CALPI PROGRAMME SERIES 8 MARCH 2008

Volume 5

Control Strategy and Action Plan for Animal Diseases of Economic Importance in Andhra Pradesh

Volume 1

Assessment and Reflections on Livestock Service Delivery Systems in Andhra Pradesh

Presents the experiences from an initiative aimed at developing a widely owned reform action plan for livestock service delivery taken up in Andhra Pradesh through a multi-stakeholder, multi-tier, multi-regional consultative process.

Volume 2

Para-veterinary Training programmes in Andhra Pradesh

Provides a comprehensive listing of all organizations extending trainings to Para-vets and Para-veterinary workers in Andhra Pradesh, an assessment of their training programmes, deficiencies and gaps and suggestions for their improvement.

Volume 3

Para-veterinarians and Animal Health Workers in Andhra Pradesh

Presents the profile of Para-veterinarians and the Animal Health Workers, their placement, service delivery, supplies, support, supervision, overreach beyond the scope of their training and suggestions for improvement.

Volume 4

Mainstreaming Minor Veterinary Services in Andhra Pradesh

Presents a definition of the Minor Veterinary Services recommended by the Expert Group to the Government of AP as required under the Veterinary Council of India Act, 1984 and the participatory process gone through in arriving at the recommendations.

India has many endemic animal diseases causing high mortality and morbidity, resulting in heavy economic losses to the poor. CALPI (Capitalisation of Livestock Programme Experiences India), a programme of the Swiss Agency for Development and Cooperation and the Intercooperation, together with the South Asia Hub of the Pro-Poor Livestock Policy initiative (PPLPI) of the Food and Agriculture Organisation (FAO) and the Department of Animal Husbandry of the Government of Andhra Pradesh took up an initiative to evolve a strategy and an action plan to control five major diseases of high economic importance for the poor. The document covers the livestock demography of the state, the Veterinary and Animal Husbandry infrastructure availability, the disease investigation and reporting system, long term trends and profiles of the identified diseases, the vaccinations and control strategy recommended and strengthening and institutionalization of the control strategy.

The widespread consultations taken up under this initiative enabled the stakeholders to gain a better understanding of their needs in service delivery. They also enabled them to make informed decisions to widen the scope of the consultations and research in to newer topics as presented in volumes 1 to 5.

A separate document on each of these is presented as a part of this compendium. The participatory process in which the state department of AH and the other stakeholders played a central role, improved the acceptability and implementability of the reforms proposed. As a result, the state department of Animal Husbandry has accepted and implemented many of the recommendations emerged from this initiative. With refinements, the process could demonstrate an effective model for service reforms elsewhere.

Control Strategy and Action Plan

for Animal Diseases of Economic Importance in Andhra Pradesh

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Control Strategy and Action Plan
for Animal Diseases of Economic Importance in Andhra Pradesh

Abbreviations

AHC	Animal Health Centre
AH & VS	Animal Husbandry & Veterinary Services Department
AI	Artificial Insemination
AP	Andhra Pradesh
APLDA	Andhra Pradesh Livestock Development Agency
BQ	*Black Quarter*
CALPI	Capitalisation of Livestock Programme Experiences India
DIS	Disease Information System
DAH	Department of Animal Husbandry
DPU	District Project Unit
DVO	District Veterinary Officer
ET	*Enterotoxaemia*
FAO	Food & Agriculture Organization of the United Nations
GDP	Gross Domestic Product
HS	*Haemorrhagic Septicaemia*
IC	Intercooperation
ICAR	Indian Council of Agricultural Research
IVRI	Indian Veterinary Research Institute
PD_ADMAS	Project Directorate on Animal Disease Monitoring and Surveillance
PPR	*Peste des Petits Ruminants*
PPLPI	Pro-Poor Livestock Policy Initiative
NGO	Non-Governmental Organization
RD	*Ranikhet Disease*
SDC	Swiss Agency for Development and Cooperation
SMILDA	State Management Institute for Livestock Development Andhra Pradesh
VBRI	Veterinary Biologicals Research Institute

Keywords

Animal Health, Disease Control, Andhra Pradesh, India.

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Contents

Foreword

The Swiss Agency for Development and Cooperation (SDC) and the Intercooperation (IC) have been actively involved in livestock-based livelihoods and natural resource management in India for many decades. CALPI (Capitalisation of Livestock Programme Experiences India), a programme of the SDC and IC, capitalises on these vast experiences, competencies and partnerships to positively influence the economic, administrative, legal and policy frame conditions affecting the poor livestock keepers. One of the thrust areas of CALPI, the Livestock Service Delivery Systems, facilitates the establishment of a need-based livestock service delivery system for the benefit of small livestock holders.

The "Reforms in Livestock Service Delivery Systems –Experiences from a Participatory Process in Andhra Pradesh" formed one of the many initiatives taken up under this thrust area. This initiative was jointly implemented by CALPI, the South Asia Hub of the Pro-poor Livestock Policy Initiative (PPLPI) of FAO and the Government of Andhra Pradesh Animal Husbandry Department. The main aim of the initiative was to: (i) create a favourable environment for facilitating policy and structural adjustments in livestock service delivery, and (ii) develop a widely owned reform action plan for service delivery in the state. The multi-stakeholder participatory process enabled the stakeholders to identify the weaknesses and deficiencies of the prevailing service delivery systems and their unmet service needs. It also led to a further review, reflection and widening of the consultative process extending it to more villages and districts in the costal and the tribal areas, members of the District Sheep Breeder's Cooperative, Tribal Communities, their Networks and the Traditional Healers.

The initiative was guided by a Steering Committee (SC) which comprised of all the key stakeholder categories and was chaired by the Principal Secretary/Special Chief Secretary of the Departments of Animal Husbandry, Dairy Development and Fisheries of the State Government. In addition, a Common Task Force (TF) oversaw the meetings, workshops, consultations, studies and documentation. By remaining active at the centre of all multi-level consultative processes, the Government took ownership of the decisions taken and ensured better acceptability and implementability of the reforms proposed.

