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Special Issue on
Syndromic Surveillance

Transforming Emergency Management

CONTENTS

MESSAGE FROM CEO

Greetings to you all!

We are happy to bring you the special issue of the Indian Emergency Journal. In this special issue we have put together various facets of syndromic surveillance based on Emergency Management services (EMS) database. Since, syndromic surveillance is generally used for early detection of outbreaks along with complete information on trend, size, spread and tempo of outbreaks, the real time nature of EMS data provides immediate analysis and triggers preventive measures in restricting a potential outbreak. GVK EMRI being the first integrated Emergency service provider in India, it has started a research project called System for Early warning based on Emergency Data (SEED) in collaboration with GEOMED Research, Germany.

Technology and innovations remain as the critical factors for development of a surveillance system where the onset of a syndrome at a geographic location is captured, processed, analyzed and disseminated to the major stakeholders in a near real time basis. Mahindra Satyam has been our technology partner and supporting the SEED project with appropriate and adequate technology and allied services. Research and analytics have been providing critical insights through new and robust methodology.

It gives me immense pleasure to inform you that GVK EMRI along with GEOMED have successfully conducted a workshop on "Emergency Data based Syndromic Surveillance in India", which was attended by eminent scientists from India and abroad in the field of syndromic surveillance. The workshop has witnessed immense scope for GVK EMRI database to develop the syndromic surveillance system in India. I am also convinced that once the system is fully developed, it would strengthen the existing surveillance system in India.

Today we are operating in ten states with more than 2530 ambulances, over 16,000 associates and growing every day towards the thirty million lives touched and one million lives saved mark, that we have set out to achieve by the year 2011. As of today we are handling more than 10,500 emergencies per day with a total daily call volume of 1.65 lakhs. In other words, GVK EMRI is serving one emergency for every 8 seconds and saving one life for every 8 minutes.

I would like to take this opportunity to thank the Governments, Hospitals, Media and other partners, associates and Governing Board of GVK EMRI for their outstanding support.

Venkat Changavalli

Emergency data based syndromic surveillance- A System for Early Warning based on real time data

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Surveillance systems in public health domain focus on trends to predict the future course of the disease. Early warning of epidemics is the commonest reason for establishing surveillance systems. Under the ongoing Indian Integrated Disease Surveillance Project (IDSP), village and sub-centre level information is submitted once in a week from the "Register for Syndromic Surveillance". The information is transferred into "S" form for suspected cases. This approach precisely serves the intention of National Institute of Communicable Disease (NICD) to detect early warning signals of impending outbreaks and help initiate an effective response in a timely manner. The need to develop systems for immediate outbreak alerts is becoming overwhelming due to several emerging and re-emerging infections. It is not only new diseases and but spread of diseases in new geographic areas as well. Need to fight emerging and re-emerging infections is national and global priority. Experiences from the outbreaks in the recent past in the form of H1N1, SARS, Nipah, Denue, Chikungunya, Malaria etc. emphasis such need.

Technology leveraged appropriately can collapse the critical time gap and make syndromic surveillance system (SSS) near real- time activity. Electronic patient details and GIS applications facilitate emergency based syndromic surveillance. In particular, geographic information about the location of cases and their temporal evolution would be invaluable to those responsible for identifying and controlling an outbreak. Centre for Disease Control (CDC), USA has listed 911 – EMS calls and Emergency Department patient volumes as clinical sources for syndromic surveillance. The current focus on SSS is hence on real-time data collection, syndrome classification, dynamic spatial mapping, and query capabilities. At the international level, the field of syndromic surveillance is experiencing the convergence of practitioners and researchers from varied disciplines with a focus on integrating automation and human capacities to improve surveillance for public health threat. GVK EMRI and GEOMED Research collaboration regarding improvement of GIS based emergency health systems data utilization is a good example of this convergence. In the similar lines, the activities of International Society for Disease Surveillance (ISDS) have demonstrated some best practices in emergency data based syndromic surveillance.

No doubt, Good epidemiological science and good GIS go hand in hand in brining maximum good to humanity in epidemics and early warning systems by findings cost effective solutions in the near future which can be applicable even in low-resource settings and developing countries.

ORIGINAL RESEARCH ARTICLES

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

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ARTICLE

India is experiencing dual burden of communicable and non-communicable diseases. Though the transition is taking place with more incidence of chronic and life style diseases, the burden of communicable and infectious diseases are still high. Managing such high disease burden in India is a major challenge as accessibility and availability of a proper health care facility is still under-expectations. In a value chain of health care, the pre hospital care was the most neglected and disintegrated component as compared other two component viz. tertiary hospital care and rehabilitation. However with introduction of integrated Emergency Medical Services (EMS) in Andhra Pradesh through GVK Emergency Management & Research Institute (GVK EMRI), the pre hospital care in the health value chain gets strengthened. Though the EMS expects reporting of more number of life style and non-communicable diseases, the socio economic development plays a major role in the reporting of communicable and infectious diseases. The current study examines the demand pattern of EMS services for fever in three selected districts of Andhra Pradesh. Computer Telephony Integrated (CTI) data of GVK EMRI from April 2007 to March 2009 along with the results of a primary study conducted by GVK EMRI was used in the present study. Results showed that Share of communicable related emergencies was increased from 28.5 percent in 2007-08 (April2007-March 2008) to 42.9 percent in 2008-09 (April 2008-March 2009). Fever accounted for 11% of the total communicable/infection emergencies reported to GVK EMRI. Significant variation was noted in age and gender as far as the community prevalence and reporting of fever cases to GVK EMRI is concerned. Clustering of the demand was observed in low socio-economic development region whereas dispersed distribution of cases was seen in developed region through Geo-Spatial analysis. Considering the pattern of reporting and prevalence at the community level, data from EMS system in developing countries can be used enormously for health surveillance. Since GVK EMRI is currently operating in 10 states and planning to expand to other states under Public Private Partnership (PPP), Emergency data based syndromic surveillance could be established in major states which would be strengthening the existing surveillance system.

Key Words:

Emergency Medical Services, GVK EMRI, Infectious Diseases, Undifferentiated Fever and Geo-Spatial Temporal Analysis

Introduction

Despite the extraordinary advances of the 20th century, a significant component of the burden of illness globally still remains attributable to infectious diseases. The populations of developing countries and particularly the disadvantaged groups within those countries remain in the early stages of the epidemiological transition, where infectious diseases are still the major cause of death. Diarrheal disease, acute respiratory infections, malaria, measles and peri-natal conditions are still accounts for 21% of all deaths in low and middle income countries.1

India is experiencing dual burden of communicable and non-communicable diseases. Though the transition is taking place with more incidence of chronic and life style diseases, the burden of communicable and infectious diseases are still high. Mortality and disability in India is twice that of China and nearly three times higher than in developed countries. Looking at the disease adjusted life years (DALY), losses (268,953,000) of burden second only to that observed in Africa (325,198,000), a sizeable proportion of this burden is due to communicable diseases (50%) followed by Non-communicable diseases (33%) and injuries.2 Managing such high disease burden in India is a major challenge as accessibility and availability of a proper health care facility is still under-expectations. A study of GVK EMRI indicates that the demand for emergency services for communicable diseases in Andhra Pradesh has increased from 7% in 2006 to 29% in 2007 and further to 43% in 2008, mostly because of the expansion of the free service to rural and tribal areas.

Fever is a cardinal manifestation of illness and is a common clinical complaint. In the developing world, depending on locale, an undifferentiated fever may be called "dengue" or "malaria". Regardless of geographic context, however, most often the diagnosis of an undifferentiated fever is on the basis of clinical observation without precise documentation by laboratory, and treatment is symptomatic or specific antimicrobial therapy provided empirically3. Therefore reporting of cases like dengue fever or malarial fever does not have the reliability of the diagnosis.

In most developing countries malaria and other non-malarial diseases (such as dengue, leptospirosis, enteric fever, and Japanese encephalitis) present as acute undifferentiated fever and are major public health problems.4-7. In India diagnosis has been a major problem where the disease is reported with fever as the chief complaint. In central India majority of the cases (88%) had non-malarial acute undifferentiated fever, which were investigated for malaria8.

Demand for the treatment of undifferentiated fever varies significantly with age; treatment was sought in 0.87 day for less than 5 years old, 1.15 days for children aged 5-15 years and 1.41 days for adults9. In developing country reporting of the cases and the treatment seeking behavior is very poor, as most of the community is the disadvantage of accessing the health care both due to transportation and quality and desired health care.

A good EMS system in a developing country may help in increasing of the reporting of infectious diseases, which may be a huge advantage to strengthen the existing surveillance system. In view of the above, the current paper tried to analyze the demand pattern of fever cases being reported to GVK Emergency management Research Institute (GVK EMRI), country's first integrated EMS provider.

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Methods & Materials:

GVK Emergency management and Research Institute (GVK EMRI) is the only integrated emergency service provider in the state of Andhra Pradesh, India operating since August 2005. Data on socio-economic and demographic parameters of all the emergency calls related to undifferentiated fever cases received from three districts viz.Srikakulam, Anantapur and Guntur was procured from the Emergency Response Centre (ERC) of GVK EMRI, where the data is captured through Computer Telephone Integration (CTI) technology. The data was collected from April 2007 to March 2009 for the purpose of the current study. The study considered the period April 2007-March 2008 as year1 and April 2008- March 2009 was considered as year2. The data was taken from April 2007 as GVK EMRI operation was made available to the whole state from April 2007 onwards. The current study also used results of a community level household survey which was conducted by GVK EMRI during 15 December 2008 to 15 January 2009 to find out the prevalence of fever among the individuals of the households in the above mentioned districts of the state of Andhra Pradesh, India. The survey was based on a sample drawn on the basis of stratified systematic random sampling. The three districts were selected based on the level of infant mortality rate, female literacy, urbanization, proportion of reported cases of fevers/infections emergencies and proportion of the scheduled caste & scheduled tribes population to ensure a representative sampling units selected for the study. Data regarding morbidity status with respect to fevers (all types) collected with a reference period of three months preceding the survey by using a questionnaire in 408 households of different socio-economic demographic characteristics in 21 Primary Sampling Units (Villages/Urban wards). The sample population of the household survey in three districts was 2127. Of the total of 2127 individuals covered in the study, 1067 were male and 1060 were female. The study estimated the prevalence rate from the survey results and the reporting rate was estimated from the GVK EMRI data.

Analysis was carried out in SPSS 16. Tools like bi-variate tables, chi-square tests were used to draw inferences and Geographic Information Systems (GIS) maps were used to analyze the spatial and temporal demand pattern of fever cases.

Results:

The community survey result showed a prevalence rate of fever was 11.5% in the study population during three months preceding the survey. The prevalence rate was found to be higher in Srikakulam (16.7%) than Anantapur (12.2%) and Guntur (4.6%). Female were more vulnerable to suffer from fever as the prevalence rate was more (13.2%) than their counterparts where the prevalence rate was found to be 9.8%. (Table 1).

Table 1: Prevalence rate of Fever by Districts, Gender and Age.

Characteristic	Prevalence rate (%)
Districts	
Srikakulam	16.7
Anantapur	12.2
Guntur	4.6
Gender	
Male	9.8
Female	13.2
Age	
<5	13.6
5-14	12.2
15-24	10.2
25-34	10.3
35-44	12.7
45-54	12.4
55+	11.0
Total Prevalence Rate	11.5

Age wise prevalence revealed that the prevalence was higher for under-five children (13.6%) as compared to the other age group where the prevalence was less than 13%.

Table 2: Percentage distribution of different type of fever in the study population.

