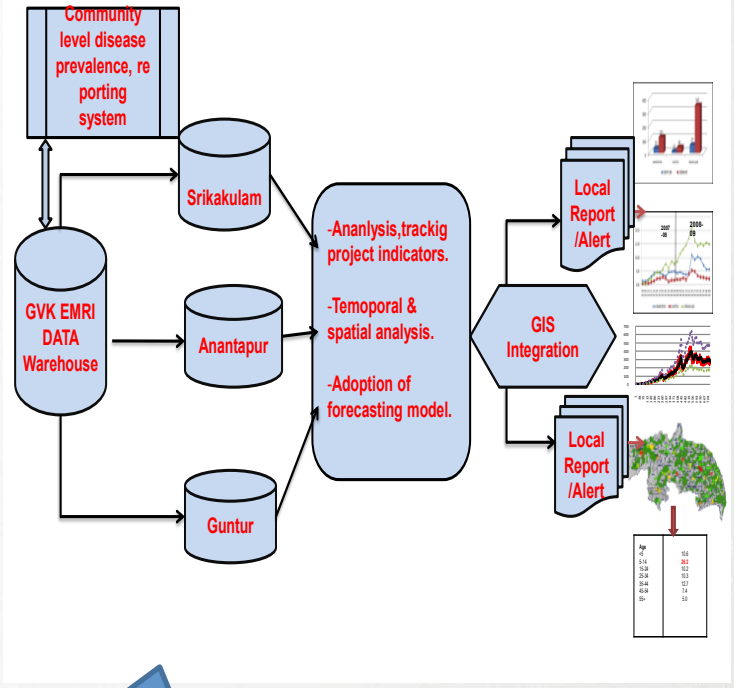
Major Steps involved in the building of a surveillance system

- Data Source
- Data Management
- Data Validation
- Process designing
- Forecasting options
- Control Chart options
- GIS options
- Data Analysis (Temporal and Spatial)
- Data Interpretation
- Dissemination

Necessary concept was built to make the project an Epidemiological risk management tool

Surveillance System for early warning Communication Platform



Testing & Validation of Temporal & Spatial Algorithms in collaboration with GEOMED

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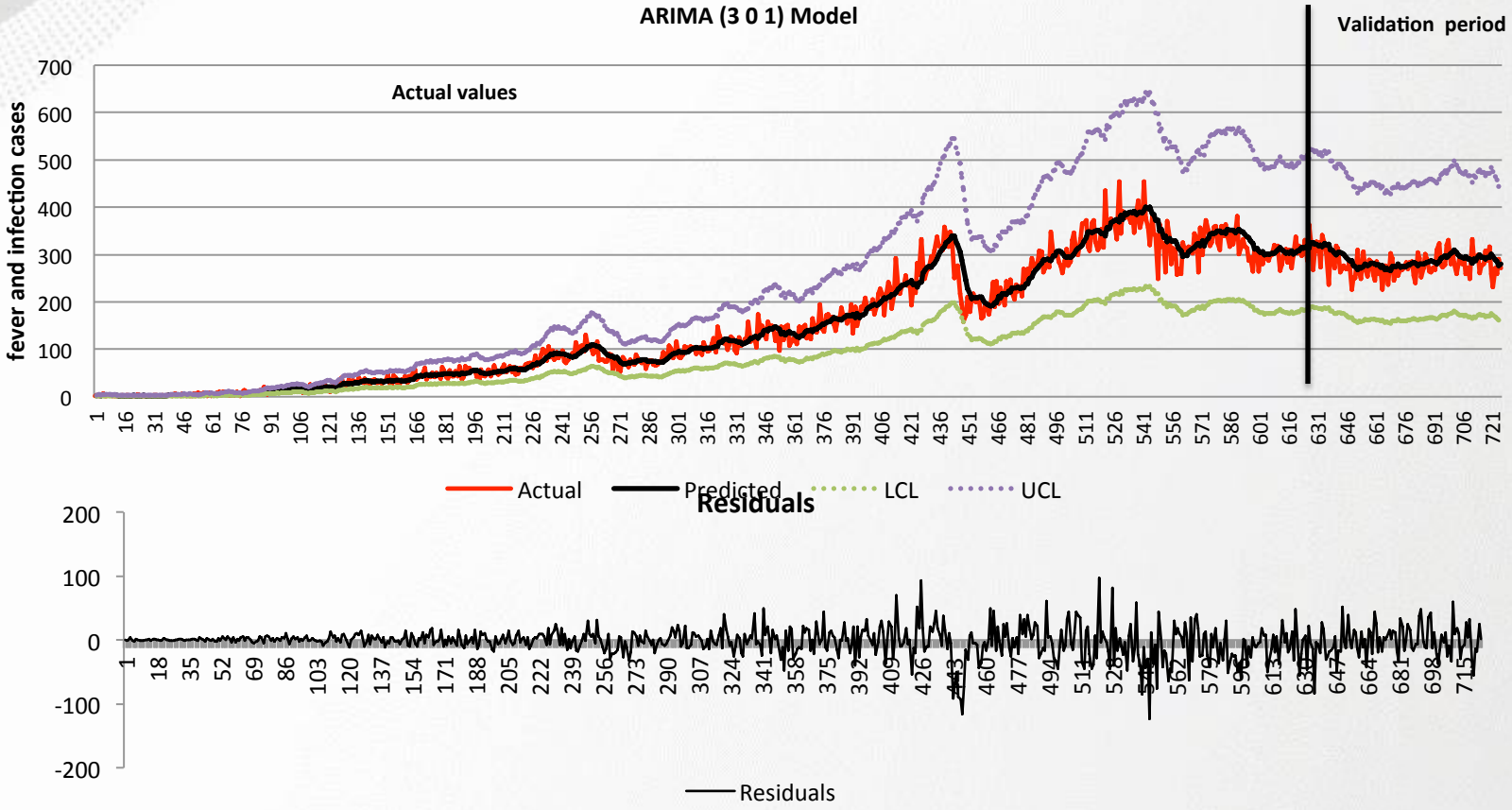
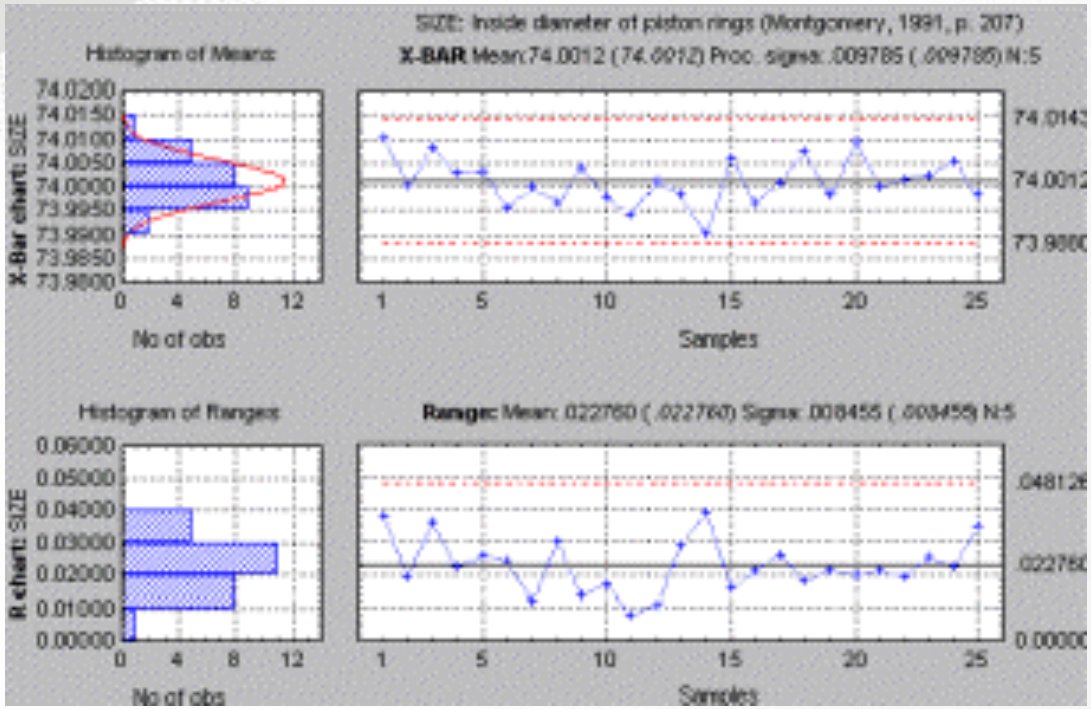
Best suit ARIMA model is applied for predictive values based on larger time series data