In the fast changing livestock production and trade environment, reforms of the type, particularly in livestock service delivery where the Government still continues to play a key role, are required to be taken up on a continuing basis. The process has also enabled the State Government to issue a Govt. Order defining minor veterinary services together with the skills and qualifications required to perform them, as required under the Veterinary Council of India (VCI) Act. In many respects, the participatory processes in which the Government played the key facilitating and steering role, is worth emulating by other State Governments in India as also other developing countries.

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Message

March 26, 2008

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The 'Reforms in Livestock Service Delivery Systems - Experiences from a Participatory Process in Andhra Pradesh' is the outcome of a partnership amongst the Government of Andhra Pradesh Animal Husbandry Department, CALPI (Capitalisation of Livestock Programme Experiences India) - a programme of the Swiss Agency for Development and Cooperation and the Intercooperation and the South-Asia hub of the Pro-poor Livestock Policy Initiative (PPLPI) of FAO. The main aim of the initiative was to develop a widely owned reform action plan for livestock service delivery in the state.

The initiative was unique in many respects. Firstly, its open and flexible approach, inclusive frame, periodic review, reflection and adjustments and well-founded evidence base through research. Secondly, its multi-stakeholder, multi-regional, multi-tier consultative process participated by all key categories of stakeholders. It involved Participatory Rapid Appraisals (PRAs), meetings, workshops as well as individual consultations with farmers, farmer organisations, NGOs, veterinary students, village, district and state level functionaries of the government AH Department; the State Veterinary Council, planners and policy makers and an expert group. Thirdly, the Government played a central, active facilitating role at the grass roots and at the district levels and a guiding and steering role through the steering committee at the state level.

In the consultative process, all categories of stakeholders actively participated from the beginning. Such participation, especially of the Government functionaries, improved the ownership, acceptability and implementability of the reforms and provided a unique and interesting experience to all participants. As a result, most of the recommendations like improved attention to preventive health care by the Government, enhanced coverage of animals under the department's preventive health care programmes, enhanced production of vaccines especially for small ruminants, coverage of more animals of the poor under insurance, expansion of the para-veterinary programmes, etc. could be accepted and implemented. Similarly, the overall budgetary allocation for Animal Husbandry activities of the department has been expanded considerably as also is the capacity development activities for all categories of staff. In this respect, an open, flexible and participatory approach followed in the reforms process formed the key to its success and is worth emulating by other state Governments in India as also by other developing countries.

Priyadarshi Dash

Preface

Effective control of animal diseases is a critical element of any strategy that aims at supporting and enhancing livestock dependent livelihoods of rural poor. Over the years, the literature on the delivery of livestock services has increasingly emphasized that the governments in developing countries have a public responsibility in ensuring that the incidence of animal diseases, especially those diseases that cause substantial economic losses for the poor, is reduced significantly so that the production and trade losses are minimized and private costs of treatment substantially reduced.

Under the auspices of a larger project to reflect and assess the effectiveness of livestock service delivery systems in Andhra Pradesh, an attempt was made to examine the incidence and trends of five diseases of economic importance for the poor—Haemorrhagic Septicaemia, Peste des Petits Ruminants, Enterotoxaemia, Black Quarter, and Ranikhet Disease—in the state. The purpose was to evolve workable strategies for reducing the incidence of these diseases in the state. Towards that end, district-wise historical data on the incidence trends and outbreak patterns were analyzed. The results of this analysis were then discussed with a large number of stakeholders in a series of consultative meetings so as to get a reality check on the analysis and to understand the field level difficulties in reducing the disease incidence. The outcome of this analytical and consultative process is summarized in this document.

In the preparation of this document, I have received immense co-operation and help of several individuals, professional experts, NGOs and Governmental institutions, to whom I sincerely express my gratitude. The first among these is Prof. Vinod Ahuja, Associate Professor, IIM Ahmadabad and South Asia Coordinator PPLPI, for his deep interest and critical assessment of all aspects of this document.

The consultative approach adopted by PPLPI (South Asia), CALPI programme of SDC/IC and Animal Husbandry Department of Government of Andhra Pradesh is a novel one. Indeed, these institutions provided me with excellent opportunity by organizing interactive group meetings of stakeholders, Government functionaries and experts, NGOs, individuals and livestock farmer groups' on more than one occasion. This richly benefited all concerned in evolving innovative, pragmatic and result oriented approaches for the control of selected livestock and poultry diseases in Andhra Pradesh and I express my sincere gratitude to all these institutions and individuals.

Dr. Daniel Gustafson (FAO Representative in India), Dr. AK Joseph (Senior Program Coordinator, CALPI), Dr. MPG Kurup (Livestock and Dairy Consultant), Dr. NR Bhasin, Consultant (Livestock) and Dr. Ramalinga Raju (Former CEO, APLDA) have been particularly helpful in developing this document and I owe my sincere thanks to them.

I enjoyed a very special professional relationship with the Department of Animal Husbandry, Andhra Pradesh. In this context, Dr. L. Mohan, Director of AH & VS, Govt. of Andhra Pradesh, richly deserves my appreciation and sincere thanks for his personal involvement and for providing the state livestock disease and related information through an expert technical team headed by Dr. Piedy Sreeramulu (Addl. Director) along with Dr. Vijaya Kumari (Jt. Director-BP, VBRI) Sudarshan Rao (Jt. Director-DIO, VBRI), Anantha Ram (Jt. Director-APLDA), Hanumantha Reddy (Epidemiologist) and others. I earnestly appreciate their active discussions and creative suggestions.

I wish to thank Dr. A.K Joseph (CALPI, New Delhi), Dr. Meeta Punjabi (FAO, New Delhi), Dr. Sagari Ramdas (ANTHRA, Hyderabad) and Ms. Rebecca Katticaren (NRMPA, Hyderabad) for their interactive participation in assessing the field problems.

Finally, I am grateful to FAO (PPLPI) and SDC-CALPI for giving me this opportunity to come up with the disease control strategies, which I am confident, the other states of India will emulate for the benefit of poor livestock farmers.