Type of Fever	Srikakulam (%)	Anantapur (%)	Guntur (%)	Total (%)
Acute Undifferentiated Fever	72	81	74	76
Malaria	18	09	04	12
Typhoid	08	02	07	06
Chikun Gunya	00	02	04	01
Dengu Fever	04	05	11	05
Total	100	99	100	100

The study result revealed that most of the prevalent cases are acute undifferentiated fever (76%), where as 12% of the total fever cases was malaria, 6% typhoid and 5% was dengue fever. Although there were no significant variation in the proportion of different type of fever in the study districts, Anantapur exhibits a very high proportion of acute undifferentiated fever (81%). (Table 2)

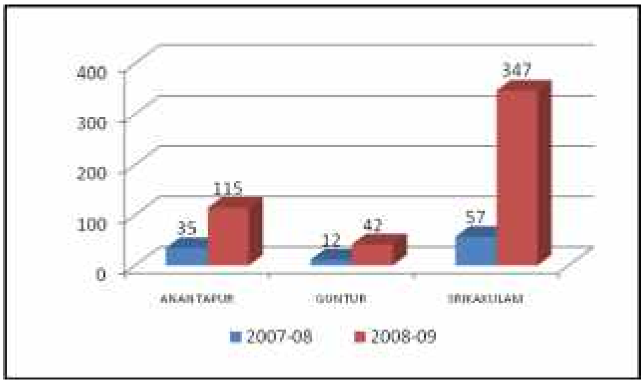
As far as the reporting of the fever cases to GVK Emergency Management and Research Institute (GVK EMRI) is concerned, all the cases were assumed to be the Acute Undifferentiated Fever (AUF) as the case diagnosis data is outside the scope of the current data used in the research work. The total demand for emergency services for AUF in Andhra Pradesh has increased by more than five times in April 2008- March 2009 (Year2) as compared to the demand for the same in April 2007- March 2008 (Year1). In contrast the demand for all medical emergencies has gone up only by 2.5 times during this period indicating the service was being demanded and utilized increasingly for infectious disease like AUF.

Table 3: Percentage share of AUF in total medical emergencies reported in Srikakulam, Anathpur and Guntur during 2007-08 and 2008-09.

Districts	% share of AUF in total Medical Emergencies reported	
	2007-2008	2008-2009
Srikakulum	6.2	14.8
Anantapur	4.1	6.7
Guntur	1.8	3.1

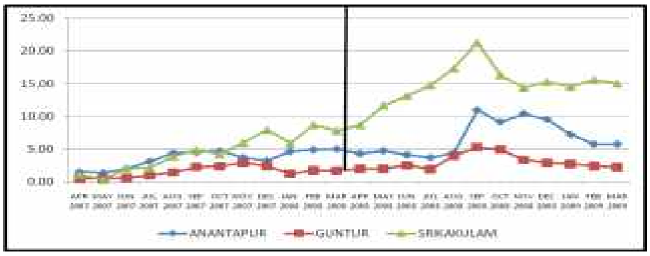
The share of AUF was found to be more in Srikakulam (6.2%) in 2007-08 as compared to Anantapur (4.1%) and Guntur (1.8%). The same trend continued in the year 2008-09, but a higher share (Table 3). The numbers of AUF cases have increased around 250% in Anantapur and Guntur during 2008-09 as compared to 2007-08, where as it has increased by more than 500% in Srikakulam during this time period. Again the reporting of AUF have gone up significantly for the all these three districts. However the degree of variation in the growth rate varied significantly in the three districts. (Figure 1)

Figure 1: Reporting of AUF per one lakh population in Anantapur, Guntur and Srikakulam.



There had been a marked seasonal variation in the reporting of AUF to GVK EMRI. The pattern of demand for the emergency services for AUF in the three districts showed that the demand had gone up during the months of post monsoon (Aug-November). The proportion of AUF cases in the total medical emergencies has been increasing consistently since April 2007 indicating more concern of the community regarding the infectious disease like AUF. However the degree of demand for the emergency services for AUF has been significantly different in the three districts included in the study. (Figure 2)

Figure 2: Seasonal Variation in the reporting of AUF in Anantapur, Guntur and Srikakulam.



The sudden spike in the demand for the services for AUF in Anantapur during August-September 2008 indicated a possible outbreak of some epidemic where the chief complaint was fever. Analysis of such trend provides a clue to investigate further to identify reasons behind such high reporting.

Though it was noted that the demand for the emergency services for infectious disease like AUF has gone up significantly in a matter of two years, it is important to study the spatial distribution of demand in the three districts. Such analysis indicates the clustering of the incidence of such disease which further signifies the vulnerability of a particular geographic area for outbreak of any epidemic.

The analysis showed that during 2007-08, a very few number of cases being reported from each district. The distribution of clustering of cases was more or less uniform in all the three districts. However there was a distinct variation in the distribution in the following year with more number of AUF cases being reported from more number of mandals in Srikakulam district than Anantapur and Guntur district. In the year 2008-09, 98.2% mandals reported only less than 100 AUF cases in Guntur. This proportion is 81% in Anantapur and 22% in Srikakulam. On the other hand, 30% mandals in Srikakulam reported more than 300 cases of AUF each in the year 2008-09 where as not a single mandal in Anantapur and Guntur reported more than 300 cases during the same period. (Table 4).

Table 4: Percent distribution of mandals according to the number of reported cases of fevers in three districts, Andhra Pradesh.

Range	Srikakulam N (%)	Anantapur N(%)	Guntur N(%)
No. reported cases(April 2007-March 2008)			
1-9	00 (0.0)	23 (37.7)	29 (54.7)
10-19	12 (33.3)	12 (19.7)	16 (30.2)
20-29	05 (13.9)	10 (16.4)	05 (9.4)
30+	19 (52.8)	16 (26.2)	03 (5.7)
No. of Mandals	36 (100.0)	61 (100.0)	53 (100.0)
No. reported cases (April 2008-March 2009)			
1-99			
100-199	08 (21.6)	51 (81.0)	56 (98.2)
200-299	12 (32.4)	07 (11.1)	01 (1.8)
300+	06 (16.2)	05 (7.9)	00 (0.0)
	11 (29.8)	00 (0.0)	00 (0.0)
No. of Mandals	37 (100.0)	63 (100.0)	57 (100.0)

The concentration of AUF cases was more severe in Srikakulam than in Anantapur and Guntur. The spatial analysis through GIS clearly indicated that in Srikakulam there were three major clusters where the AUF posed a major health problem, where as the southern part of Anathpur district to some extent forming a cluster. However there were no such clusters formed in the districts of Guntur. (Figure 3,4 and 5)

The following were the clusters in Srikakulam where AUF was a major problem;

Cluster	Position of the District
Tadpai, Somagandi,Pedduru, Haddubhangi	North-Western
Goda, Padda, Meliputti	North
Sompeta, Kaiti, Ichhapuram	East

Figure 3: Spatial distribution of AUF reported to GVK EMRI from Srikakulam during 2007-8 and 2008-09.

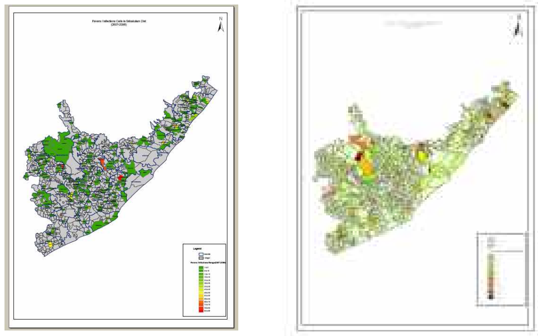


Figure 4: Spatial distribution of AUF reported to GVK EMRI from Anantapur during 2007-8 and 2008-09.

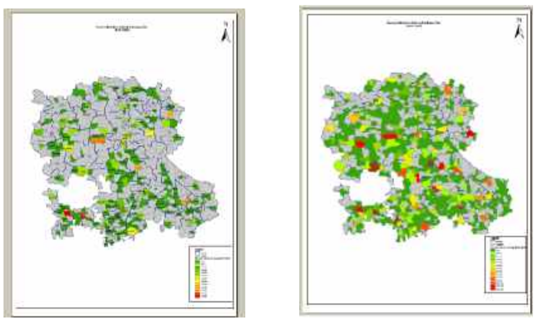


Figure 4: Spatial distribution of AUF reported to GVK EMRI from Anantapur during 2007-08 and 2008-09.

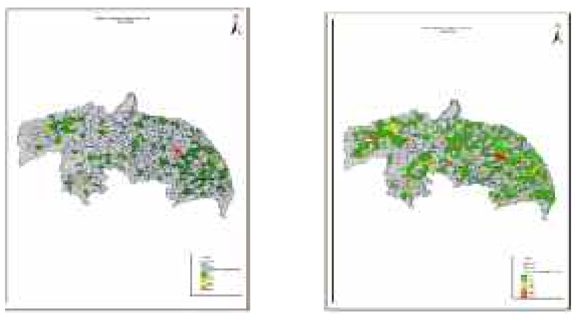


Table 5: Percent distribution of reported cases of fevers by demographic and socio-economic variables, three districts of Andhra Pradesh.

Characteristic	Srikakulam (%)	Anantapur (%)	Guntur (%)	Total (AP) (%)
Age Group				
<5	8.0	7.3	8.3	7.8
5-14	12.0	6.3	6.1	9.6
15-24	18.2	14.2	15.6	16.7
25-34	18.5	22.6	19.3	19.8
35-44	18.6	17.3	17.4	18.1
45-54	12.1	14.3	12.8	12.8
55+	12.7	18.0	20.4	15.2
Gender				
Male	55.8	58.9	58.6	57.0
Female	44.2	41.1	41.4	43.0
Social Status				
Backward Class	54.3	51.0	28.1	50.0
Scheduled Caste	12.4	22.8	43.1	19.2
Scheduled Tribe	29.7	9.7	6.5	21.2
Others	3.6	16.4	22.3	9.6

Discussion:

The community study by GVK EMRI established higher prevalence rate of fever in the Srikakulam than in Anantapur and Guntur. Socio-economic development plays a major role in the prevalence of infectious disease like fever. An important socio-economic factor for both diarrhoea and fever morbidity was parental education, especially maternal educational attainment10. The female literacy rate in Srikakulam was 43% as against 53% in Guntur11.A composite index based on 13 socio-economic and demographic parameters indicate that Srikakulam is the least developed district after Mahaboobnagar, where as Anantapur was ranked at 11 and Guntur at 812. Prevalence and reporting must follow the same trend in order to relyon the database for any kind of community level health surveillance. The reporting of the fever cases to GVK EMRI followed almost the same trend as the community level survey on prevalence rate of fever. A correlation co-efficient of 93% (p>0.05) was noted between the proportion of AUF cases in the total medical emergency and the prevalence rate of fever in the community. Results in the current study revealed that the reporting of AUF increased significantly during the post monsoon period. Quantum of rainfall may have an impact on the incidence and reporting of AUF. The annual normal rainfall in Srikakulam were recorded much higher (1162 mms) as compared to Guntur (714 mms) and Anantapur (407mms) 11. Therefore rainfall may be a predictor in the demand of emergency medical services for AUF. However this requires further investigation.

The study revealed that there was a significant difference in the prevalence rate of fever among females than that of males. Earlier research in the present geographical study area revealed that the chance of being suffered by waterborne diseases in females was more when compared to males in areas both covered and not covered by the water supply project13. Comparisons of the morbidity of men and women in the same households usually show female morbidity to be higher, possibly due to lack of health care. Differential morbidity by gender is partly due to the different health hazards to which men and women are exposed14. The present study indicated that 57% of the victims reporting to GVK EMRI for fever were male victims. Therefore demand for the emergency medical service from female victims with fever still remains at a lower level. Chihiro K et al. reported that when facing no serious situation, male were more likely would call an ambulance than the female15.

The present study found that proportion of victims reporting to GVK EMRI for emergency services for fever were more for age group of more than 25 years victims than the proportion of prevalent cases in the same age group. Again it was also found that demanding of emergency services from GVK EMRI increases with age. Elderly persons would tend to call an ambulance more than the younger persons and age influenced the hypothetical ambulance call rate linearly15.

Conclusion:

The demand for emergency medical services for acute undifferentiated fever was highly influenced by the prevalence of this disease. Although infectious diseases like fever do not often require emergency medical services, due to the low socio-economic development and high burden of communicable diseases the demand of emergency medical services for fever was found to be very high in the study area A significant variation was observed in age of the victim in demanding of such service and the prevalence rate, as demand was more from adult age group than the child and adolescent group. Similar variation was also found in gender. Clustering of the demand was observed in low socio-economic development region whereas dispersed distribution of cases was observed from developed region. Considering the pattern of reporting and prevalence at the community level, data from EMS system in developing countries can be used enormously for public health surveillance

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ORIGINAL
RESEARCH ARTICLE

Exploratory Study of Syndromic Surveillance data for stratification of symptoms and diseases in Andhra Pradesh

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ABSTRACT

The Integrated Disease Surveillance Project (IDSP) was launched with the primary aim of detecting early warning signals of impending outbreaks and facilitates the initiation of an effective response in a timely manner. The IDSP data obtained from the State Surveillance Unit during a one year period (December2007-December2008) was analyzed with the aim of showing the region wise distribution of symptoms and the relationship between symptom and disease in the 23 districts of AP. Time Trends, Regionality, endemicity of diseases or syndromes, region-wise distribution of symptoms and the relationship between symptoms and diseases from 16,570 health care centers and laboratories all over Andhra Pradesh, for the period December 2007-December 2008, were analyzed. The results indicated that the proportion of fever was the highest in the Rayalseema region and the proportion of cough was the highest in the Telangana region. The highest number of fever and jaundice cases occurred in the district of Vizianagaram. Correlation was used as the measure of association between symptoms and disease. A significant positive correlation (p<0.05) was found between fever (> 7days) and jaundice, fever with bleeding and dengue, cough (<3weeks) and Tuberculosis (TB) positives, fever (>7 days) and typhoid positives, jaundice and hepatitis B, overall fever and malaria positives and fever (<7 days) and malaria positives. The conclusions of the study were that fever was continuously high in all the districts, the highest number of cases of jaundice occurred in the district of Vizianagaram, the rate of overall fever ranges from 19% to 54% and the rate of cough ranges from 2.43% to 6.51% and that there was a significant positive correlation between certain symptoms and diseases.