A different approach is taken as a FIRST Level outbreak detection



Approach of Control Charts

Generation of Upper and lower control

μ ± *1.96 * (Sigma/Square Root(n)*)--- at 95% CI

μ ± *3 * (Sigma/Square Root(n)*)--- at 99% CI

Upper control limit is used to detect the "Outliers". In case of infectious disease , if reporting of cases more than the normal range, it is considered as an outlier and can be a POTENTIAL outbreak signal

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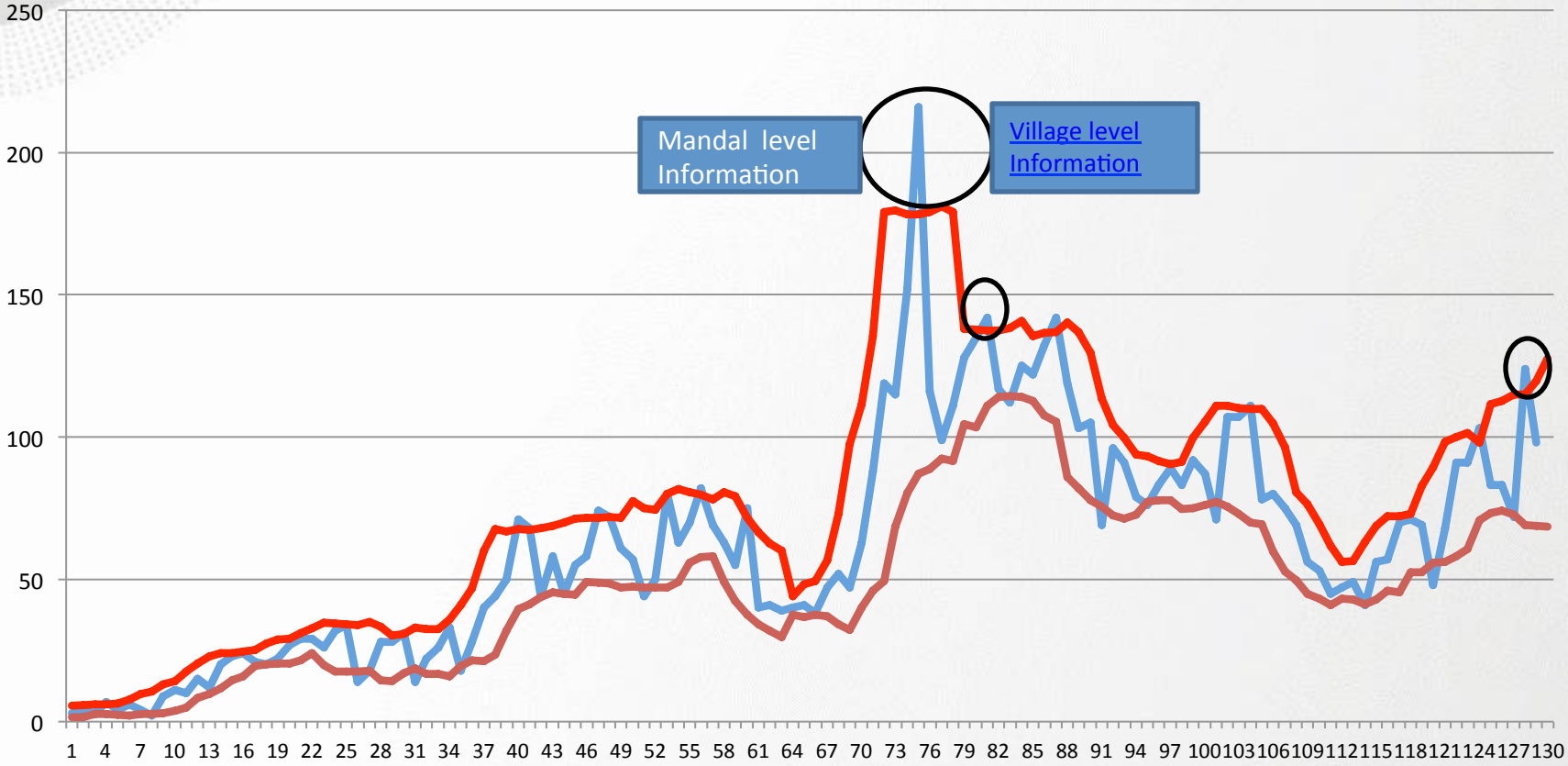
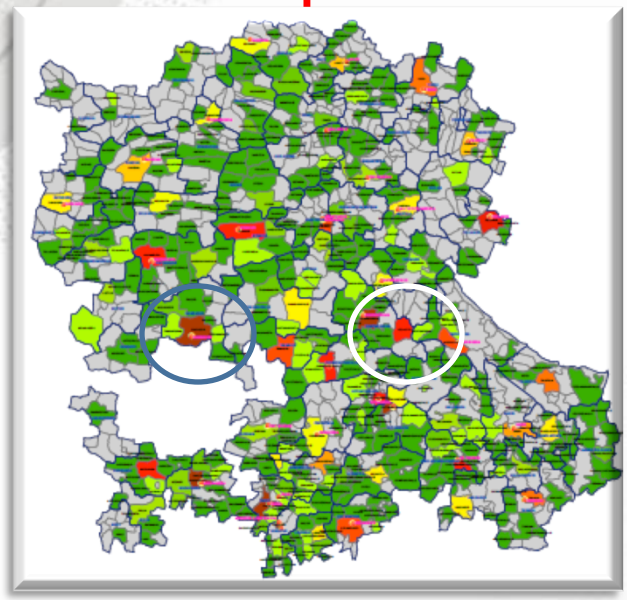
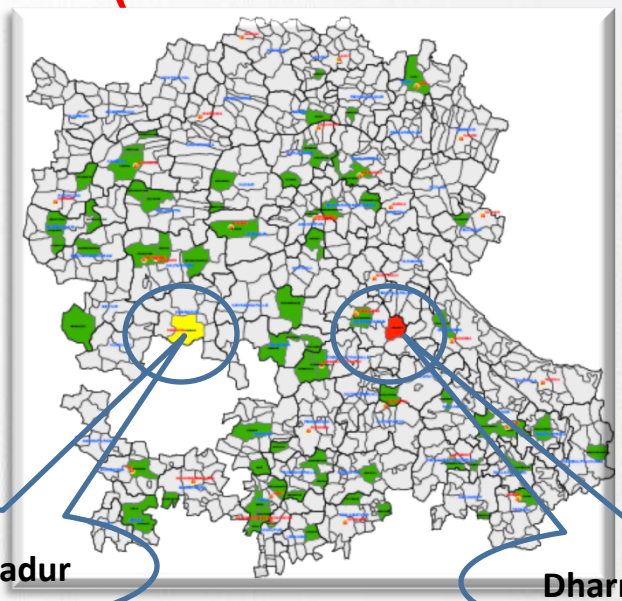
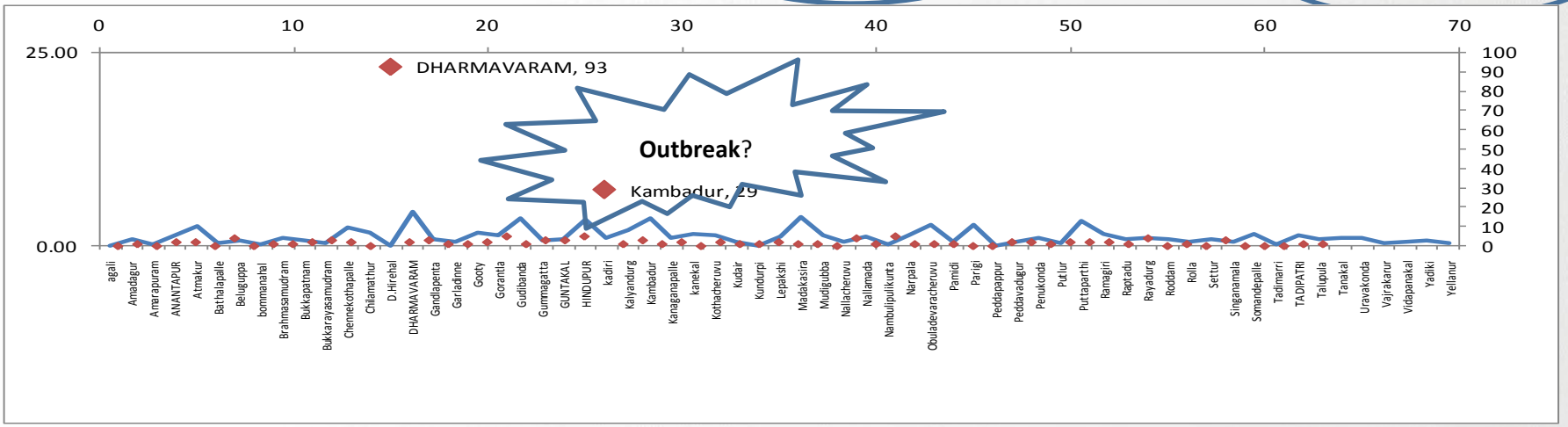
UCL and LCL is calculated as per the control charts and incorporated in the actual reporting pattern to diagnose the first level outbreak detection



Annual reporting rate would identify the vulnerability of a particular place for outbreak (2nd level detection)