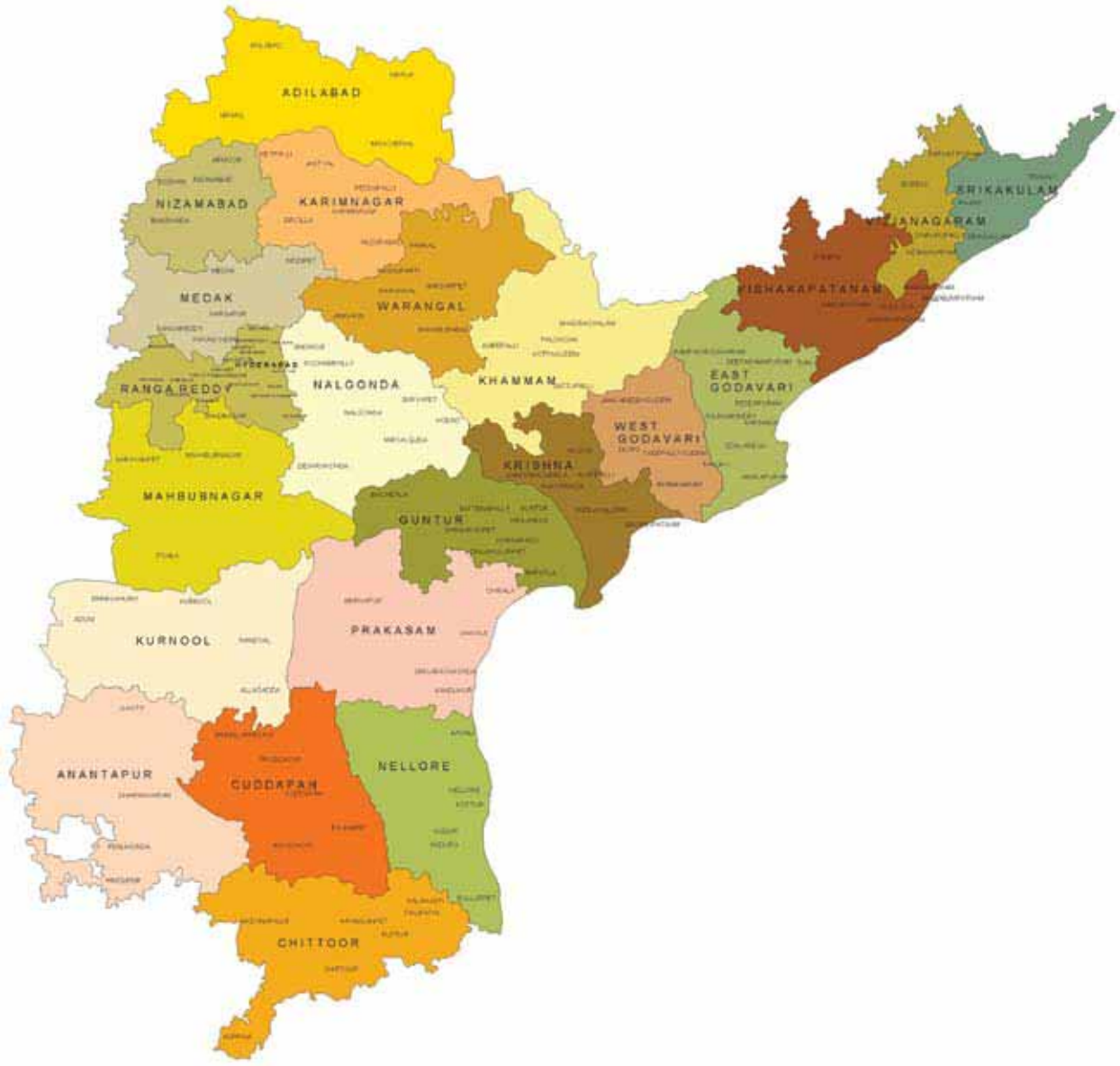
M Rajasekhar

Author

Dr. M. Rajasekhar, a veterinary microbiologist, earned his B.V.Sc. (1966) and M.V.Sc. (1968) degrees from the University of Agricultural Sciences, Bangalore and a Ph.D. (1981) from the University of Edinburgh, Scotland. He served as Associate Professor of Veterinary Microbiology at Bangalore Veterinary College and then as Founder Project Director, Project Directorate on Animal Disease Monitoring and Surveillance, Indian Council of Agricultural Research, Hebbal, Bangalore, from where he retired in 2002. He has worked in the top veterinary laboratories in Europe and USA and has received awards from ICAR, DBT and Office International des Epizooties, Paris (OIE Meritorious Award -2002).

He has richly contributed to animal disease monitoring and surveillance and control of infectious diseases in India, in addition to developing ELISA Diagnostic Kits and epidemiology software - India.admasEpitrak. He played a pivotal role in the eradication of Rinderpest from India. Presently he is a Consultant in animal health programmes and production of veterinary biologicals.

Map Of Andhra Pradesh



Introduction

India has the world's largest livestock population reared under poor nutrition, zoo-sanitary and healthcare practices. In addition, innumerable endemic diseases cause considerably high economic losses to predominantly poor, marginal and landless farmers. The economic losses related to disease arise through morbidity, mortality, decreased production; reduced fertility, inefficient feed utilization resulting in inadequate weight gain and impaired draught power. Further, some of these diseases are Zoonotic and have significant impact on public health especially in womenfolk who traditionally work with animals.

Disease prevention and control of major livestock diseases in the predominantly agrarian community has great potential to improve the quality of life of the rural people. The high incidence and prevalence of livestock and poultry diseases, often round the year, demand long-term sustainable approaches including provision of operational infrastructure, organised disease monitoring and timely reporting and mobility of biologicals (vaccines and diagnostics) and veterinary professional service providers.

In this context, PPLPI and CALPI joint effort to study the most common diseases of significant economic losses in the state of Andhra Pradesh, has the objective to help the state administration fine-tune its initiatives to provide timely livestock healthcare to prevent disease outbreaks.

Five diseases — Haemorrhagic septicaemia (HS), Peste des Petits Ruminants (PPR), Black quarter (BQ), Enterotoxaemia (ET) and Ranikhet disease (RD) — were identified for this study. Selection of these diseases was done on the basis of their economic importance for the poor. In the absence of precise data/estimates on the extent of economic losses caused by different diseases, the selection of these diseases was done by a brainstorming session comprising of representatives from PPLPI, CALPI and DAH, selected professional veterinarians, epidemiologists and NGOs.