Keywords: *Symptoms, Syndromes, Endemicity, Disease, Time-Trends*

Introduction

The Integrated Disease Surveillance Project (IDSP) is a state-based passive surveillance program in India that was launched by the Government of India (GoI) with assistance from the World Health Organization in 2004[1]. Early detection of impending outbreaks and initiation of a timely response, monitoring progress of existing disease control programs and optimal allocation of health resources are the foremost goals of IDSP. Andhra Pradesh (AP) is a state in the southern part of India with an estimated population of 76 million[1]. The state has three regions (Telangana, Rayalaseema and coastal Andhra) that are further divided into 23 districts (10, 4 and 9 districts respectively in the three regions). The Telangana region consists of ten districts of Adilabad, Karimnagar, Warrangal, Khammam, Nalgonda, Mahboobnagar, Medak, Nizamabad, Hyderabad and Rangaredyy. The Rayalseema region consists of 4 districts viz. Kurnool, Ananthapur, Kadappa and Chithoor. Rest of the nine districts viz. Srikakulum, Vijaynagaram, Vishakapatnam, East Godavari, West Godavari, Krishna, Guntur, Prakasham and Nellore are covered under Andhra region [1].

The Andhra Pradesh (AP) state unit of IDSP, which began its functioning in the first phase of IDSP, receives surveillance reports from various health units (primary to tertiary) in the state on a weekly basis, every succeeding Monday. These reports are submitted using paper forms that are handed in by the health workers. Sub-centers, staffed by a health care worker (first point of contact between the community and the public health care system), in villages that cover a population of about 5,000; Primary Healthcare Centres (PHC), which cover 4-6 sub-centers and provide the initial contact for the communities with a Medical Officer (MO), covering a population of 30,000 at the village level; and Community Health Centres (CHC), offering specialist and secondary care of services, located in semi-urban areas, covering a population of about 100,000 are the 3 levels of reporting units which turn in weekly reports to the District Surveillance Units (DSU). DSU's collect the aggregated reports and then relay seamlessly the weekly reports to the State Surveillance Units (SSU). In addition to these, there are government and private hospitals as well as dispensaries located in urban areas[1].

Under the IDSP, data are collected in three formats – S (suspected cases from syndromic surveillance), P (presumptive cases), and L (laboratory cases). Information on the S-form is provided by the health workers at the sub-centre level in a village. The S-form includes information on fever lasting less than 7 days (with or without rash, bleeding, daze or unconsciousness), fever lasting over 7 days, cough (less than or greater than 3 weeks), loose watery stools (with or without blood in stools), jaundice, acute flaccid paralysis, unusual symptoms leading to death or hospitalization and death.

Under IDSP, the Health Workers, AWW Village Volunteers and Non-formal Practitioners conduct syndromic surveillance. The health worker in-charge of disease surveillance maintain 'Register for Syndromic Surveillance' at the sub-centre level and extract data from the register on a weekly basis to enter into Form S. Form S is provided in triplicate. The first and second pages of Form S (colors Yellow and Green respectively), to be given to the Medical Officer of the supervising PHC. The third page (Blue) is retained by the Health Worker. The variables on which information is collected are district name, fever (subdivisions), cough (subdivisions), loose watery stool (subdivisions), jaundice, acute flaccid paralysis cases and death. The Health Worker first writes the State, District, Block names and the calendar year. He then writes his/her name and Name of the Supervisor. Under the 'Name of the Reporting Unit', he/she fills in the name of his/her sub-center. District Surveillance Unit then assigns the Unique Identifier or ID No given to each reporting unit. The Health Worker fills the information on reporting week by copying the information from the 'Register for Syndromic Surveillance[2].

The objective of the study is to determine the frequency of incidence, of various symptoms such as cough, fever and diarrhoea in the 23 districts of Andhra Pradesh for the period of December 2007 to December 2008 and to assess the impact of seasonality on the frequency of symptoms recorded in IDSP.. The study also tries to establish a relationship between symptoms and disease to know the symptoms that accompany frequently occurring diseases.

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Materials and Methods:

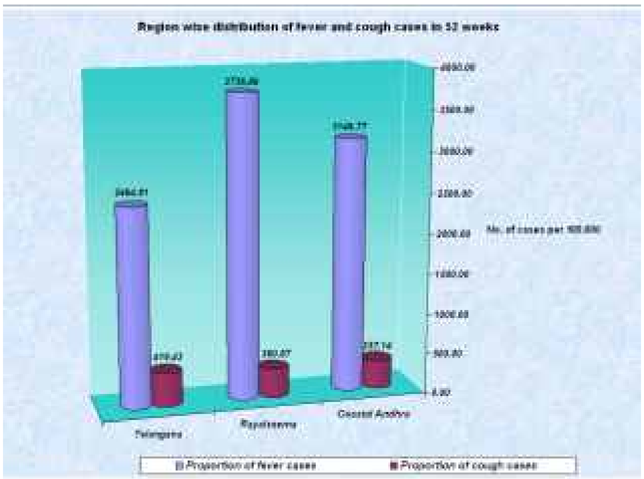
Weekly surveillance data under the IDSP from the entire state during a 52-week period (December 2007 to December 2008) were explored for consistency and frequency of reporting from all the districts. The state level consolidated S, P and L forms, received from the 23 District Surveillance Units (DSU's), were analyzed for completeness of reporting, frequencies and time trends of the reported syndromes and diseases. The units for analysis were the 23 districts and the three geographical regions of coastal Andhra, Telangana, and Rayalaseema. Form S, which is the reporting format for syndromic surveillance, is submitted by the health worker based on the information from the 'Register for Syndromic Surveillance', which is kept at the sub-center level. The information in the registers of the Angan Wadi Worker (AWW), village volunteers and non-formal providers were also transferred to the S-form, at the sub-centre level.

Data from the S forms was analyzed to determine the region-wise distribution of symptoms mentioned in the S forms. The relationship between symptom and disease was also analyzed. Statistical software programs like SAS and R were used to conduct the exploratory data analysis.

Results :

Highest proportion of fever cases (3736.86 cases per 100,000) was found in the Rayalseema region followed by coastal Andhra (3146.77 cases per 100,000) and Telangana (2464.81 per 100,000) (Figure 1).

Figure 1: Region-wise distribution of fever and cough cases in 52 weeks in Andhra Pradesh, December 2007-December 2008



The highest rate of fever cases was seen in the district of Vizianagaram followed by Cuddapah and Srikakulum (Figure 2). Vizianagaram (406 per 100,000) and Visakhapatnam (227 per 100,000) were found to be districts with higher of jaundice cases in the 52 weeks (Figure 3). As seen in Figure 4, the highest number of jaundice cases was seen in the month of November and March. Figure 5 shows that, high incidence of fever cases was accompanied by a corresponding increase in the incidence of malaria in the 23 districts of Andhra Pradesh for the period December 2007 to December 2008. Figure 6 shows that there was a substantial increase in the number of cough cases as the number of cases of Tuberculosis increase over the 52 weeks in the period December 2007-December 2008. Figure 7 shows that as the number of fever cases increased, there was a corresponding increase in the number of typhoid cases in the study period of December 2007 to December 2008.

Figure 2: District-wise rate of fever and cough in Andhra Pradesh, December 2007-December 2008

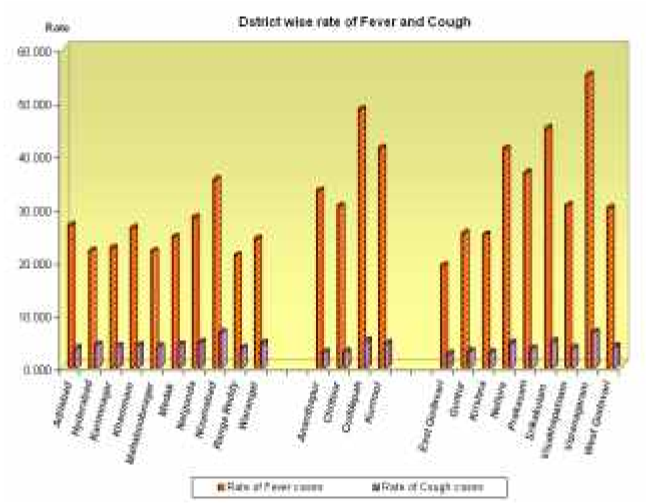


Figure 3:District-wise distribution of jaundice cases in 52 weeks in Andhra Pradesh, December 2007-December 2008

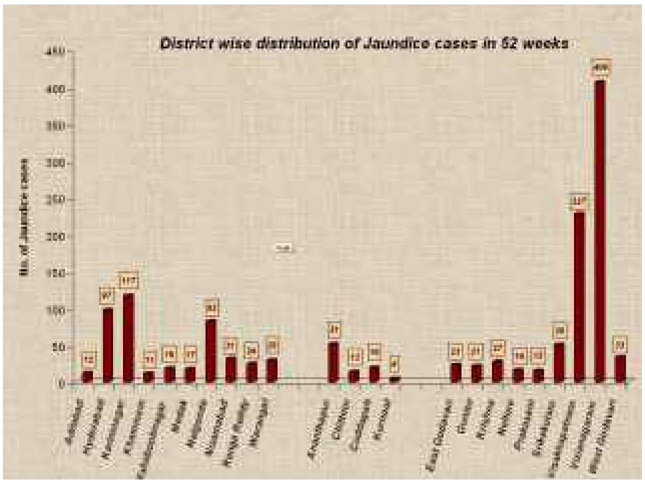


Figure 4:Month-wise distribution of jaundice cases in 52 weeks in Andhra Pradesh, December 2007-December 2008

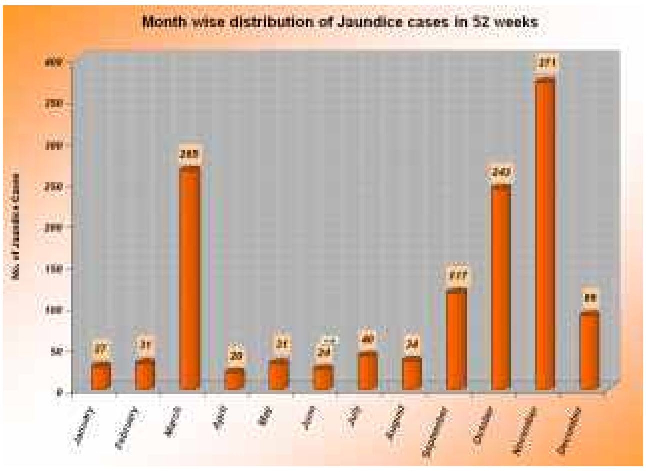


Figure 5: Distribution of malaria and fever in 52 weeks in Andhra Pradesh, December 2007-December 2008

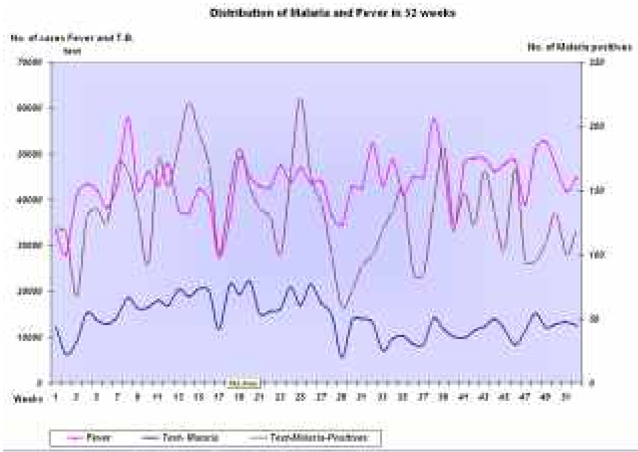


Figure 6: Distribution of cough and TB in 52 weeks in Andhra Pradesh, December 2007-December 2008