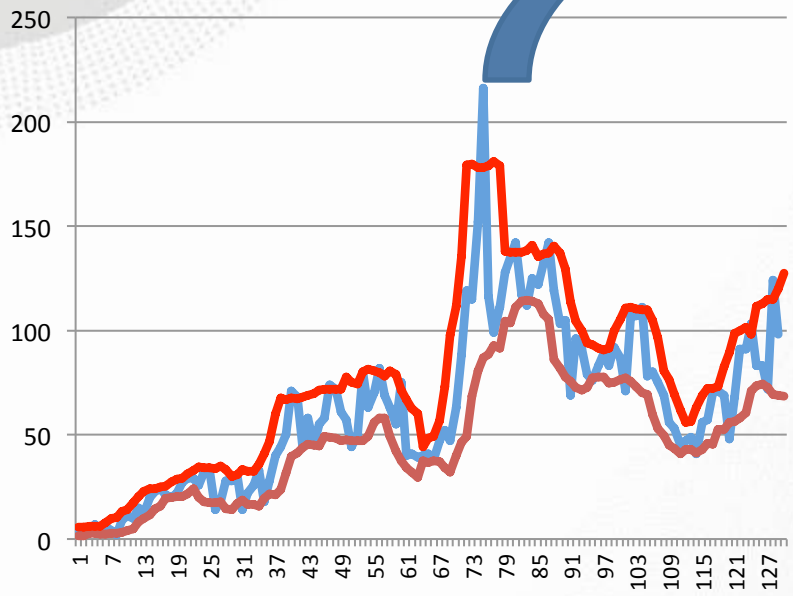


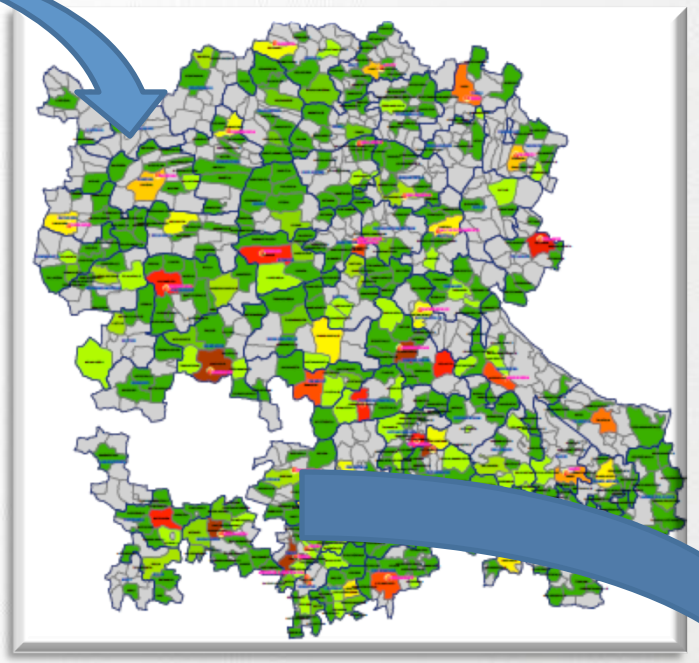
A third level detection may be done through reported cases attributes

Age	Annual Average	Current Week
<5	2.65	10.6
5-14	5.17	26.2
15-24	50.02	10.2
25-34	8.34	10.3
35-44	9.54	12.7
45-54	16.29	7.4
55+	7.81	5.0

- Age wise distribution
- Social class wise distribution
- Gender wise Classification

Three level detection method for syndrome outbreak…….





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Current system is designed to detect the outbreak on a daily basis

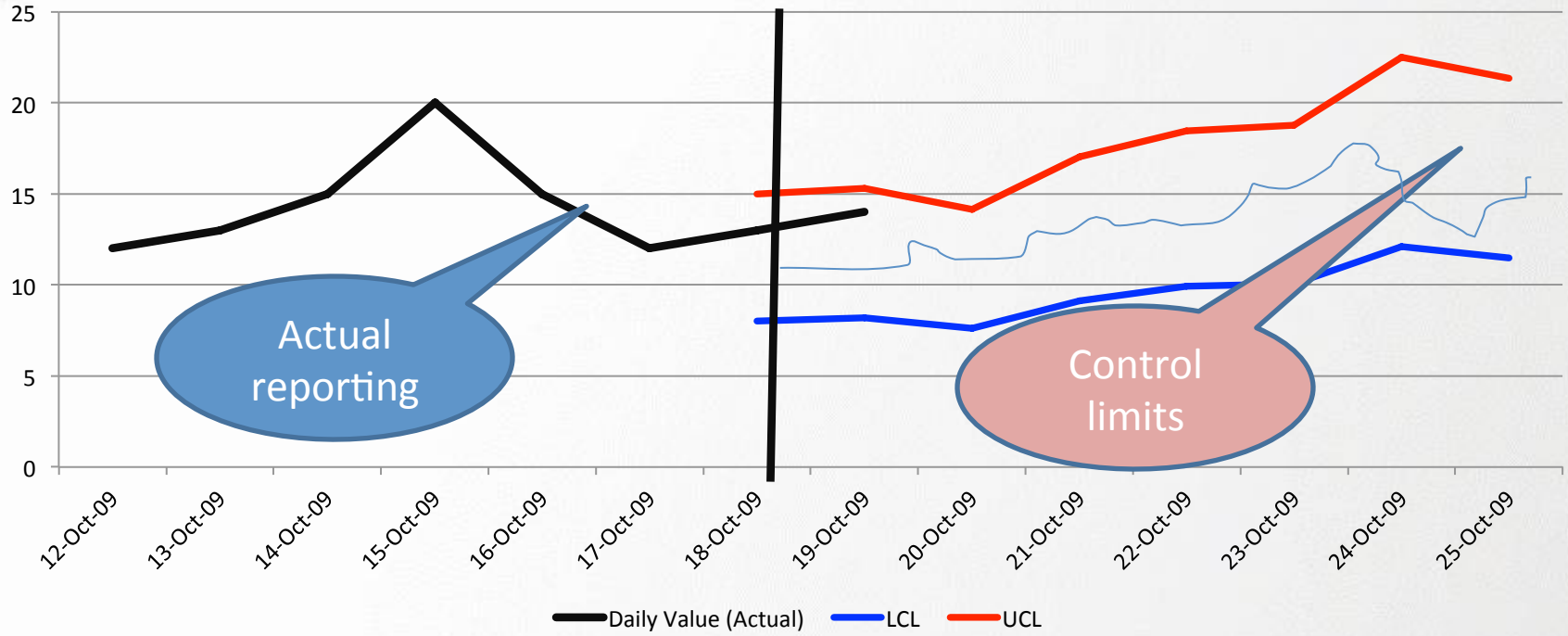
-The forecast is done on the basis of weekly data

- The next POINT weekly forecast is bifurcated to daily forecast numbers based on two weeks prior two the forecasted week and the week of the previous year

- 50% weight is given to the most recent weeks and another 50% weight is given to the week in the previous year

- the UCL and LCL of the daily forecast is estimated in the same way

The automated system would track the daily reporting of fever cases and would provide initial warning based on projected UCL