The scope and mandate of this exercise was to evolve 'Action Plans' to control the 'identified five diseases' in AP, through a focused epidemiological analysis of the retrospective seven-year (1998 to 2004) disease outbreak data to delineate their long-term trends. Specific temporal and spatial parameters associated with the long-term disease trends in the population and their usefulness in evolving control strategies and action plans were considered.

The long term influence of monthly and seasonal incidence of disease outbreaks e.g. monsoon periods, also formed the basis for data analysis, interpretation and identification of critical periods for vaccine interventions. The disease situation in the 22 districts of the state was analyzed in

totality to prioritize the disease burden in each district and this in turn, paved the way to categorize districts that sustained around 80 per cent infection load in the past seven years. This was done for all the five 'selected diseases' with specific intention of introducing targeted long term action plans to bring down disease incidence and prevalence levels and the spread of infection to other locations.

Based on analysis and general epidemiological considerations, a two-pronged approach to disease control is suggested. This includes massive sustained vaccinations in high disease incidence districts to substantially bring down or freeze disease outbreaks in high-risk districts while allowing restricted vaccination in identified 'infection foci' if and when persistent outbreaks surface in low-risk districts.

This report is organized as follows:

Section 1 presents background information on the livestock demography of Andhra Pradesh, veterinary and animal husbandry infrastructure and disease investigation and reporting system. Section 2 presents long term trends and profiles of the

Table 1: Livestock Population in Andhra Pradesh: 1999 and 2003 ('000 numbers)

District	1999						2003					
	Cattle	Buffaloes	Sheep	Goats	Pigs	Total	Cattle	Buffaloes	Sheep	Goats	Pigs	Total
Adilabad	756	206	178	258	17	1416	865	301	584	328	18	2097
Ananthapur	670	316	929	355	30	2316	695	411	1906	503	39	3570
Chittoor	857	144	550	223	21	1796	835	141	981	247	11	2217
East Godavari	336	498	65	155	49	1104	248	515	125	137	26	1052
Guntur	135	960	483	218	52	1849	105	961	777	180	24	2048
Hyderabad	3	7	1	6	1	19	4.4	31.4	2	12	0.4	52
Kadapa	219	429	533	262	13	1459	159	447	973	371	12	1965
Karimnagar	634	468	728	242	39	2112	468	441	1817	317	62	3105
Khammam	704	507	151	265	57	1683	571	566	325	292	31	1787
Krishna	160	767	202	125	29	1283	102	849	424	136	17	1528
Kurnool	548	415	567	283	18	1842	429	459	1149	387	13	2444
Mahbubnagar	893	352	1475	445	42	3207	731	356	3357	509	44	4998
Medak	463	301	346	293	32	1439	422	367	1015	370	35	2212
Nalgonda	694	604	746	334	57	2437	533	592	1822	404	41	3392
Nellore	266	629	406	175	14	1490	156	634	783	183	12	1768
Nizamabad	354	271	246	190	16	1079	316	334	784	234	13	1685
Prakasham	157	830	569	231	38	1826	119	1029	1157	295	19	2620
Rangareddy	317	201	241	243	23	1026	305	272	647	319	14	1558
Srikakulum	637	163	235	145	38	1219	695	157	514	185	21	1572
Vishakhapat-nam	448	420	192	237	44	1343	385	484	220	226	20	1337
Vizianagaram	440	274	273	163	41	1192	400	253	513	197	31	1395
Warangal	691	433	554	265	51	1995	578	487	1329	328	53	2774
West Godavari	220	451	69	101	26	868	177	541	171	113	14	1016
Andhra Pradesh	10602	9657	9743	5213	748	36010	9300	10629	21376	6277	570	48195
All India	198882*	89918*	57494*	122721*	13291*	485385*	178938	93225	61507	114594	635	464472

** 1997 data*

*** Source: Indiastat*

identified diseases and outlines the vaccination and control strategy for each of the five diseases (with district wise disease trends and proposed vaccination schedules in Annexure 1 to 4). Section 3 offers some thoughts on strengthening and institutionalizing the disease control programmes in Andhra Pradesh.

1. The Setting

Andhra Pradesh (AP) is the third largest state in India with an area of 275,000 sq. km. with 6,85,08,008 hectares of pastures and grazing land. The net irrigated area in the state is 60,92,074 hectares. The State is bordered on the south by Tamil Nadu state, on the west by Karnataka state, on the north and northwest by Maharashtra state, on the northeast by Madhya Pradesh and Orissa states, and on the east by the Bay of Bengal. The northern area of Andhra Pradesh is mountainous. The climate is generally hot and humid with annual rainfall of 125 cm. The Krishna and Godavari are the major river systems in the state. The human population of the state is 75,727,541 with literacy rate of 61.11%. Net Domestic Product of the state is Rs.397.04 million.

AP has 23 districts (in this report Ranga Reddy and Hyderabad districts have been merged making it 22 districts – as is being used by the State Animal Husbandry Department) and agriculture is the most important sector of the state's economy. About 70 percent of the population works in agriculture and the state is one of India's main rice-producing areas. The main crops are rice, maize, millets, pulses, castor, tobacco, cotton, sugarcane, groundnut, and banana.

Livestock Demography

Andhra Pradesh has a large livestock population—about a million heads (almost 10 percent of total livestock population of India). Nearly two-thirds of livestock in AP comprises small ruminants (about 44 percent sheep and 13 percent goats). This composition is in sharp contrast with the national picture with the proportion of small ruminants being below 40 percent and that too predominantly in favour of goats (Table 1). At all India level, goats comprise about 25 percent of the total livestock population and sheep less than 15 percent. Another striking feature pertains to the growth of livestock population. Across the species, sharpest growth was recorded by sheep followed by buffaloes. Population of cattle, on the other hand, declined during this period.

1.1 Contribution to state GDP

During 2003-2004, the livestock sector contributed 7.22 per cent to the state GDP and provided employment to several lakh families as provided in *Table 2*.