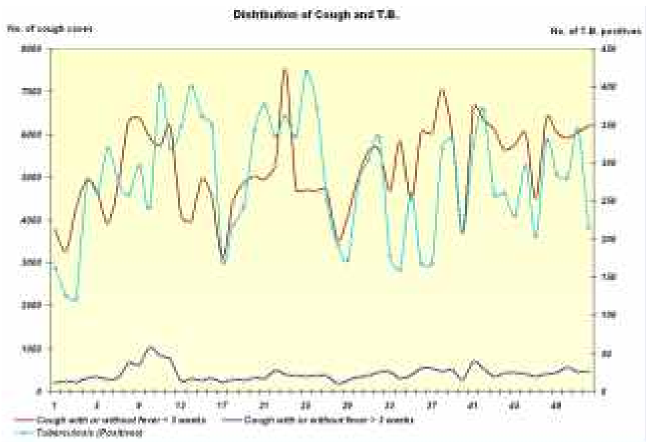


Figure 7: Distribution of typhoid and fever in 52 weeks in Andhra Pradesh, December 2007-December 2008

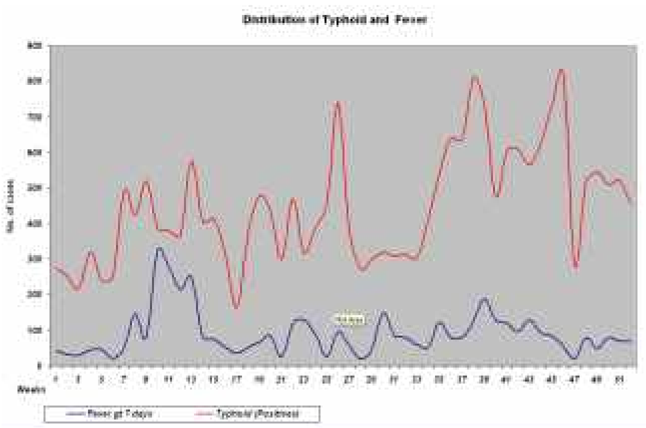


Figure 8:Distribution of fever with bleeding and dengue in 52 weeks in Andhra Pradesh, December 2007-December 2008

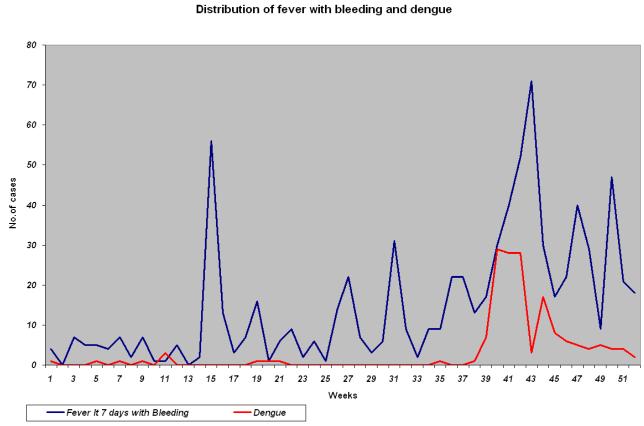


Figure 9:Relationship between jaundice and fever greater than 7 days in 52 weeks in Andhra Pradesh, December 2007-December 2008

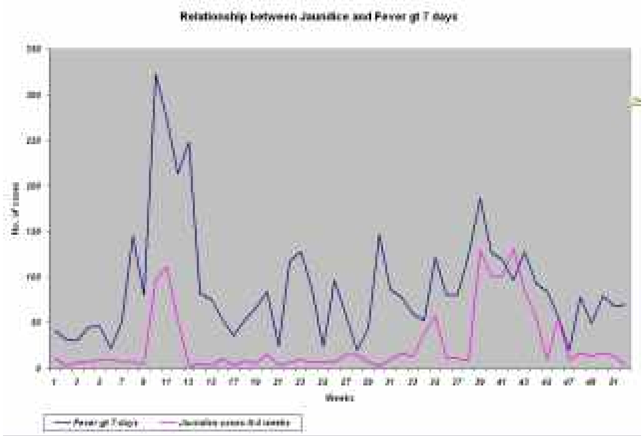


Figure 8 shows that an increase in the incidence of fever (less than 7 days) with bleeding was accompanied by an increase in the incidence of dengue cases in the state of AP for the period December 2007 to December 2008. Figure 9 shows that as the incidence of fever (greater than 7 days) increased, the incidence of jaundice cases also increaseed. As shown in Table 1, a significant positive correlation was found between malaria and fever (r=0.143, $p < 0.05$) and between cough (<3 weeks) and TB positives (r=0.313, $p < 0.05$).

Table 1: Correlation between symptoms and diseases in the state of Andhra Pradesh, December 2007-December 2008

Symptoms and Diseases	Correlation Coefficient	*p value*
Fever with bleeding and Dengue	0.503	*p* value < 0.05
Cough < 3 weeks and TB positives	0.313	*p* value < 0.05
Fever > 7 days and Typhoid positives	0.261	*p* value < 0.05
Jaundice and Hepatitis B	0.19	*p* value < 0.05
Overall fever and Malaria positives	0.143	*p* value < 0.05
Fever < 7 days and Malaria positives	0.128	*p* value < 0.05

A significant positive correlation was also found between fever greater than 7 days and typhoid positives (r=0.261, $p < 0.05$) and between fever less than 7 days and Malaria positives (r=0.128, $p < 0.05$) (Table

1). As shown in Table 1, there was a significant positive correlation between fever with bleeding and dengue ($r=0.503$, $p < 0.05$), between Jaundice and Hepatitis B ($r=0.190$, $p < 0.05$) and between jaundice and fever greater than 7 days ($r=0.552$, $p < 0.05$).

Discussion:

The IDSP reporting network covers the entire population and receives reports from interior and hard-to-reach areas of the state of AP. This study presented surveillance data over a 52-week period (December 2007 to December, 2008) from AP, the southern state in India. Typhoid, tuberculosis and malaria were the main public health concerns in the state during the study period. Proportion of fever was the highest in Rayalseema region and proportion of cough was the highest in the Telangana region. The highest proportion of fever cases occurred in the district of Vizianagaram in 52 weeks. This could be due to the fact that the reporting frequency is high in the district of Vizianagaram. In order to obtain a realistic estimate of the incidence of symptoms, the reporting frequency must improve in each of the 23 districts. The highest number of jaundice cases was seen in the district of Vizianagaram. The highest number of jaundice cases occured in the month of November, followed by March and then in October. This shows the effect of seasonality on the incidence of jaundice cases and hence appropriate control and prevention measures must be enforced in the months of October, November and March to control the seasonal outbreak of symptoms.

Fever and cough were commonly reported symptoms in the state. The incidence of fever was 2464.81, 3146.77 and 3736.86 per 100,000 and the incidence of cough was reported to be 419.43, 357.14, and 360.87 per 100,000 in (Figure 4) in the Telangana, Coastal and Rayalaseema regions respectively. Fever was cconsistently high throughout the year. The rate of overall Fever ranges from 19% to 54% and rate of Cough ranges from 2.43% to 6.51% in A.P. Hence suitable and timely action must be taken by the health workers to control the symptoms of fever and cough in the state of Andhra Pradesh.

The correlation between symptoms and specific diseases obtained by combining data from the S- and L-forms (Table 1) ranged from 0.128 (for fever less than 7 days and malaria confirmation by laboratory testing) to 0.503 (for fever with bleeding and dengue). One of the limitations of the study were the inconsistent reporting rate ,inconsistent reporting of diseased cases and no account of the factors causing the symptoms. Thus, the need of the hour, is to enhance and strengthen, the quality of reporting of the S forms in terms of the frequency, completeness and timeliness. Accuracy and reliability is required at the data collection, compilation and analysis stages as well. Improved reporting frequency can be achieved by training the health workers at the dub-centre level about the importance or frequent, timely and complete reporting to the public health system in India. Capacity-building of health workers at the grass root level can greatly enhance the quality of health programs and services in India.

Conclusions:

Fever was found to be consistently high in all the districts of AP. The rate of overall fever ranges from 19% to 54% and the rate of cough ranges from 2.43% to 6.51% in the state of AP. The district of Vizianagaram had the highest number of fever and jaundice cases. Though There was a week correlation between disease and symptoms like malaria and fever, tuberculosis and cough, typhoid and fever, fever with bleeding and dengue and jaundice and fever, all relationship was found to be statistical significant . Hence appropriate control and preventive measures must be implemented in the state of Andhra Pradesh (AP), to control and prevent the incidence of symptoms. Seasonality also influenced the appearance of symptoms with the highest number of cases of jaundice occurring in the month of November. Consistency in the reporting format of the S forms as well as investigating the factors causing the symptoms will strengthen the surveillance system. Capacity building of the health workers is required in order to equip them with the necessary technical, communication and interpersonal skills to meet the current public health needs and demands and to enhance the public health system and delivery of health services in the state of Andhra Pradesh.

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Reporting pattern in Integrated Disease Surveillance Project (IDSP) in Andhra Pradesh

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ABSTRACT:

The Integrated Disease Surveillance Project (IDSP) is a decentralized, state based surveillance program in the country. It is intended to detect early warning signals of impending outbreaks and help initiate an effective response in a timely manner. Data collected under IDSP would also provide a rational basis for decision-making and implementing public health interventions. IDSP data obtained from the State Surveillance Unit during a one year period (December 2007-December 2008) was analyzed with a goal to quantify the reporting frequency of various District Surveillance Units (DSUs) and address the information generation gaps that exist in the State Surveillance Unit of Andhra Pradesh (AP). The frequency of completeness in the reporting of the S, P and L weekly surveillance reports, received from 16,570 health care centers and laboratories all over the state of Andhra Pradesh, for the period December 2007-December 2008, were analyzed. The mean proportion of reporting in AP, from all the 16,570 weekly reporting units for syndromic surveillance (S-forms), presumptive surveillance (P-forms), and laboratory (L-1), L2 and L3 reporting formats, was 58.2% (18.6). The mean (SD) of the P, S, L1, L2and L3 reporting forms were 48.73% (16.25), 50.42% (16.76), 46.8 % (20.17) and 87.4 % (22.32) respectively. A consistent 50% reportage for P forms, S and L1 reports were observed in only less than districts. Efforts should be made to ensure comprehensive reporting from all the health units in the state.

Key Words:

Outbreaks, Syndromes, Disease, Surveillance, Health

Introduction

Integrated Disease Surveillance Project (IDSP) was launched by Hon'ble Union Minister of Health & Family Welfare in November 2004. It is a decentralized, State based Surveillance Program in the country. It is intended to detect early warning signals of impending outbreaks and help initiate an effective response in a timely manner. Major components of the project are : (1) Integrating and decentralization of surveillance activities; (2) Strengthening of public health laboratories; (3) Human Resource Development – Training of State Surveillance Officers, District Surveillance Officers, Rapid Response Team, other medical and paramedical staff; and (4) Use of Information Technology for collection, collation, compilation, analysis and dissemination of data.

Under IDSP data is collected on a weekly (Monday–Sunday) basis. The information is collected on three specified reporting formats, namely “S” (suspected cases), “P” (presumptive cases) and “L” (Laboratory confirmed cases) filled by Health Workers, Clinician and Clinical Laboratory staff. The S-form includes information on fever lasting less than 7 days (with or without rash, bleeding, daze or unconsciousness), fever lasting over 7 days, cough (less than or greater than 3 weeks), loose watery stools (with or without blood in stools), jaundice, acute flaccid paralysis, unusual symptoms leading to death or hospitalization and death. Presumptive surveillance based on the probable medical diagnoses of the presenting symptoms, provided by medical officers at the primary health centres, district hospitals, private hospitals at the district or sub-district levels and private medical practitioners is reported on the P-form. The P-form includes information on cases with a presumptive diagnosis of measles, Japanese encephalitis, typhoid, cholera, hepatitis, polio – all of which are Vaccine preventive diseases (VPD), dengue and other locally relevant and endemic diseases, and also on unusual symptoms leading to death or hospitalization[1].