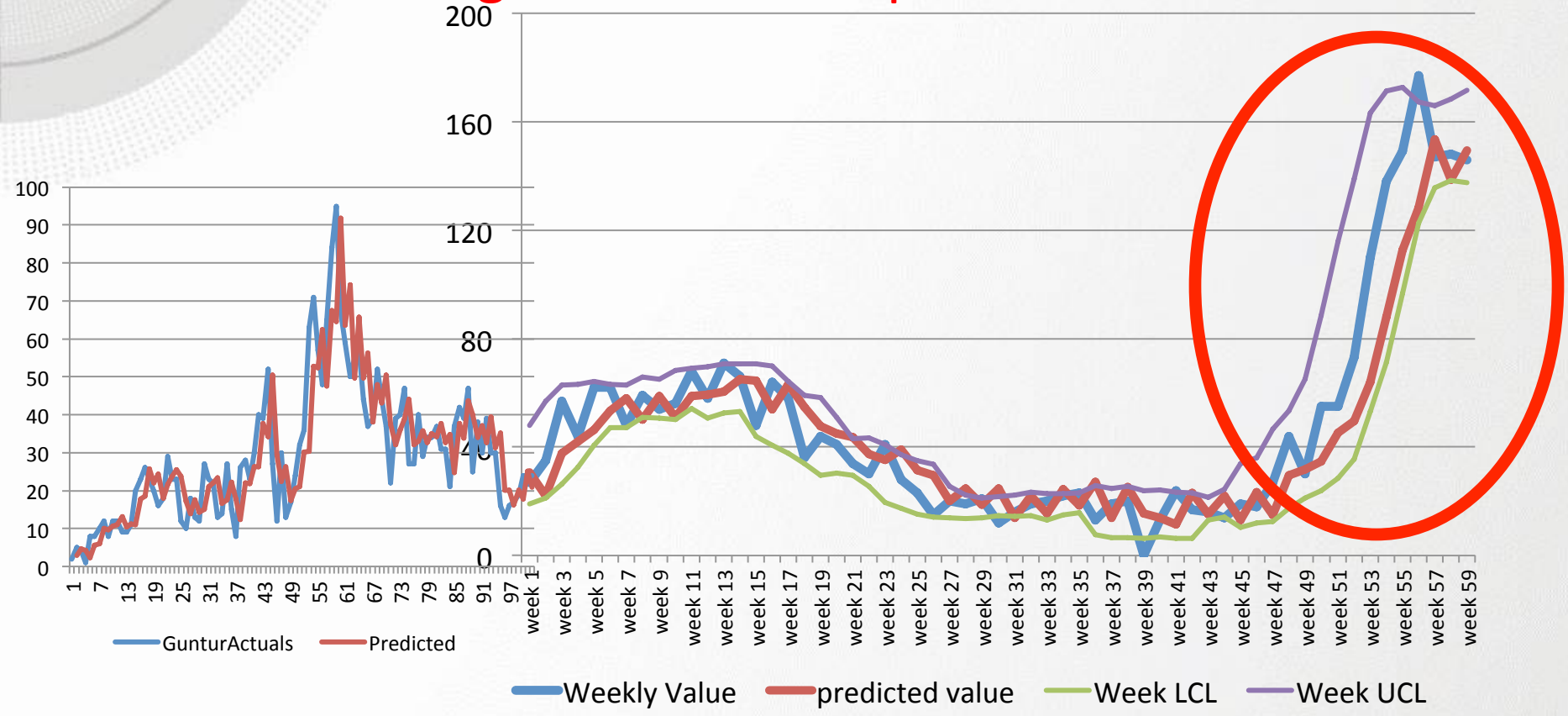


TESTING OF THE MODEL

Back ground of the Test Phase

- August 2009 to September 2010
- Guntur district
- A series of dengue fever cases were reported from the district from Mid August 2010 to September 2010
- The test result is validated with the community data from various news paper