1.2 Veterinary and Animal Husbandry infrastructure

The progressive outlook of the State Dep. of Animal Husbandry has resulted in rapid growth of the livestock sector. The state has impressive record of participation in the internationally sponsored programmes and actively supports NGOs involved in livestock developmental activities in the state. The unique state institutions - APLDA and SMILDA – are spearheading livestock development activity in the state. The central epidemiology unit at the

Table 2: Livestock sector contribution to State GDP (in Rs. Crores

Sl.no.	Livestock sector	Value at current prices	Value at constant prices	Percentage contribution to GSDP	Employment generation (Lakh families)
1	Milk	6,263	3,554	3.69	17.50
2	Meat	3,344	2,314	2.16	5.31
3	Eggs	1,649	1,037	1.13	1.82
4	Wool & Dung	550	225	0.24	---
Total		11,806	7,130	7.22	23.63

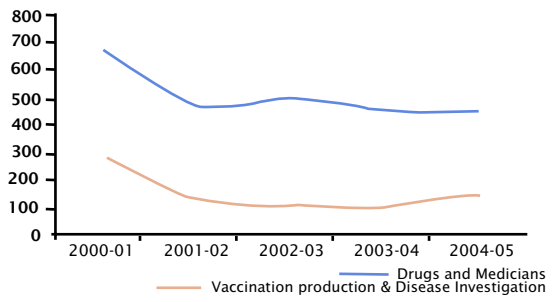
Table 3: Veterinary infrastructure in Andhra Pradesh

Sl.no	District	Animal Health Centre	Vet Poly clinic	Vet Hospital	Vet Dispensary	Rural Livestock Unit	RP Check Post
1	Adilabad	1	1	9	76	61	0
2	Ananthapur	1	1	16	95	62	1
3	Chittoor	1	1	15	97	179	4
4	E. Godavari	1	1	15	105	100	0
5	Guntur	2	1	16	99	152	0
6	Kadapa	1	1	13	69	135	0
7	Karimnagar	1	1	9	91	145	0
8	Khammam	1	1	10	78	148	0
9	Krishna	1	1	17	88	212	0
10	Kurnool	1	1	15	91	190	0
11	Mahbubnagar	1	1	12	97	223	0
12	Medak	1	1	10	68	132	1
13	Nalgonda	1	1	13	95	161	0
14	Nellore	1	1	15	80	101	0
15	Nizamabad	1	1	8	45	57	1
16	Prakasam	1	1	9	90	96	0
17	RR & Hyd	0	2	11	61	160	0
18	Srikakulam	1	1	13	56	112	5
19	Vishakapatnam	1	1	16	64	76	0
20	Vizianagaram	1	1	11	47	85	3
21	Warangal	1	1	14	81	133	0
22	W. Godavari	1	1	11	83	94	0
Total		22	22	278	1756	2814	15

head quarters is putting its best effort to computerize livestock and poultry disease database. The state veterinary professionals and service providers are motivated and dedicated to provide livestock health care and production.

AP has an elaborate network of veterinary services sector consisting of poly-clinics (22), vet hospitals (278), vet dispensaries (1756) and rural livestock units (2814) which provide livestock health care through treatment, prophylactic vaccinations and extension programmes (*Table 3*). In addition, each district has an Animal Health Centre (AHC) which serves as district veterinary disease diagnostic laboratory.

Figure 1: State budget allocation for drugs, medicines, vaccine production and disease investigation



1.3 Vaccine production and disease investigation services

The Veterinary Biologicals Research Institute at Hyderabad and its subsidiary at Samalkota manufacture vaccines used to prevent endemic diseases (*Tables 4 and 5*). The VBRI also provides disease investigation and diagnostic services in the state. The budget allocated for vaccine production and disease investigation has consistently

Table 4: VBRI - Vaccine production particulars (in Lakh doses)

Vaccine	2000-01	2001-02	2002-03	2003-04	2004-05
Hyderabad unit					
HS	77.2	82.929	77.337	82.807	65.68
BQ	30.1	29.672	31.676	31.561	23.732
ET	70.0	59.691	75.116	90.095	72.224
Anthrax	5.2	5.02	5.117	5.202	5.143
RD (K)	107.0	74.00	94.48	72.16	77.26
RD (F1)	1.5	-	2.64	7.00	5.5
Fowl pox	31.0	37.02	37.3	30.2	44.7
Sheep pox	9.1	13.80	10.68	29.47	32.8
PPR (TCV)	15.8	4.70	4.70	29.00	57.5
Samalkota unit					
RD (K)	89.938	87.69	129.04	157.77	83.68
RD (F1)	10.146	7.2	15.682	11.885	21.81
Duck plague	-	42.2	-	-	-
Fowl pox	30.5		35.422	31.47	49.36
HS	-		-	1.01	20.216
Total					
HS	77.2	82.929	77.337	83.817	85.896
BQ	30.1	29.672	31.676	31.561	23.732
ET	70.0	59.691	75.116	90.095	72.224
Anthrax	5.2	5.020	5.117	5.202	5.143
RD (K)	196.938	161.69	223.52	229.93	160.94
RD (F1)	11.646	7.200	18.322	18.885	27.31
Fowl pox	61.5	37.02	72.722	61.67	94.06
Sheep pox	9.1	13.80	10.68	29.47	32.8
PPR (TCV)	15.8	4.70	4.70	29.00	57.5
Duck plague	-	42.2	-	-	-

declined and stood at Rs.450 lakhs for drugs and medicines and Rs.142 lakhs for vaccine production/disease investigation in 2004-2005 (Figure 1).

The number and the type of clinical samples examined are presented in *Table 6.*

1.3.1 Livestock Diseases in Andhra Pradesh

General considerations

A P has an interesting and unique geo-agro-climatic location in the peninsular India, which in turn, bestows a formidable disease burden on its huge livestock population. The climatic predisposition (southwest and northeast monsoons) of coastal Andhra and dry and drought prone Rayalaseema distinctly support varied livestock population preponderance and husbandry practices that have direct influence on disease incidence and prevalence. The frequent cyclonic depressions and hot and humid weather conditions along the Coastal Andhra especially predispose animals to vector borne diseases like Bluetongue and respiratory diseases like HS.

The outbound uncontrolled migration of AP livestock, especially cattle, sheep and goats, to its surrounding five states adds new dimension to Trans-boundary movement of diseases. Increased commercialisation of livestock trade (and their products) has added a new dimension to rapid spread and high endemicity of livestock diseases.