The L-forms provide laboratory data. The L-1 form contains information from peripheral laboratory and microscopic centers. The L-2 and L-3 forms provide data from the district and state-based laboratories respectively. The L-1 form includes information on the number of tests done and the number who tested positive for laboratory diagnosis of malaria (falciparum and vivax), tuberculosis (sputum for acid fast bacilli) and typhoid dot test[2].

The weekly data gives the time trends. Whenever there is a rising trend of illnesses in any area, it is investigated by the Medical Officers/Rapid Response Teams (RRT) to diagnose and control the outbreak. Data analysis and action are being undertaken by respective districts. Emphasis is being laid on reporting of surveillance data from major hospitals both in public and private sector and also hospitals specifically dealing with Infectious Disease. The compilation and disease outbreak alerts has been started recently. On an average 10-15 outbreaks are reported every week to Central Surveillance Unit, IDSP[3].

The aim of the current study was to summarize the information flow in the IDSP in the state of AP during a one year period from December 2007 to December 2008.

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Methodology :

Weekly surveillance data under the IDSP from the entire state during a 52-week period (December 2007 to December 2008) were explored for consistency and frequency of reporting from all the districts of Andhra Pradesh. The state level consolidated S, P and L forms, received from the 23 District Surveillance Units (DSU's), were analyzed for completeness of reporting, frequencies and time trends of the reported syndromes and diseases. For the purpose of the current study, information flow was analyzed for 23 districts and the three geographical regions of coastal Andhra, Telangana, and Rayalaseema. Form S, reporting format for syndromic surveillance, is submitted by the Health Worker (HW) based on the information from the 'Register for Syndromic Surveillance', which is kept at the sub-center level. The information in the registers of the Angan Wadi Worker (AWW), village volunteers and non-formal providers were also transferred to the S-form, at the sub-center level. Presumptive surveillance, the surveillance of diseases based on the probable medical diagnosis of the presenting syndrome(s), is conducted and submitted by the Medical Officers (MO's) at the Primary Health Centers (PHC's), Community Health Centers (CHCs), district hospitals, private hospitals at the district or sub-district level and private medical practitioners. The analysis included laboratory data reported on the L-1 form by the peripheral laboratories which handle microscopic examination of sputum, blood smears and the 'typhoid dot' test.

Data from P forms & L forms was combined and analyzed to find correlation between 'presumptive cases reported from the health centers and hospitals' and 'laboratory confirmed cases during the same time period'. Similarly, data from S forms & L forms was combined and analyzed to find correlation between 'suspected cases reported from the health sub-centers' and 'laboratory confirmed cases during the same time period'. Exploratory Data Analysis (EDA) in this study was done using SAS (Version 9.1) and R statistical software programs..

Results :

The mean proportion of reporting (and SD) for the S, P, L1, L2 and L3 reporting formats, from all the 16,570 reporting units, in Andhra Pradesh was 58.2% (18.6).. The mean (SD) of the P, S, L1, L2and L3 reporting forms were 48.73% (16.25), 50.42% (16.76), 46.8 % (20.17) and 87.4 % (22.32) respectively. The change in the mean monthly proportion of P, S and L1 forms was found to be positive in December 2008 as compared to December 2007 (43.8 to 47.8, 40.8 to 58.2, and 34.7 to 58.4 respectively). The over all increase in the reporting of L1 from was found to be 23.7% followed by the reporting of S from (17.4%) and P form (4%) during the period from December 2007 to December 2008.. In case of P form, the lowest reporting was found in Adilabad (19%) and the highest reporting was found in Vizianagaram (75.6%). RangaReddy and Guntur (20.2% and 92.1%) were the districts found to be the least and most reporting of S form and Mahabubnagar and Vizianagaram (13.3% and 90.1%) were the least and most reported districts for L1 form. The mean reporting frequency of the S (Suspected Cases) form for the 23 districts of Andhra Pradesh in the year December 2007-December 2008 was 47.69% with the minimum reporting percentage being zero and the maximum being 97.96%. The highest reporting frequency of the S (Suspected Cases) form for the period of December 2007-December 2008 was seen in the districts of Hyderabad and Guntur (Figure 1). The lowest reporting frequency of the S form was seen in the districts of Rangareddy, Medak and Adilabad.. The mean reporting percentage of the P (Presumptive Cases) form for the 23 districts of Andhra Pradesh (AP) for the period of December 2007-December 2008 was 53.74% with a minimum reporting percentage of zero and a maximum reporting percentage of 100%. The highest reporting of the P form in the year December 2007-December 2008 was seen in the districts of Hyderabad, Guntur and Cuddapah (Figure 2). The lowest reporting of the P (Presumptive Surveillance) form was seen in the districts of Adilabad, Medak and Nizamabad. The mean reporting percentage, of the L (Laboratory) form for the 23 districts of AP for the period of December 2007 to December 2008 was 46.12% with a minimum reporting percentage of zero and a maximum reporting percentage of 100%. The highest reporting frequency of the L (Laboratory forms), was seen in the districts of Vizianagaram, Srikakulum and Hyderabad. The lowest reporting frequency of the L(Laboratory) forms in the 23 districts of AP during the period of December 2007 to December 2008 was seen in the districts of Khammam, Medak and Rangareddy (Figure 3).

Hyderabad and Vizianagaram were found to be more consistent in reporting through all the three forms. Kurnool, Adilabad and Ranga Reddy were found to be low reporting of all the three forms. Districts in the coastal region reported consistently above 45% and had higher rates as compared to other regions in the state. There appeared to be a modest increase in reporting towards the end of the year. There was no seasonal variation in reporting rates of any of the forms (Figure 1, 2 and 3). March and June 2008 showed a dip in the reporting formats across all the three reporting formats.

Figure 3: Reporting Frequency of the Syndromic Surveillance Form in the 23 districts of Andhra Pradesh, December 2007-December 2008

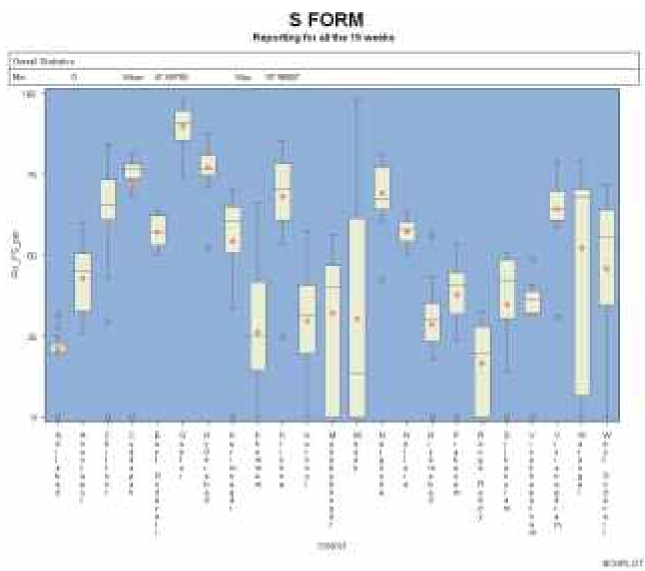


Figure 2: Reporting Frequency of the Presumptive Surveillance Form in the 23 districts of Andhra Pradesh, December 2007-December 2008

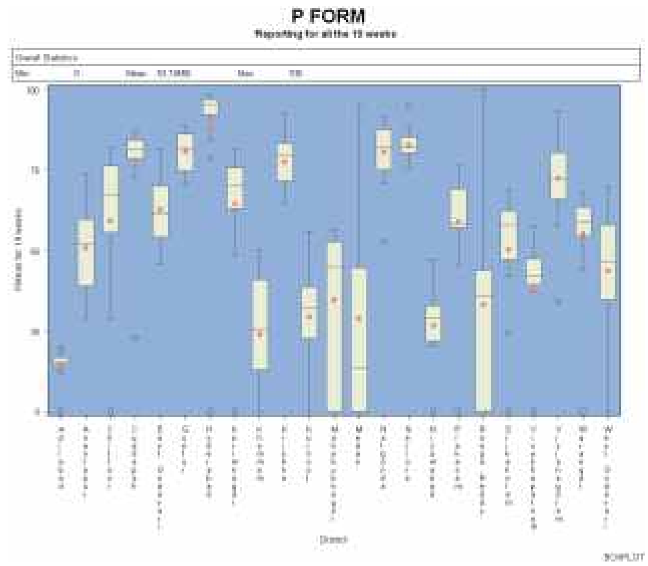
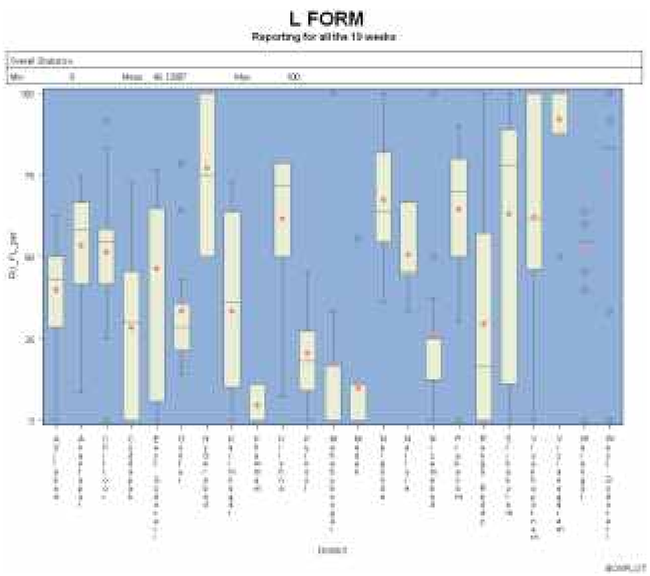


Figure 3: Reporting Frequency of the Laboratory Surveillance Form in the 23 districts of Andhra Pradesh, December 2007-December 2008



Discussion:

Higher reporting of S (suspected) forms of more than 75% was seen in the districts of Cuddapah, Guntur and Hyderabad (75%, 77% and 90%) respectively. An average reporting of around 60% was seen in the districts of Chittor, East Godavari, Karimanagar and Nellore. A very low reporting of the S forms of less than 30% was seen in the districts of Adilabad, Khammam, Medak, Mehbubnagar and Rangareddy (23%, 25%, 27%, 28% and 20%) respectively. The reporting units in the districts with the lowest reporting frequencies should be strengthened in order to estimate the true burden of disease in the state of AP.

In the case of the P (presumptive cases) forms, higher reporting was seen in the districts of Cuddapah(78%), Nellore(80%), Nalgonda(79%), and Hyderabad(85%). Reporting of around 50% was seen in the districts of Ananthapur, Srikakulam and Warrangal. The lowest reporting of P forms was seen in the districts of Adilabad (20%), Khamman (25%), Medak(28%) and Kurnool(28%).

In the case of the L (laboratory confirmed cases) forms, higher reporting was seen in the districts of Vizianagaram (85%) and Hyderabad (77%) respectively. Reporting of around 60% was seen in the districts of Krishna, Nalgonda and Prakasham respectively. The lowest reportage of L forms was seen in the districts of Khamman(12%) and Medak(15%) respectively.

From the above discussion, it is apparent that the reporting system in the districts of Andhra Pradesh needs to be enhanced and particular focus on the low performing districts is required to implement appropriate disease control and prevention measures. A consistently low reporting was seen in the private medical colleges and private hospitals which show that a proper system needs to be implemented for effective and efficient functioning of the public health system in the state of Andhra Pradesh. It was also seen that data entry was not done in a proper and standard way and the weekly reports were incomplete and irregular.

A health system's efficiency and quality of health care delivery is largely determined by the surveillance and reporting standards that exist at the very base of the health systems pyramid (PHC and sub-center). It does not augur well to have a consistent 50% yearly reportage for P forms, S and L1 reports in only less than 12 districts of AP. Conducting training sessions and reinforcement for health personnel in the state on the utility, relevance, and importance of good and consistent S, P, L1 reporting formats are the need of the hour. An open feedback to the reporting units will help in enhancing quality and delivery of health care to the majority of rural and semi-urban Indian population.