Weekly data for syndromic surveillance indicates an outbreak during 2nd week of September 2010



Model Phase-
April 2007 to July 2009

Test Phase: August 2009 to September 2010

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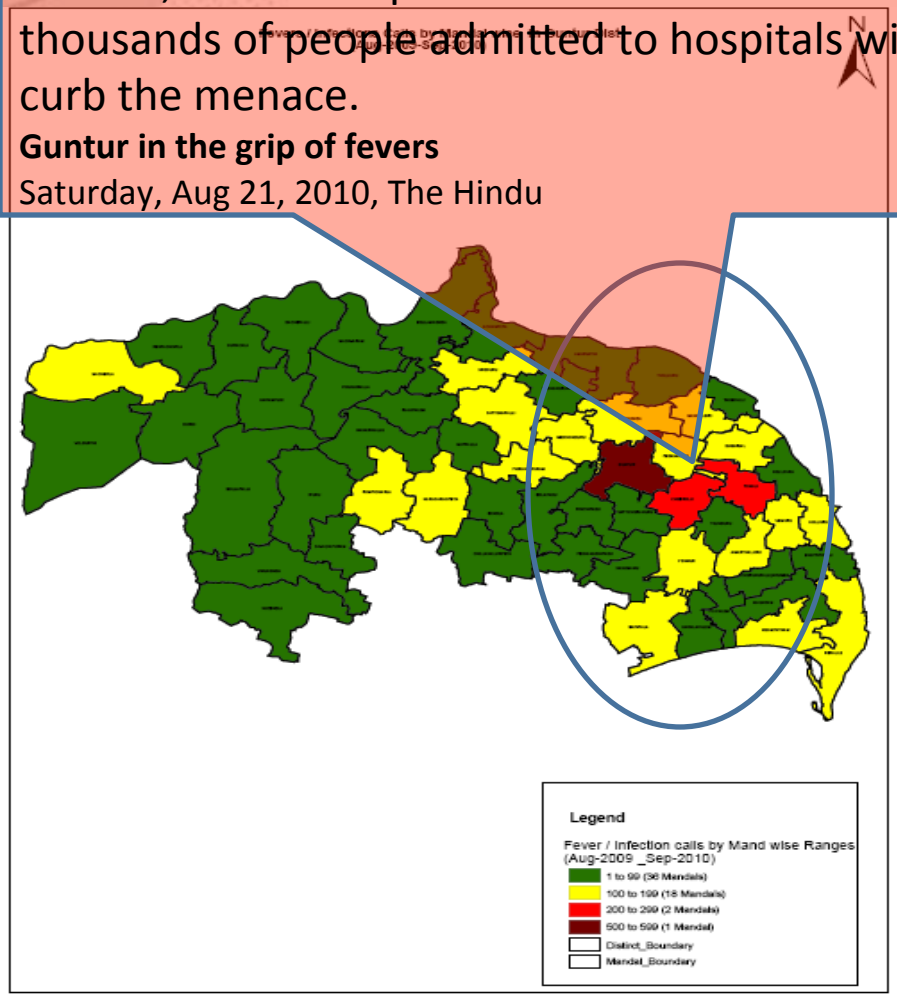
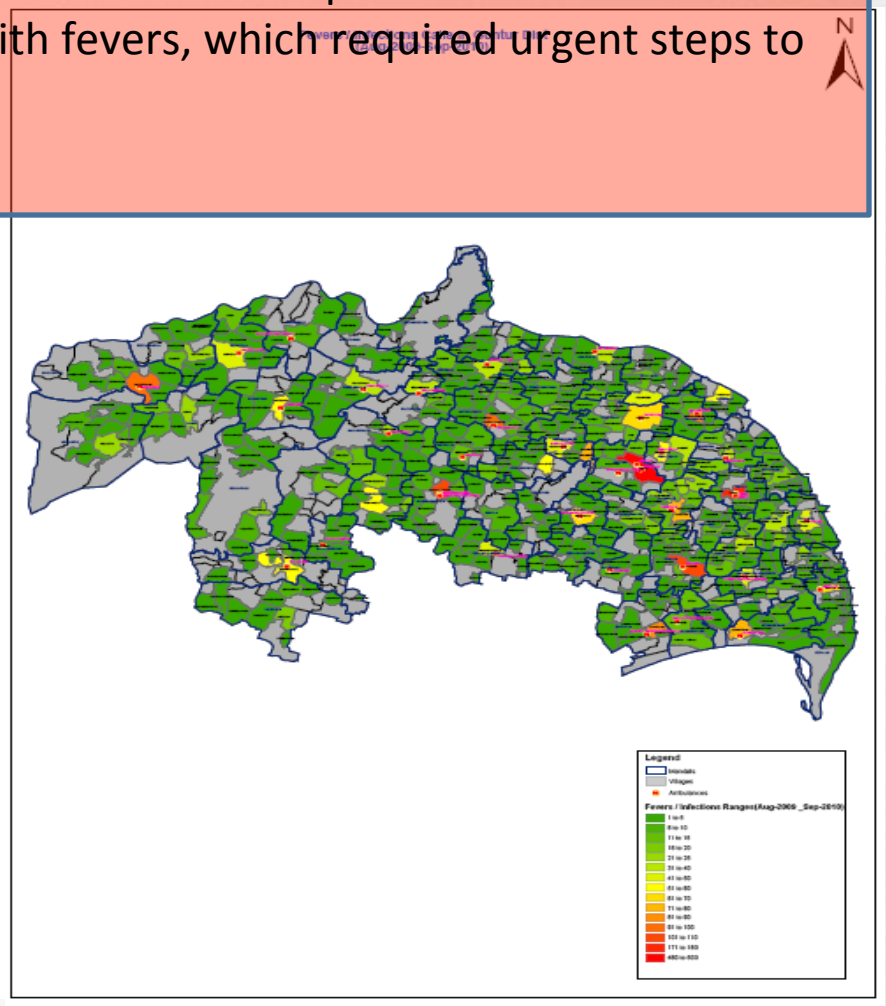
Though Mandal level analysis indicates some cluster the village level analysis does not