Table 5 VBRI – Vaccine supplied to the districts during 2004 – 2005 *(Doses)*

District	HS	BQ	ET	AX	RD (F1)	FP
Adilabad	326400	182600	226000	0	0	330000
Ananthapur	520950	257700	989200	36000	0	460000
Chittoor	175500	31200	397800	172800	10000	0
E. Godavari	58500	89700	62400	0	0	0
Guntur	319400	15600	78200	5000	0	0
Kadapa	327600	31200	448900	77000	103000	70000
Karimnagar	411800	139700	943500	0	0	140000
Khammam	42000	144600	143600	0	0	250000
Krishna	373700	16850	160600	0	12000	20000
Kurnool	350600	214000	653200	67000	10000	115000
Mahbubnagar	462500	397500	660500	15000	150000	1090000
Medak	421100	100000	325000	13000	105000	330000
Nalgonda	359000	98600	431600	1200	0	436000
Nellore	80600	30000	464300	30300	0	0
Nizamabad	370700	136000	340800	5000	35000	409000
Prakasam	181650	31200	327600	20600	0	40000
RR & Hyd	287950	125150	818900	31200	13000	763600
Srikakulam	78000	226200	249600	0	0	0
Vishakapatnam	67050	152100	278900	30000	60000	80000
Vizianagaram	50700	97500	249600	0	0	0
Warangal	582600	36800	440400	0	0	184000
W. Godavari	98800	42900	78000	10000	0	0
Sold to other states	0	0	0	2200	0	0
Total	5947100	2597100	8768600	516300	498000	4717600

The endemic infectious diseases in the state include viral diseases: Foot and Mouth disease, Peste des Petits Ruminants, Bluetongue, Sheep Pox, Goat Pox, Cow pox, Ranikhet disease, Infectious Bovine Rhinotracheitis, Rabies, Infectious Bursal Disease, Marek's disease, and bacterial diseases: Anthrax, Black quarter Brucellosis, Haemorrhagic septicaemia, Enterotoxaemia, Pullorum disease and Fowl Cholera.

The current levels and timing of population vaccinations is inadequate to induce sustainable herd immunity levels to prevent recurrence of outbreaks. The state has no specific long-term policy or approaches for disease control and routinely carries out post-outbreak vaccinations, generally to tide over disease crisis.

1.3.2 Livestock disease reporting system

The disease reporting system is sadly a routine, snail-paced and low profile administrative ritual. More importantly, there are no restrictions on disease reporting. The brighter side of this 'slow process' is that, over the years, the AP state has consistently recorded disease outbreaks. This is in sharp contrast to many other states which do not report disease outbreaks on the expected lines. As regards the accuracy and validity of the disease reports, the state vet

Table 6: Clinical samples examined by the disease investigation lab. (VBRI)

Type of clinical sample	2002-03	2003-04	2004-05
Blood, tissue impression, culture smears	27957	27939	25534
Faecal samples	14264	10125	12567
Serological tests	5355	5361	4659
Histopathological tests	14156	12784	13167
Culture tests	2628	4235	4440
Biological tests for disease confirmation	1053	913	779
Post-mortems of livestock & lab animals	1272	1540	1608
FAT for rabies diagnosis	126	114	90
Human sera screened for JE antibodies	555	859	517
Animal sera screened for JE antibodies	1251	1183	1050
Mosquitoes collected for JE vector study	1074	541	624
TB and Jones disease screening	1585	830	1187
Brucellosis screening of serum samples	5254	5420	5614
Brucellosis screening of milk samples	774	422	900
ELISA screening Brucellosis antibodies	4112	2361	124
ELISA screening PPR screening	2346	3039	1783
FMD virus typing	405	653	77
Aflatoxin estimation in feeds	407	356	409
Proximate principles analysis in feeds	1343	1041	884
Mineral, Phytotoxin, Inorganic poisons	48	145	60
Other diagnostic tests	704	567	623
Health certificates on meat /mutton samples	651	745	944
Health certificate on egg consignments	180	252	132
Total	87500	81425	77772

administration has good reputation for encouraging/supporting field veterinarians to send clinical samples for laboratory confirmation both within and outside the state (Consultant's personal experience at PD_ADMAS, Bangalore). In fact, the AP Veterinary Association has an exclusive award and honours for veterinarians who sends maximum number of clinical samples for laboratory investigations.

In the specific context of this study, sole importance is given to disease outbreaks as an empirical temporal and spatial event and relatively less credence to their actual numbers, attacks, deaths or villages affected, which are often not very reliable. The disease outbreak data of the seven-year period (1998 to 2004) selected for this report is considered adequate and a disease outbreak is simply reckoned as an event recorded at particular time and space in the state.

2. Proposed Approach For Disease Control

A decisive emphasis on timely and location-specific vaccine interventions, only in previously infected locations to bring down the disease burden, is the basic concept on which the proposed strategy is based. Most importantly, relative disease incidence priority at district level focuses on timely vaccination helps to optimize short supply and distribution of precious vaccines in the state.

This report recommends a two-pronged district-level approach, which involves,

1. Pulse and/or massive annual simultaneous vaccination policy in "high- risk" top ten districts in one-go at the "epidemiologically prime period" of the year for 3-5 years (or longer). This is ideal for HS, PPR, BQ and ET but not for RD.
2. Conventional "combing" vaccinations in previous outbreak locations, post outbreak 'ring vaccination' in fresh outbreaks, in the low-risk districts – other than the top ten districts - for all the 'selected diseases' is required.

The long term reward of these approaches is high. The conventional limited area vaccine programmes have no tangible impact on disease occurrence. In addition, it may prove uneconomical in the end and lead to 'live with the disease' situation. There is a definite need to change our 'mind set' in this context and the scrutiny of long term disease profile maps presented in this report confirm the need for this strategic vaccination change.

The significant limitations of vaccine availability, manpower, resources and administrative/political willingness to embark on state-wide mass vaccination campaigns make it prudent to priority targeting of 'high-risk districts' with high endemicity, attack and mortality rates. The present restricted area vaccination programmes on the face of an outbreak present a piece-meal and fire-fighting approach – though ideal for sporadic outbreaks.

The following vaccination strategies are recommended for control of the 'selected diseases'.