An intensified effort by the District Surveillance Units (DSU's) and the State Surveillance Units (SSU's) under IDSP to activate slow or non-reporting sites to comply with the mandatory reporting is the need of the day. Succinct and reliable information relaying needs coordination and strong political commitment. . Short Messaging System (SMS) when actively taken up by all the IDSP reporting sites, in future, will enable faster relay and response rates. Data collection, internal quality control, analysis and reporting, and speedy and an efficient response are mutually inclusive events in the life cycle of a health policy. The primary step, i.e. data collection is the stepping stone for effective and efficient health care delivery models. Extra seeding efforts along the awareness that 'information is knowledge' and training of health care worker staff must be undertaken by Andhra Pradesh state government to reap in the rich harvest of information in health care surveillance systems.

Conclusion:

The District Surveillance Units (DSU's) and the State Surveillance Units(SSU's) in the state need to stimulate the low reporting units to generate complete, timely and accurate reports in order to implement and evaluate disease control and prevention programs. Identifying the causes of low reporting of S(suspected), P(presumptive) and L(Laboratory confirmed cases) and taking timely action in improving the reporting system will pave the way for planning and enforcing effective disease control programs in the state of Andhra Pradesh.

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Use of ARIMA models for forecasting needs in Emergency data based Syndromic Surveillance

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ABSTRACT:

Though traditional health surveillance is well established in many developing world, need for real time disease surveillance is highly felt to facilitate an effective early warning system for disease outbreaks. Since data generated from Emergency Response Service centre are dynamic and continuous in nature, time series predictive models can be used for forecasting of various chief complaints based emergencies. In the current paper a uni-variate time series analysis method has been used to model and forecast the daily number of fevers and infection cases in Andhra Pradesh, India. We developed autoregressive integrated moving average (ARIMA) models for the period from April 2007 to December 2008 and then validated the models using the data collected between January 2009 to March 2009. The results showed that the regressive forecast curves were consistent with the pattern of actual values. The ARIMA (3 0 1) model fitting was adequate for the data with Ljung-Box statistics (47.349). The mean absolute percentage error of the ARIMA model was found to be 14.74%. The model was also found to be useful for the forecasting needs for a syndromic surveillance with adjusted R2 of 0.96.

Key Words:

Autoregressive integrated moving averages (ARIMA) model, fever and infections, time series and diseases prediction.

Introduction

Globally, the communicable diseases continue to be one of the most important public health problems. Not only about half of the deaths in some developing countries are attributable to infectious causes, new agents such as severe acute respiratory syndrome (SARS), avian influenza and Nipah virus are beginning to add to the existing burden of infectious diseases, which include tuberculosis (TB), fevers (malaria, dengu fever, kala-azar, etc.,) and leprosy. To make the prognosis even worse, some communicable diseases such as dengue fever are not only expanding geographically, they are also becoming more pathogenic. The emerging diseases are thus becoming a cause for national and international concern[1].

An estimated 2.9 million deaths in the South-East Asia Region (SEAR) are caused by infectious and parasitic diseases and an estimated 89 million disability-adjusted life years (DALYs) are lost as a result. Each year, 250 million people are at risk of contracting malaria in the countries of the Region. While India reports the largest proportion of malaria cases in the Region. Three bordering countries in the Region (Bangladesh, India and Nepal) account for an estimated 20% of the global burden of kala-azar in 96 districts with over 147 million people at risk[2].

Managing such high disease burden in India is a major challenge as accessibility and availability of a proper health care facility is still under-expectations. In India, the research domains in emerging infectious diseases are in various stages of development i.e. basic and fundamental, applied and strategic, translational and operational. There is also a critical need for health monitoring and identification of new potentially zoonotic pathogens, as a forecast measure for emerging infectious diseases[3]. A study of GVK EMRI indicates that the demand for emergency services for communicable diseases in Andhra Pradesh has increased from 7% in 2006 to 29% in 2007 and further to 43% in 2008[4]. Thus due to unmet need for accessibility to healthcare, the demand for emergency services for communicable diseases like fever is on rise.

Depending on the local epidemiology, the term "acute undifferentiated fever" has different connotations. Fever is a cardinal manifestation of illness and is a common clinical complaint. In the developing world, depending on locale, an undifferentiated fever may be called "dengue" or "malaria". Regardless of geographic context, however, most often the diagnosis of an undifferentiated fever is on the basis of clinical observation without precise documentation by laboratory, and treatment is symptomatic or specific antimicrobial therapy provided empirically[5]. In most developing countries malaria and other non-malarial diseases (such as dengue, leptospirosis, enteric fever, and Japanese encephalitis) present as acute undifferentiated fever and are major public health problems[6-9]. In India diagnosis has been a major problem where the disease is reported with fever as the chief complaint. During the year 2000 there were about 2 million malaria fever cases reported in the India [10].

A good EMS system in a developing country may help in increasing of the reporting of infectious diseases, which may be a huge advantage to establish a development of statistical methods for accurately modeling disease count time series for the early detection of these diseases is a

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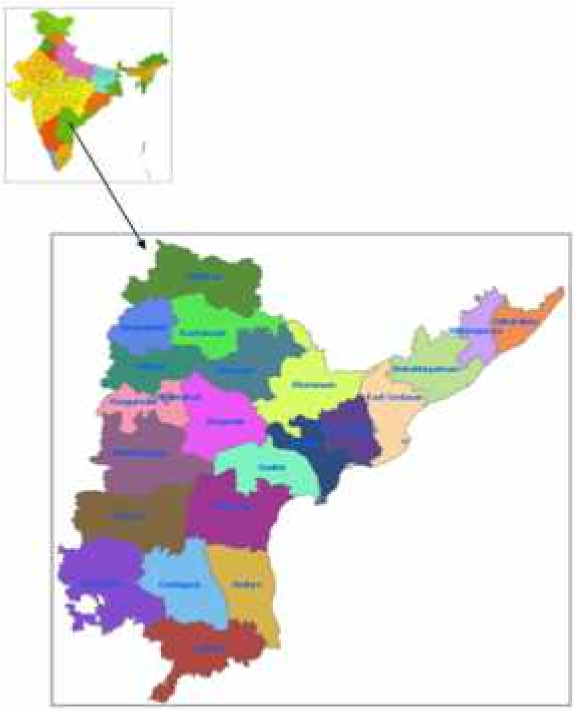
very active area of research in syndromic surveillance. In view of the above, the current paper tried to analyze in order to early detection of abnormal reporting of cases with fever as chief complaint through accurate modeling of the data of GVK Emergency management Research Institute (GVK EMRI), country's first integrated Emergency Medical Service provider.

Forecasting fever and infection cases in Andhra Pradesh using time-series models would provide useful link for development of a syndromic surveillance. The main relationship in modeling time-series and fever and infection cases at time period $_t(Y_t)$ from the past data point (observations) ($Y_1, Y_2, Y_3, \ldots\ldots Y_{t-1},$) without using any other variables[11]. The study aimed at developing univariate time-series models for the daily fever and infection cases available from April 2007 to March 2009. This forecasting offers the potential for improved contingency planning of public intervention through a system for syndromic

Material and Methods:

The State of Andhra Pradesh is located between 12° 41' and 22° East longitude and 77° and 84° 40' North latitude, covers an area of 2,76,754 sq. kms in the Indian sub continent (Figure 1). It shares common boundaries with Madhya Pradesh and Orissa to the north, the Bay of Bengal to the east, Tamil Nadu and Karnataka to the south and Maharashtra to the west[12].

Figure 1: Map of Andhra Pradesh state in India



GVK Emergency Management and Research Institute (GVK EMRI) started running the first professional and comprehensive free emergency services in Andhra Pradesh from August 2005 under the Public Private Partnership (PPP) by establishing a single toll free number 108. GVK EMRI has set up an Emergency Response Centre (ERC), where the calls from emergency victim are received from all over the state and the emergency service is provided within 18 minutes in urban area and 24 minutes in rural areas with the support of technologies like GPS / GPRS / AVLT etc. As part of a routine protocol being followed, details of the emergency victim including demographics, chief complaints and other details are captured by the GVK EMRI emergency services after the call is recorded on dialing 108, thus a real time data is generated by the system.

The statistical package SPSS version 16.0 for windows was used for developing the ARIMA models. The models were analysed with the Box-Jenkins approach, which was appropriate for a long forecasting period13. This method for selecting an appropriate ARIMA model for estimating and forecasting a univariate time-series consisted of identification, estimating, diagnostic checking and forecasting14. The process of ARIMA model, first a check for stationary was made with the aid of a control chart, which was useful to graphical device for detecting the lag of stationary in time series data points. The mean of $\overline{Y}$ and standard deviation of the time series and regarded the Lower Control Limit (LCL) and Upper Control Limit (UCL). After verifying that the series was stationary, an ARIMA model was developed through a trial and error method. The adequacy of the model was checked by comparing the observed data (i.e. January 2009-March 2009). The autocorrelation function (ACF) and Partial auto correlation function (PACF) was also considered as an inspection agent.

A set of period time series data was required for univariate time series forecasting. It was generally recommended that at least 50 observations should be available[15]. Therefore 636 observations were used in this study. As a first step to model identification, the daily fevers and infection cases time series Y_t for 21 months were used for building the univariate Box-Jenkins model, while data for the remaining 3 months were reserved for model evaluation. Using an Autoregressive Integrating Moving Averages specification to identify the suitable model and the general terms were followed.

Results:

The time series function of fevers and infections cases were tailed off lag 1 (figure 2) whereas the PACF of fevers and infections time series also tailed off (figure 3). When both the ACF and the PACF of time series were tailed off tend to zero, these results indicated a Auto regression (AR) and Moving averages (MA) or ARMA (3, 1) otherwise ARIMA (3, 0, 1). The General model of Auto Regressive Integrated Moving Average model was as follows:

$Y_t = \varphi_1 Y_{t-1} + at - \theta_1 at\text{-}_1$ -------- (1)

Where φ_1 and θ_1 are the two parameters or the model coefficients, at was time-series of residual error or white noise process at time t, a_{t-1} was white noise process at time t-1[15]

A time series process $\{a_t\}$ was called a white noise process if it was a sequence of uncorrelated random variable from the a fixed distribution with a constant mean $E(a_t)=\mu_a$, usually assumed to be 0, a constant variance $Var(a_t) = \sigma_{at}^2$ and a covariance $\gamma_k = cov(a_t, a_{t-1})=0$ for all $k \neq 0$.

The coefficients were estimated as $\varphi_1=0.802(p<0.01)$, $\varphi_2=0.010(p>0.01)$, $\varphi_3=0.187(p<0.01)$, and moving average θ_1

=0.670(p<0.01) (table 1). The autoregressive coefficients were very close to their limit of stationary 1.0, ($|\varphi_1| < 1$ and $|\theta_1| < 1$),[13,16-17] the tentative model was as follows without constant;

$Y_t = 0.802(Y_{t-1}) + 0.010(Y_{t-2}) + 0.187(Y_{t-3}) - 0.670(a_{t-1})$ - - - - - (2)

The reported cases of fever and Infections at time t were approximately 96% of the fever and infections incidence at time t-1 plus a white noise process. The time series model in equation (2) was used to forecast fever and infection cases at time t (Y_t) for 90 days from January 2009 to March 2009 (figure 4) based on the last observation of data point as the forecast region.

The graphic time series analysis showed that the residuals in the model appeared to fluctuate randomly around zero with obvious trend in variation as the predicted incidence values decreased (figure 5).