Ponnur, Chilakaluripet and other towns and the district headquarters too have thousands of people admitted to hospitals with fevers, which required urgent steps to curb the menace.

Guntur in the grip of fevers

Saturday, Aug 21, 2010, The Hindu





Other News Paper reports also reported the severity of the problem

The collector declared that 47 people died till Friday due to seasonal diseases and 303 malaria and suspected dengue cases were registered in the district.

- Health emergency in Guntur district, September 4th, 2010 , Deccan chronicle

GUNTUR: The Medical and Health Department is awaiting reports from the Guntur Medical College (GMC) on the condition of 135 people suspected to be suffering from dengue fever.

- ***Over 130 suspected dengue cases in Guntur ,Sunday, Sep 05, 2010, The Hindu***

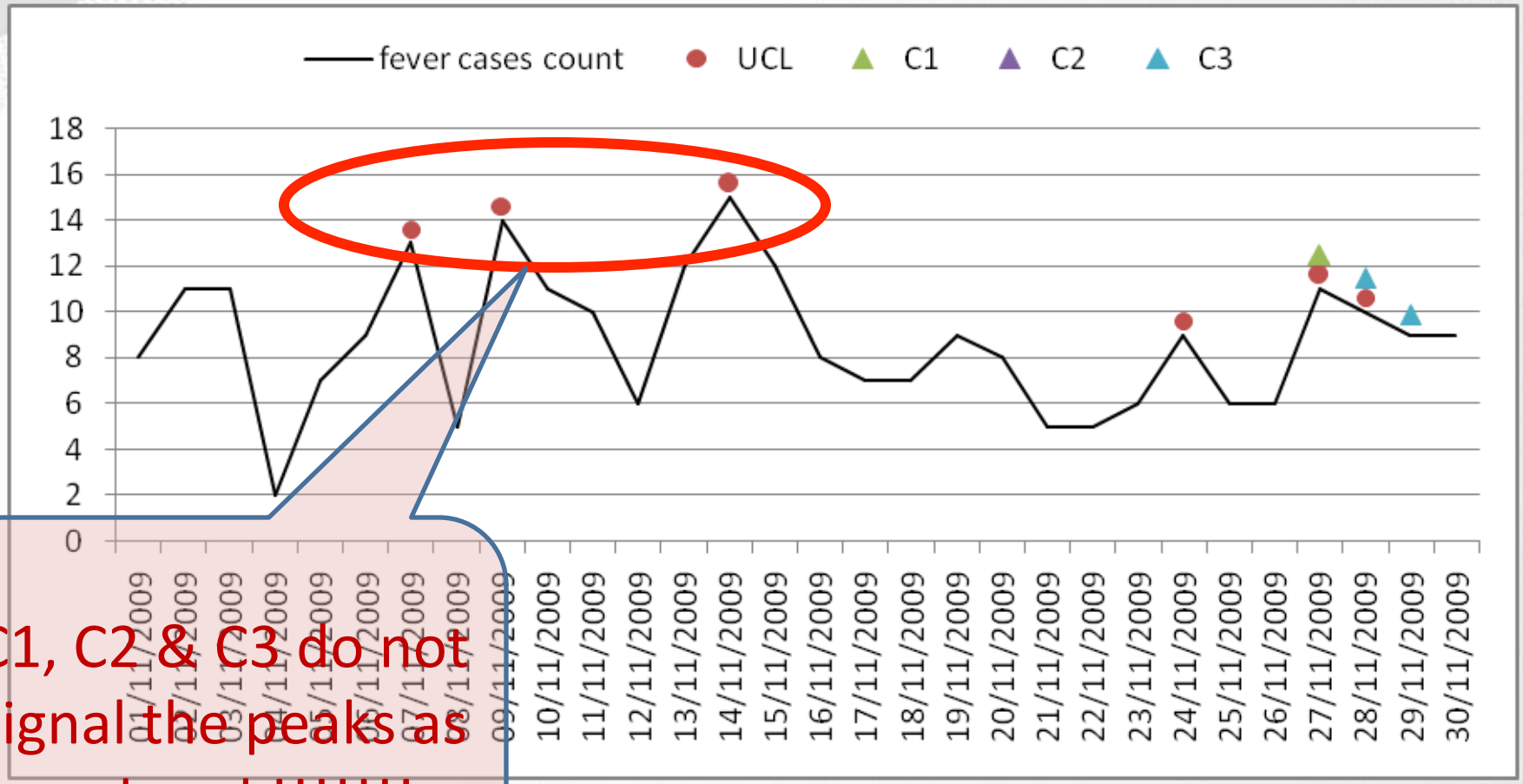
The SEED project was further evaluated, validated and strengthened through GEOMED Collaboration

- Scientist from GEOMED worked on SEED project to understand and to implement the spatial analytics.

- Workshop was conducted to develop the capability to establish the spatial and temporal analytical needs at all the GVK EMRI centers in India

- Internship student from Maastricht University, Netherlands was working on the temporal algorithm for a better detection method

The detection algorithm applied in SIDHARTHa was tested and compared with the current SEED detection algorithm



C1, C2 & C3 do not signal the peaks as outbreak!!!!!!!