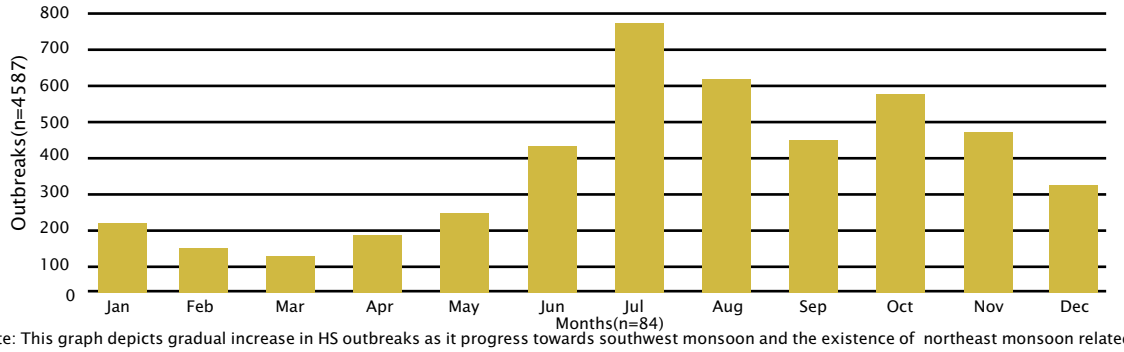
2.1 Haemorrhagic Septicaemia (HS)—A tough call

Haemorrhagic septicaemia (HS), a bacterial disease caused by Pasteurella multocida, is the most economically important bacterial disease of cattle and buffaloes in India. At national level, after Foot and Mouth Disease, HS is the most widespread with high morbidity and mortality rates and kills more than 100,000 animals annually. It assumes basic importance as the causative organism is present as a commensal in the upper respiratory tract of healthy animals and stressful conditions, often related to monsoon precipitate the outbreaks.

Andhra Pradesh ranks first in the total number of HS attacks reported in the country in the past five years followed by Gujarat and Karnataka. In fact, Prakasam, Nellore, Guntur and Kadapa districts of AP are among the top ten districts reporting maximum HS outbreaks in the country (source: PD_ADMAS, Bangalore).

Continuous round the year HS outbreaks pose a challenge to control as the immunity produced by the presently used Aluminium Hydroxide gel vaccine (VBRI supply) produces immunity for four to six months only and is not particularly suited to coastal Andhra. This situation demands more than one vaccination, unless changed over to oil adjuvant vaccine, which is produced by many other states and commercially available.

Figure 2: HS in Andhra Pradesh - Long term monthly trend



Note: This graph depicts gradual increase in HS outbreaks as it progress towards southwest monsoon and the existence of northeast monsoon related outbreaks during September to December months are apparent, as seen by the minor peak

Table 7: HS outbreaks in AP – District level incidence during 1998-2004

District Name	Number of Outbreaks	Villages Affected	Number of Attacks	Number of Deaths
Prakasam	1134	1140	4505	2403
Nellore	455	455	1836	1063
Guntur	452	452	3197	1504
Kadapa	444	443	1865	1297
Ananthapur	356	359	1376	966
Nalgonda	259	271	1051	636
Mahbubnagar	241	241	1043	604
Khammam	240	240	1081	498
East Godavari	221	221	714	351
Krishna	217	223	1291	654
Kurnool	132	132	623	439
Medak	96	101	518	322
Karimnagar	94	94	378	156
Nizamabad	80	80	588	302
Chittoor	70	85	413	231
Warangal	63	66	821	265
Vishakapatnam	35	36	215	135
West Godavari	31	31	248	129
RR & Hyd	27	27	191	102
Adilabad	24	24	158	84
Srikakulam	9	9	85	27
Vizianagaram	5	5	39	24
Total	4685	4735	22236	12192

It is well known that coastal districts of AP bear the brunt of vagaries of the sudden or sustained adverse climatic conditions that invariably predispose livestock to HS outbreaks. The top five high risk/endemic districts in the state are seen in *Table 7*. Unlike other peninsular states of India, coastal AP receives most of the northeast monsoon and this decidedly adds to the disease burden – and there are definite and distinct outbreaks during this period – second peak. For example, Nellore, Kadapa, Ananthpur districts have more HS outbreaks during northeast monsoon as compared to southwest monsoon. Prakasam district has almost equal number of outbreaks in both the monsoons.

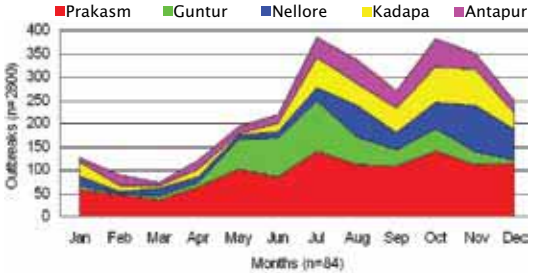
Time wise, HS outbreaks occurred round the year with highest incidence during and pre-and-southwest and northeast monsoons from May until the end of November (Table 8 and Figure 2). The HS outbreaks in June to December ranged high at 751 to 338 outbreaks compared to low to moderate numbers in March (133), February (140), April (177), January (229) and May (272). This fact obviously indicates that geo-agro-meteorological factors decide on the disease incidence and prevalence in a particular location, as reflected by the long term seasonal disease trends.

In addition to the large number of outbreaks during the southwest monsoon, there are definite and distinct outbreaks related to northeast monsoon period – the second peak in the epidemic curve (For example, Nellore, Kadapa, Ananthpur districts have more HS outbreaks during northeast monsoon as compared to southwest monsoon. Prakasam district has

Table 8: HS in AP - Monthly outbreaks during 1998-2004 –Long-term trend

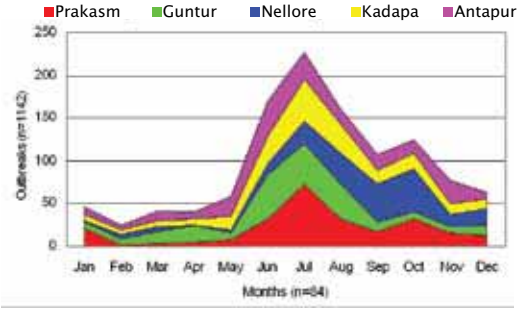
Month	Number of Outbreaks	Villages Affected	Number of Attacks	Number of Deaths
January	229	229	1035	626
February	140	140	563	355
March	133	133	752	376
April	177	179	880	436
May	272	284	1560	850
June	435	437	2059	1064
July	751	752	3835	1816
August	623	627	3096	1683
September	523	525	2309	1339
October	587	590	2726	1635
November	477	489	1957	1214
December	338	350	1464	798
Total	4685	4735	22236	12192

Figure 3: HS in AP, Area map of top five districts – Relative trends



Notes: This area map intricately depicts preponderance of HS outbreaks in the top five districts of AP. For example, HS in Guntur is predominantly a pre southwest monsoon activity, in contrast to Nellore and Kadapa districts where most outbreaks occur during northeast monsoon. Ananthpur is equally poised for both monsoon periods.