Figure2: Auto correlation function of Fevers and infections time series

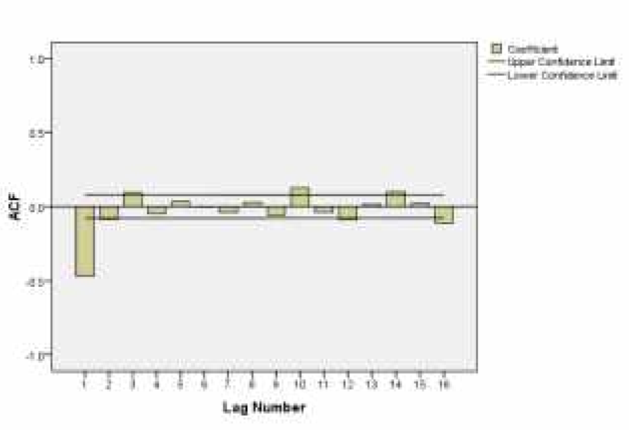


Figure 3: Partial auto correlation of Fevers and infections time series

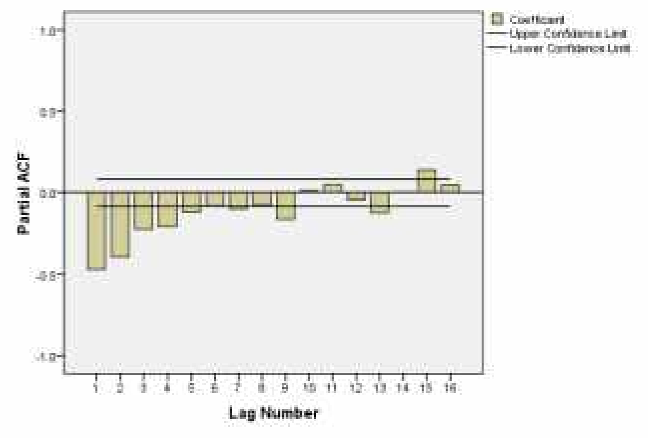
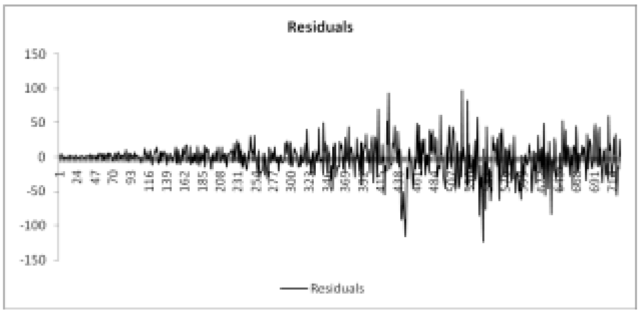


Table 1: Fitted equation of ARIMA (3 0 1) model

ARIMA (3 0 1)	Model	Estimate	SE	t-value	P-value
Constant		2.9615	2.8749	1.0301	p>0.05
AR	Lag 1 Lag 2 Lag 3	0.8018 0.0103 0.1874	0.0565 0.0526 0.0504	14.1838 0.1964 3.7150	p<0.01 p>0.05 p<0.01
MA	Lag 1	0.6703	0.0475	14.1197	p<0.01

Figure 4: Sequence of observed Fever and infection cases and predicted ARIMA (3, 0, 1) values for the year (April 2007 to March 2009)

Figure5: scatter plot of the residuals of the ARIMA (3, 0, 1) model



Discussion :

The results of current study showed the predictive values of reported cases of fevers and infection to GVK EMRI in Andhra Pradesh, India in 2009. It was revealed that the number of fever and infection cases reported during December 2007 – June 2008 was in the range of 100 to 350 cases. The evaluation phase of the model indicated a lower level of reporting of fever cases. Based on the recent past data, it was found that the model fitted well in forecasting reported fever cases in Andhra Pradesh.

The ARIMA models are useful tool for analyzing non stationary time series data containing ordinary or seasonal trends18, 19. In this study, the model reflected the trend in the reporting of fevers and infections to GVK EMRI in Andhra Pradesh. It is not yet possible to predict with accuracy the extent and magnitude of the alternation in the disease pattern. Time series forecasting of fevers and infections cases in Andhra Pradesh may offer the potential for improving planning, pre care hospital, control and prevention by GVK EMRI and public health intervention. Finally, the fevers and infection cases estimated for reporting helps for serious multi-sector preparedness to reduce the intensity in Andhra Pradesh.

One the key advantage of ARIMA models is their ability to correct for local trends in the data –what had happened on the previous day is incorporated into the forecast of what will happen today. This works very well, for example during the particular period of fever and infection season, where extended time periods of high visits rates are adjusted to by the ARIMA model, thus preventing the alarm from being triggered every day throughout the fever and infection season[20].

The selection of criterions to judge for the best model taken the results of ARIMA model should be relatively high adjusted R^2, relatively small of SEE, relatively small of BIC (Schwarz criterion) and Q-statistics

(Ljung-Box statistics) and correlogram shows that there is no significant pattern left in the ACFs and PACFs of the residuals, it means the residuals of the selected model are white noise. In this ARIMA model the adjusted R_2 was 0.96 which means 96% of variation explained by dependent variable ie daily cases of fevers and infection.

Conclusion

The ARIMA model that we developed for forecast modeling to predict the reported cases of fever and infection during the time series period performed reasonably well, with adjusted R^2 was 0.96. In addition, we found that three months prediction of the number of cases occurred. ARIMA (3 0 1) models provide useful tools for forecasting daily cases during the next time series periods, the model could be sued in planning for handling, transportation, pre hospital care for fever and infection cases, as well as prediction requirement for the other critical resources. Thus ARIMA can be used as a detection tool for emergency data based syndromic surveillance.

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Public Health Surveillance in India - Challenges and Opportunities.

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ARTICLE

Surveillance is a regular collection, analysis, and interpretation of data on disease patterns of a geographic area which helps in indicating outbreaks of major health related symptoms. In developing countries like India, efficacy of a surveillance system is often hindered by the quality and availability of data. Again accessing the real time data on health and disease symptoms is too critical in setting up a syndromic surveillance system. India is currently passing through epidemiological transition and is burdened by both communicable and non communicable diseases. Many states in India have good health delivery systems while other are lagging far behind. The present paper evaluates the major challenges being faced by existing health surveillance programs like National Surveillance Programme for Communicable Diseases (NSPCD), Integrated Disease Surveillance Program (IDSP) and the opportunities available to complement the existing surveillance systems in India. This paper also highlights the role of GVK EMRI for being an effective public health emergency data based surveillance system.

Key Words:

Public Health Surveillance, IDSP, NSPCD, Emergency Surveillance & GVK EMRI.

Introduction

Collecting and using information is a powerful tool for improving the public's health which was known from a long time. John Graunt from England in 1662 has suggested that data taken from death certificates should be analyzed to help improve the health of the public [1]. Practice of gathering and using vital statistics for describing impact of diseases was started by William Farr in nineteenth century [2]. Today, public health surveillance is every bit as important as the information gathering that went on centuries ago. In the wake of recent infectious disease outbreaks such as severe acute respiratory syndrome (SARS) and continuing chronic disease epidemics such as obesity, health surveillance has become a core function to improve the capacity of the public health system [3]. The Centers for Disease Control and Prevention (CDC) defines surveillance to be the ongoing, systematic collection, analysis, interpretation, and dissemination of data about a health-related event for use in public health action to reduce morbidity and mortality and to improve health [4]. To control and prevent disease, it is important to be vigilant for infectious disease outbreaks or geographic areas of notably high chronic disease incidence this is the primary aim of public health surveillance, and surveillance should play an integral role in public health practice [5].

Health Surveillance Need: Health surveillance is needed by Public health practitioners, health planners, epidemiologists, researchers and policy-makers for helping to [3]:

1. Make decisions related to program planning, evaluation, policies and resource allocation, for understanding economic and health impacts of public health issue, and nature and extent of its impact on community.
2. Rapid communications for resolving problems.
3. Risk reduction in public health crisis.
4. Strengthen measures for preventive and corrective actions.

What Is Health Surveillance?

Health surveillance is not only the collection of health data, but also "… the ongoing, systematic use of routinely collected health data to guide public health action in a timely fashion"[6]. Surveillance is particularly important for the early detection of outbreaks of diseases. To define the burden of infections and to track trends and their incidence, surveillance is very important. Outbreak detection and investigation are a critical part of the control strategy for many infections[7].

In the absence of surveillance, disease may spread unrecognized because sick people would be seen in small numbers by many individual health care workers and by the time the outbreak is recognized, the best opportunity to take intervention measures might get delayed. Surveillance is essential for the early for the early detection and continuous monitoring of emerging (new) or re-emerging (resurgent) infectious diseases.

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Surveillance data can be effectively used for the purpose of social mobilization and make public participate more effectively in control of important diseases. This is an important step in reducing the burden of disease in the community. Data collection, analysis, Interpretation and timely dissemination of findings are important steps involved in health surveillance data process.

Health Surveillance in India:

India is currently passing through epidemiological transition. Many states in India have good health delivery systems while other are lagging far behind. Health problems are predominantly due to communicable diseases and non communicable diseases. Any state / system should to take this variability into account and cater to the differential needs of the country. Health delivery systems should be decentralized and state specific. Health programs should be tailored according to geo-political and socio-economic differences in the country. In states having advanced health delivery programs, focus should be for improving existing health processes and to implement basic health delivery programs for states having poor health delivery programs. India needs effective disease surveillance and equity in health delivery programs for taking corrective actions to improve health conditions of vulnerable populations.

A systematic process of reporting of various diseases of public health importance, as and when, and where, they occur, to a designated agency responsible for taking effective interventional steps, is known as disease surveillance. Its success will depend upon 3R's i.e., the quality of diagnosis (Recognition), the timeliness and completeness of Reporting, and analysis and effectiveness feedback Response. Disease surveillance has long been recognized as an important tool for measuring the disease burden, studying morbidity and mortality trends and early detection of outbreaks for instituting effective control measures in a timely manner. Through the health infrastructure in our country has grown immensely over the years, disease surveillance system did not get the desired attention. The outbreaks of plague (1994, 2002), malaria (1995), dengue (2006) in different parts of the country further highlighted the weaknesses in the surveillance system. This brought urgency for its strengthening so that early warning signals of outbreaks are detected and appropriate preventive and control measures are applied timely to minimize the impact of the outbreak. Following plague outbreak in 1994, Government of India constituted a number of high-powered committees like Technical Advisory Committee on Plague (1994), Committee to formulate a comprehensive National Programme on Sanitation and Environment Hygiene on the lines of Technology Mission (1995) and Expert Committee on Public Health System (1996). All these committees recommended strengthening of diseases surveillance activities across the country. Thereafter, the Government of India constituted a National Apical Advisory Committee (NAAC) under the chairmanship of Union Health Secretary in 1999 to look into this aspect.

National Surveillance Programme For Communicable Diseases (NSPCD):

On the recommendation of the NAAC, Government of India launched National Surveillance Programme for Communicable Diseases (NSPCD) as a pilot project in 1997-98 with the overall goal of improving the health status of the people and was in operation in 101 districts and a total budget allocation of Rs. 25 crores was made during the IXth plan 8. The main objectives of the program were capacity building at district and State levels. A review of the programme indicated that, districts in which it has been made fully operational there is definite improvement for early detection of outbreaks and response time. The program was implemented through the existing health infrastructure and surveillance system strengthened through training of medical and para medical personnel, up gradation of laboratories, communication and data processing systems. The program was implemented through the State Health Systems.

Existing Components for Disease Surveillance in Disease Control Programmes:

Many surveillance components are built into the various health systems projects being undertaken to improve health care infrastructure in various states under World Bank funding. All these activities need to be coordinated with sharing of information and resources for cost effective and efficient surveillance system. The major programs where a surveillance component exists are:

- The National Program for Malaria.
- The National Tuberculosis Control Program
- The National AIDS Control Program
- The AFP Surveillance being carried out as part of the drive to eradicate polio

Need to Integrate Disease Surveillance Activities:

An analysis of the existing disease surveillance activities in the country have revealed that there is considerable scope for improvement in many areas and there are some areas which are not covered by the present surveillance activities. The main reason why disease surveillance activities in the country perhaps are not as effective as they could be is because of the following factors:

- There are a number of parallel systems existing under various programs which are not integrated.
- The existing programs do not cover non-communicable diseases.
- There is need to bring the medical colleges and large tertiary hospitals in the private
- Sector into the reporting system as well as for utilization of laboratory facilities.
- The laboratory network needs to be improved and there is a need to prescribe clear cut threshold for response at each level.
- Surveillance must be not only for detection of epidemics but for rapid response to arrest spread of disease and to generate essential data for decision making on a regular basis.
- Presently, surveillance is sometimes reduced to routine data gathering with sporadic
  response systems built in.
- There is a need for increase use of information technology in order to ensure that information is gathered rapidly and responses made immediately. IT can also be used to analyze and sort data so as to predict epidemics based on trends of reporting of disease so that preventive action can be taken.

- The consensus is to evolve a system that functions within the existing healthcare system by improving on existing infrastructure and facilities rather than by creating new monoliths and to concentrate on improving human capacity and to focus on utilizing existing facilities for surveillance to the fullest.
- Need to prioritize the diseases for comprehensive surveillance.