Blocking and eliminating/rejecting signals

Problem:

• Forwarding 53 and more outbreak warnings per year would overload public health authorities.

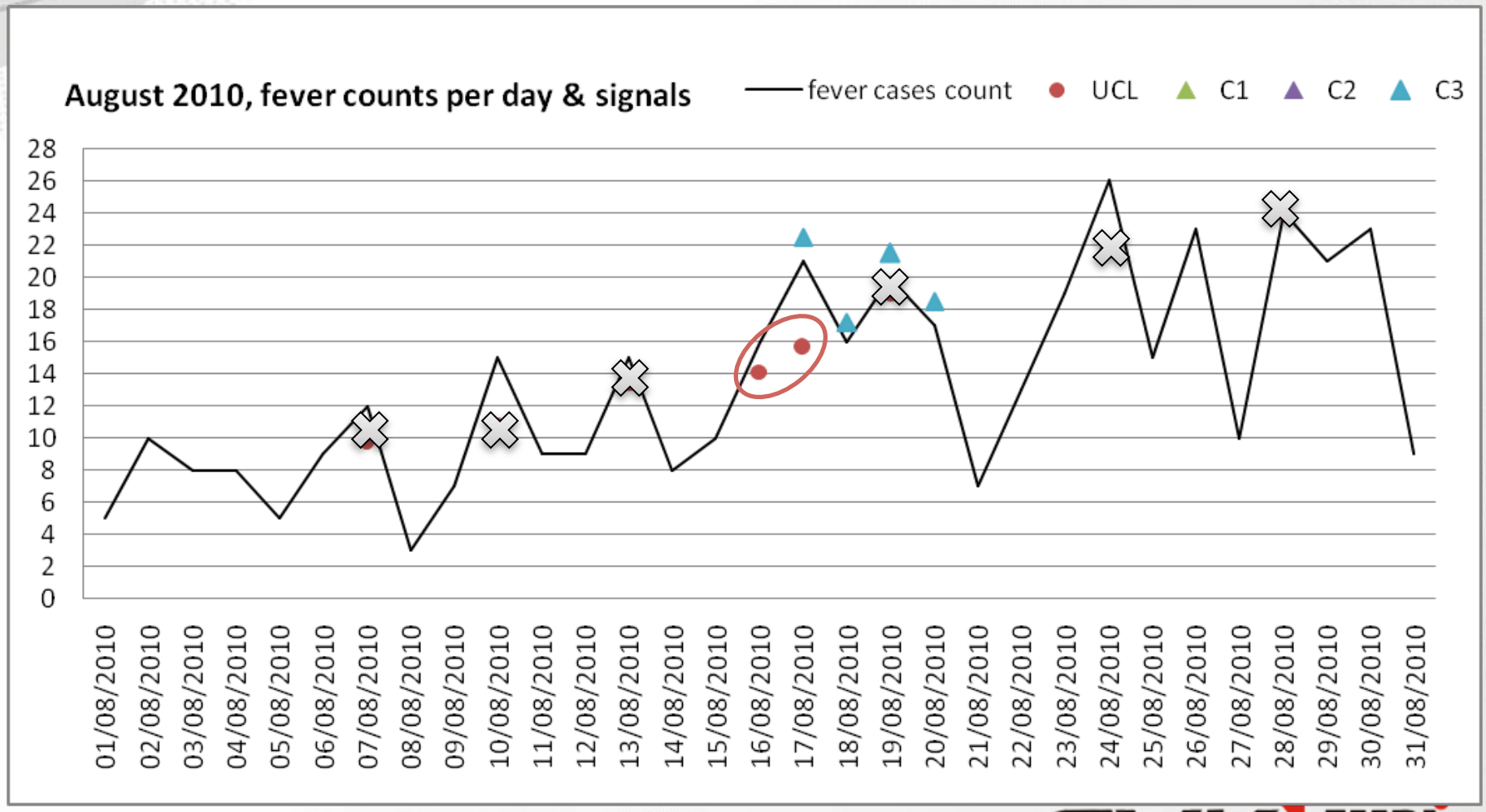
• Single small peaks in the data do not necessary signal an outbreak when taking into account the low stability of Indian data.

➔ It was decided to ignore single one-day signals by UCL and to only regard signals of two or more consecutive days. Single signals are divided in signal-blocks if they appear on consecutive days, then single-day-blocks are excluded.

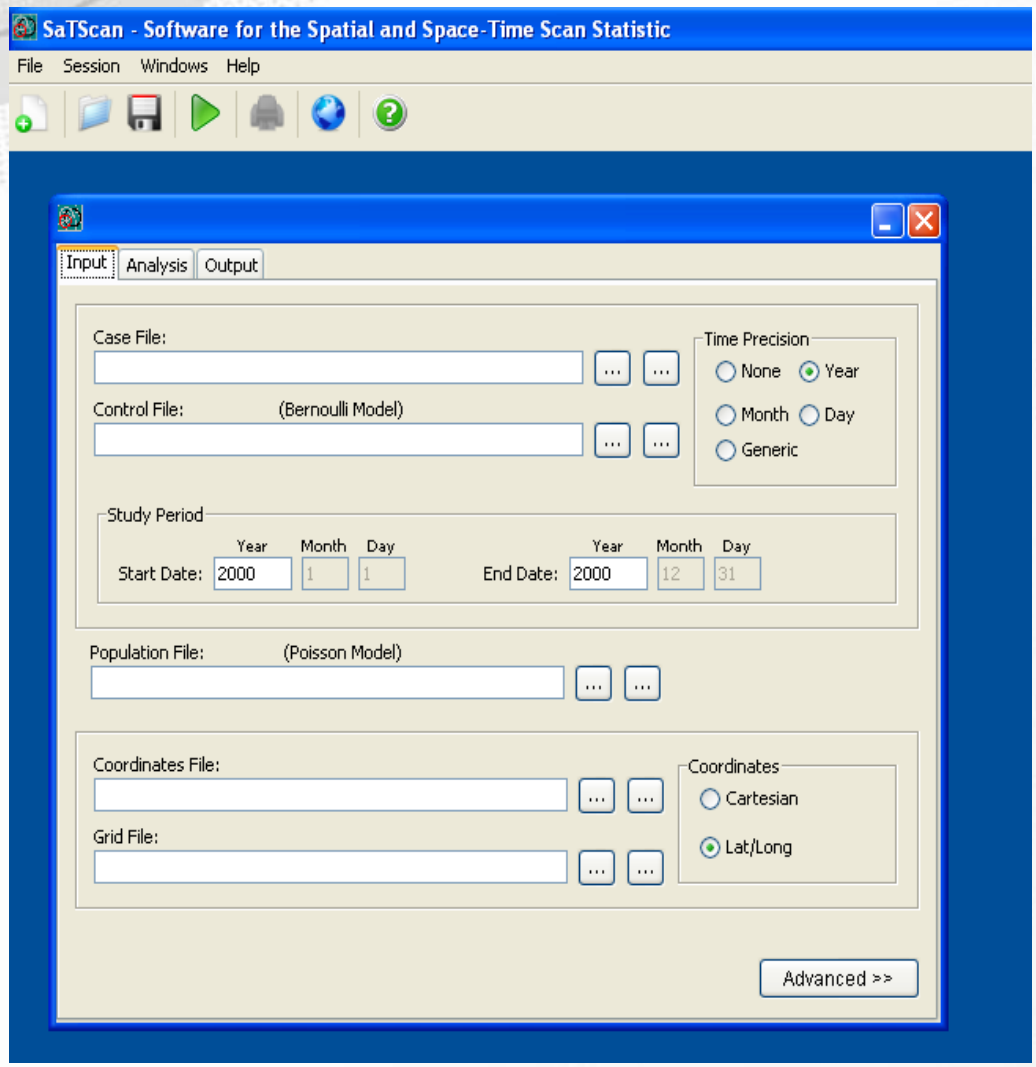
Results:

53 signal-blocks were detected in 2009 excluding the one-day blocks resulted in 8 blocks, out of previous 59 blocks in 2010, 11 blocks remain

Rejecting single-day signals



SaTScan software was introduced for a better scientific cluster detection



Retrospective space-time analysis:

Settings:

- Purely spatial cluster size: Max. 15km radius
- Purely temporal cluster size: 28 days

Purely spatial analysis:

- To detect whether the outbreak occurred in a risk prone area
- Applied algorithm: Poisson model

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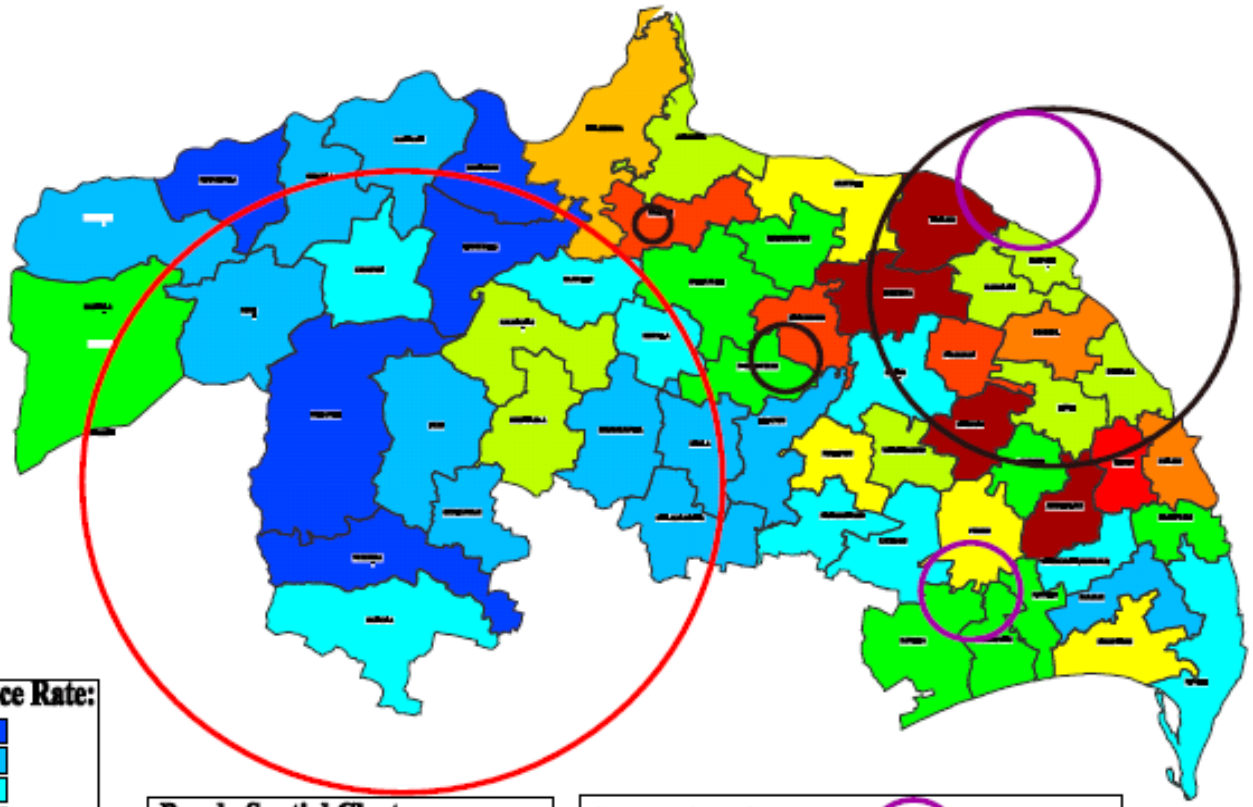
Guntur District. Cluster for 2010



Prevalence Rate:

- 0-4
- 5-9
- 9-14
- 15-19
- 20-24
- 25-29
- 30-34
- 35-39
- 40-44
- 45-49
- 50-55

Purely Spatial Cluster:

Cluster of High Rates:

Cluster of Low Rates:

Space-Time Clusters:

1. 2010/9/17 to 2010/9/27: thulluru, Tadepalli

2. 2010/5/20 to 2010/5/24: p.v.palem, karalapalem, kakumanu

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SaTScan in SEED

- The Dengue fever outbreak was detected as retrospective cluster from **Sept. 17 to Sept. 27 In Thulluru and Tadepalli Mandal**
- The outbreak was the 1st significant cluster out of 2 significant cluster. (The 2nd cluster occurred in May 2010)
- The dengue fever outbreak consisted of 36 cases with a **p-value of <0.001**
- **Thulluru and Tadepalli** were identified in the purely spatial analysis as risk prone areas

SaTScan in SEED

- The dengue fever outbreak was dynamic
- A prospective cluster could be detected within the space-time permutation model earlier than in the purely temporal algorithm ARIMA
- The cluster differed significantly in the prospective analysis than in the retrospective analysis – the prospective cluster remained for a longer time
- SaTScan is useful for early warning systems

To conclude…..

- EMS data was found to be more effective for detecting the syndrome outbreaks as compared to other traditional methods.
- GIS and SaTScan adds more scientific input for the temporal and spatial analysis
- The system MUST be developed as a complementary to the existing and integrated IDSP
- More chief complaints may be added to the EMS system to make them more responsive to the syndromic surveillance.

Thank You!!!!!!

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