Need for having District Epidemiology Cell:

This cell is headed by one senior officer not below the rank of District Health Officer designating as the District Epidemiology Officer. One Medical Officer and 5 field workers per 2 million or less population will assist the District Epidemiology Officer. This cell completes the list of all health care institutions within the district. It will also prepare the list of private medical practitioners of the modern system operating within the district. All reports should be entered in the computer and any duplication removed. The report should be scanned everyday to detect any unusual clustering of cases either in time or space. Data should be analyzed on a weekly basis and weekly summary statistics will be forwarded to the State Epidemiology Unit. Every outbreak of disease should be investigated without any delay by the district unit.

The district cell will be responsible for defining and designing interventions. The entire health system in the district may be mobilized for interventions and whenever necessary arise the National Institute of Communicable Diseases may be involved for specialized help.
The programme is currently in operation in 45 districts of 18 states. NICD is the nodal agency for formulation of strategies and operational guidelines supervision, monitoring and coordinating the programme implementation.

Achievements:

1. The programme is on operation in 80 districts of 28 states and Union Territories.
2. Multidiscipline Rapid Response Team (RRTs) at state and district levels under the programme has been constituted. The teams have been provided training in surveillance, prevention and control of outbreaks.
3. RRTs for states have been trained at NICD, Delhi.
4. A joint team comprising of WHO and NICD undertook assessment of NSPCD in seven states, namely Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, and Uttar Pradesh.
5. All the states and district level epidemiological cells have procured computers, fax machines, and telephones for data processing and rapid communication of information.

Challenges:

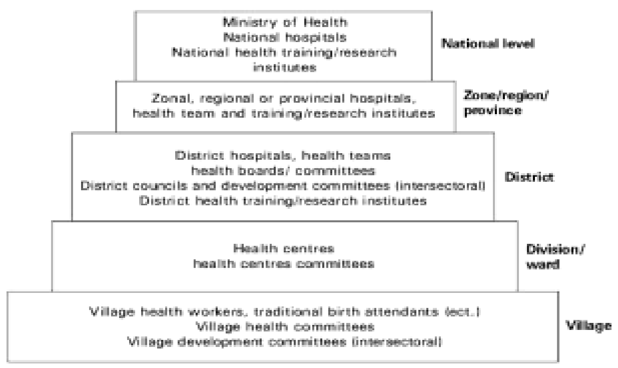
1. Non-communicable diseases should also have comprehensive and effective programme of surveillance. Disease related to tobacco, dust exposure particularly in coalmines, PEM including iodine, selenium, vitamin-A, occupational and non-occupational injuries, mental disorders, etc. need surveillance system.
2. The District level laboratories are not developed much. The District Hospital must have adequate microbiology laboratory facilities, which will be available both for diagnostic purposes and for epidemiological investigations within the district. There is a need for a state level laboratory, for the purposes of supporting the district laboratory service network in the district for helping in investigating the etiology of disease of public health importance, endemic or epidemic.
3. District epidemiology cell must have an experienced epidemiologist.

Integrated Disease Surveillance Program (IDSP):

Definite improvement in outbreak detection and response time was achieved in all 101 NSPCD operative districts; however Integrated Disease Surveillance Program (IDSP) was formally launched by Union Minister of Health and Family Welfare on 8th November 2004 for establishing decentralized surveillance covering communicable and non communicable diseases. IDSP9 was intended to be the back bone of public health programs in the country. Integrated Disease Surveillance Project is a decentralized, state based surveillance programme 10,11. It is intended to detect early warning signals of impending outbreaks and helps to initiate effective response in a timely manner. It is also expected to provide essential data to monitor progress of on-going diseases control programs helps to allocate health resources more efficiently and will be crucial in obtaining political and public support for the health programs. It will help to identify areas of health priority where more inputs are necessary.

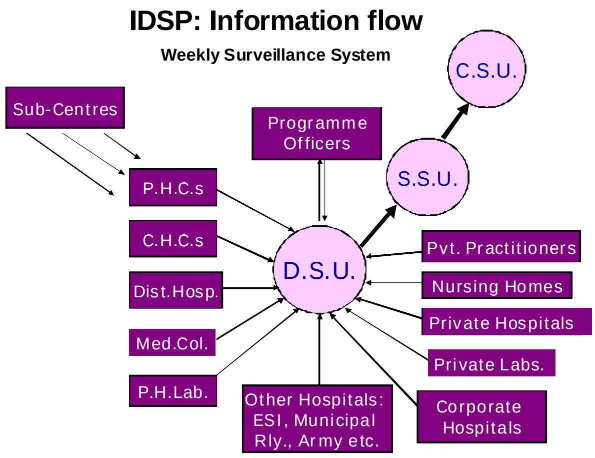
The IDSP proposes a comprehensive strategy for improving diseases surveillance and response through an integrated approach with rational use of resources for disease control and prevention (Figure 1). Data collected under IDSP would also provide a rational basis for decision-making and implementing public health interventions. Specific objectives of the IDSP are to establish a decentralized district-based system of surveillance for communicable and non-communicable diseases so that timely effective public health actions can be initiated in response to health challenges in the urban and rural areas. The other objective is to integrate existing surveillance activities to extent possible without having a negative impact on their activities and facilitate sharing of information across all disease control programmes and other stakeholders.

Figure 1: Process of Disease Surveillance



The key features of Integrated Disease Surveillance are that the district level is the focus for integrating surveillance functions. All surveillance activities are coordinated and streamlined. Several activities are combined into one integral activity to take advantage of similar surveillance functions, skills, resources and target populations. The IDSP integrates both public and private sector by involving the private participation. The IDSP integrates communicable and non-communicable diseases. Integration of both rural and urban health systems as rapid urbanization has resulted in the health services not keeping pace with the growing needs of the urban populace and the gaps in receiving health information from the urban areas needs to be bridged urgently. Integration with the medical colleges (both private and public) would also qualitatively improve the disease surveillance especially through better coverage.

Figure 2: IDSP – Information Flow



Applications of GIS in Disease Surveillance:

Epidemiologists have traditionally used maps when analyzing associations between location, environment, and disease. GIS is particularly well suited for studying these associations because of its spatial analysis and display capabilities. Recently GIS has been used in the surveillance and monitoring of vector – borne diseases, water borne diseases, in environmental health, and the analysis of disease policy and planning.

GIS allows analysis of data generated by global positioning systems (GPS). Combined with data from surveillance and management activities, GIS and GPS provide a powerful tool for the analysis and display of areas of high disease prevalence and the monitoring of ongoing control efforts. The combination of GIS and GPS enhances the quality of spatial and non-spatial data for analysis and decision-making by providing an integrated approach to disease control and surveillance at the local, regional, and / or national level.

Challenges:

Periphery Level:

- Active or passive data collection is going on for more than 30-90 different conditions in the states.
- Absence of case definitions, poor communication.
- Poor data quality and absence of structured reporting formats
- Data is not obtained from private practitioners, laboratories and hospitals both in rural and urban setting.
- There is poor feed back at lower levels.
- There is lack of basic requirements and facilities for surveillance.
- There is no quality control for the data collection and reporting.

District Level:

- Quality of data is poor and inadequate data analysis.
- Massive under utilization of data.
- No district level response system in place.
- The information is not shared across disease control programs.
- District administrative system not able to make use of the health data.

State level:

- There is need to improve the quality of data in terms of reliability and validity.
- There is problem of timeliness of this data.
- Most of the data received at the state level is not analyzed.
- Data not used for routine program planning.
- There is need to improve human resources.

IDSP limitations were also cited by other research studies too. Improper distribution of patients in a health facility as some departments were over burdened and some others were underutilized requires remodeling of health care system. Disease surveillance is limited to diseases covered under IDSP other diseases remains unreported and doesn't explore causes of observed patterns12.

GVK EMRI Capability For Emergency Surveillance:

GVK Emergency Management and Research Institute (GVK EMRI) 13, since August 2005, has been running the first professional and comprehensive free emergency services in India, in partnership with various state governments, by running a single toll-free number 108 offering emergency services in ten different states of India covering Medical, Fire and Police related emergencies. We are covering nearly 25 types of medical emergencies along with emergencies related to infectious diseases, communicable and non communicable diseases. GVK EMRI emergency operations are strengthened by trained work force that are well equipped to handle complex emergencies and can implement needed interventions. Further, emergency handling strategies are redefined from time to time based on presenting conditions.

GVK EMRI process of data collection starts whenever a patient or bystander requests for pre hospital care by calling 108 Communication Officers (CO) receives call at GVK EMRI centralized call center, they collect particulars related to specific emergency, incident location, severity and demographics, then after call will be diverted to Dispatch Officer (DO) who are responsible for dispatching ambulance to respective incident location by mapping victims location using geospatial information, in between depending on emergency type and severity ERCP's (Emergency Response Center Physician) are contacted for medical help and intervention. Emergency Medical Technicians (EMT) are responsible for providing pre hospital care to patients, who provide medical help upon ERCP's guidance.

All emergency related information is collected and documented by EMT's and the data is transcribed onto PCR's (Pre hospital Care Records). All the PCR information is continuously monitored, validated and stored in centralized repository consisting of dedicated servers and databases, and stored as computer telephonic integrated data. GVK Emergency Management and Research Institute (GVK EMRI) routinely collects computer telephonic integrated (CTI) data that provide the opportunity to be used for near real time syndromic surveillance of infection threats. As we continuously monitor emergencies, any outbreak or endemic, new or resurgent disease can be easily notified alerting public health departments, emergency management systems, authorities and immediate action plan to tackle outbreaks can be initiated whereby effective disease surveillance can be implemented for preventing emerging epidemics. We handle all emergencies in a coordinated manner with periodical follow-ups, which turns out to be very crucial for disease surveillance. GVK EMRI emergency management system is continuously strengthened by providing regular training to EMT's and ERCP's and apprising them about latest developments in community health seeking behavior.

GVK EMRI- Geomed Pilot Project For Fever / Infection Surveillance:

GVK EMRI services are over burdened by the emergencies resulted from communicable disease. Share of communicable related health emergencies was seen to be increased to 28.5 percent in 2007 from 6.9 percent in 2006 and increased further to 42.9 percent in 2008 14. Therefore it is very important to build capacity to handle such emergencies effectively. The effective management of infectious disease and the ability to respond to health emergencies depends on a good surveillance system. The surveillance of infection and other threats to public health in primary care through emergency based data is expected to provide an effective surveillance system in countries like India. India has experienced many epidemic viz. chikanguniya, dengue etc for which high fever is the presenting symptom.

Average demand for fever/infections caused emergencies has increased to 5.5 (proportion of fever in total emergencies) (S.D. =2.0) in 2008 from 1.9 (S.D. =1.31). Thus fever as a symptom may be of interest to be studied from the syndromic surveillance point of view.

The proposed syndromic surveillance would monitor symptoms (e.g fever) being reported by the victim requiring the health emergency services and such symptoms may be associated with the early presentation of a syndrome. Therefore the major objective is early detection of out-break of any infectious diseases where the presenting symptom is high fever through the 108 dispatch data.

The project would be using methods like Meta analysis, community survey, case detection method for filtering the fever cases, data warehousing, building of assumptions and validation, risk model, forecasting model, GIS data integration tool and other statistical tests of spatial-temporal base lines. Based on the preliminary investigation into the existing data, community based survey results, literature and context analysis, EMRI and GEOMED would finalise the system conceptualization /design and work out the final agreement on data collection, analysis and detection method.

With correct utilization of the results by its stakeholders, it is unlikely to miss any disease epidemics where the primary symptom is fever. A historical recording of when alarms occur, whether they are true or false and what action is taken in each case will greatly help the adjustment of parameters utilized in the result. The timeliness of the system would be one of the major strong points of the project. It has a true ability to report in real-time any case of fever occurring within the community where EMRI services are used at a greater extent.

Conclusion:

Overall, using the various Health surveillance mechanisms presented above has been not very successful but good initiative. They have made an important contribution to the promotion of diseases surveillance in India. Many of the Reporting sites/units have shown the effectiveness of the diseases surveillance input via their active involvement in disease surveillance projects covering the broadened disease surveillance mandate in some cases, it was noted that the application of disease surveillance findings had led to policy change and improvement in networking. The varying degrees of effectiveness of the disease surveillance strategy noted in the different centers in the three regions are attributable to centre- and region-specific factors and future strategies would have to look into creative ways to overcome some of the centre- and region-specific constraints, so as to enable centers to meet their districts health needs more effectively. Paper also presents GVK EMRI role and its strength for being an effective public health surveillance system that employs trained and qualified practitioners in the skills and methodologies of health surveillance. GVK EMRI structured data collection, dedicated data servers and qualified data analyst will further strengthen timely dissemination of outbreaks.

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