Figure 4: HS in AP, Area map of next top five districts – Relative trends



Notes: The 'next five' districts implicitly indicate that a majority of the HS outbreaks are factored into southwest monsoon and less so with northeast monsoon. Interestingly, in Mahbubnagar district, a majority of the outbreaks occur towards the end of the southwest and beginning of the northeast monsoon and the reverse is the situation with Khammam district.

almost equal number of outbreaks in both the monsoons).

In view of the above analysis, the following action plan is recommended for HS control.

2.1.1 District-wise action plan for HS control

Each district has a niche ecosphere and biosphere favourable or non-favourable for the pathogen to produce HS disease. These results in precise timing of HS outbreaks now identified for each district, which forms the basis for vaccination.

To immediately bring down the disease burden in the highly endemic top five districts and elsewhere and to reduce the economic losses to the poor and marginal farmers, a workable 'road map' should be prepared by the Department of Animal Husbandry.

1.All veterinary institutions should create a calendar of vaccination events in their jurisdiction. A list of villages and Mandals (with their bovine population), which suffered HS in the past 2-3 years should be prepared on priority basis and mandatory prophylactic vaccination campaigns planned well in advance as recommended in this report.

2.Ring vaccination in villages/Mandals

reporting HS outbreaks outside the previously documented locations initiated immediately and followed up by annual prophylactic vaccinations for next 3-4 years or longer.

The causative organism being 'insidious' to the bovine respiratory tract, the disease may occur any time and efforts should be made to avoid stressful conditions – especially in the rainy seasons.

2.1.2 Vaccination schedule

The sheer magnitude of massive HS outbreaks (1134), Prakasam district demands organised priority HS vaccination of its 24-lakh bovine population. In addition, Nellore, Guntur, Kadapa, and Ananthapur districts with 350 to 450 outbreaks and other districts with lesser outbreaks, also need annual prophylactic vaccinations. The state roughly needs 212 lakh HS vaccines to cover all its livestock and this is not simply achievable due to the resource constraints.

Therefore, a tangible approach for HS control would be to bring down the outbreak levels in Prakasam, Nellore, Guntur, Kadapa and Ananthapur and in other districts preferably pre-monsoon vaccinations to reduce mortality is undertaken. Initiation of vaccinations in high-risk areas during April and May is expected to provide the optimal protection during the ensuing southwest and northeast monsoon periods. Detailed district-wise vaccination schedule is outlined in Annex 1.

2.2 Peste des Petits Ruminants (PPR) control- a distinct possibility

PPR is a disease of small ruminants caused by PPR virus, related closely to the Rinderpest virus. It predominantly affects goats, but in India the disease is more often seen in sheep. The virus does not infect cattle and buffaloes under the natural conditions.

PPR was first reported in sheep in 1987 in Tamil Nadu and from a sheep outbreak in February 1992 in Chittoor District in AP. During the last few years, the state had major epidemics of PPR, considerably more compared to the other Indian states, possibly because of the huge small ruminant population and nomadic sheep husbandry system. The small ruminant population consists of 9.64 million sheep and 5.16 million goats and their population density is highest in the southern half and high in Mahbubnagar and Ananthapur districts.

Sheep husbandry in AP: Some features

Sheep rearing is not very important in agricultural areas that rely on irrigation, but low rainfall and dry areas practice sheep husbandry quite extensively. Sheep rearing is confined mostly to the western and southern districts but goats are kept throughout the state – both for meat, primarily. Both sheep and goat rearing are largely undertaken by the low-income villagers providing their main source of livelihood.

For decades, sheep reared on free-range grazing resort to organised migration due to diminishing grazing resources during two different periods of the year. In irrigated areas, sheep must move away to dry, uncultivated areas or to the forests from July to February, when crops are growing. They return in March with the harvest of the second crop as practiced in Guntur, Krishna, West Godavari, Vizianagaram, Kurnool and Kadapa Districts.

Sheep living in arid areas migrate from January to June to areas with large, canalized irrigation projects which is

The rearers are increasingly becoming aware of the urgency for timely vaccinations

typical in Mahbubnagar (to Nalgonda District), Karimnagar (to the forest fringes of Adilabad District), Ananthapur (to the adjacent area of Karnataka State) and in Medak (to the backwaters of Nizamsagar). Usually migration involves flocks of 50 or more sheep only; smaller flocks are able to subsist throughout the year within the village limits. Small number of goats may accompany these migrating sheep to act as lead animals but are retained largely at the villages, all the year round.

The state veterinary department has found sheep owners to be both conservative and superstitious. On the face of an outbreak of an infectious disease, traditional remedies are tried generally, before veterinary advice is sought. However, shepherds have some knowledge concerning infectious diseases and ways of limiting their spread. Even so, they do not hesitate to dispose of sick animals for local slaughter and the incubating stock in local weekly livestock markets. If an affected flock is large, it may be sent for slaughter to a metropolitan market following a so called "distress sale".

Epidemiological considerations

The macro-epidemiologic picture of PPR at Andhra Pradesh state level is indeed an epidemiologist's delight for it being so uniquely simple with a confirmative sloppy trend, true to the PPR virus characteristics of being highly infectious but less contagious. There is a very slow and gradual build up of infection in the population starting from October to January when massive and explosive outbreaks start forthcoming. After reaching steep peak in March, outbreaks gradually decline with the progression of ensuing summer months until June. In addition, the onset

Table 9: PPR in AP – District Level outbreaks during 1998 to 2004

Sl.no	District Name	Number of Outbreaks	Villages Affected	Number of Attacks	Number of Deaths
1	Warangal	288	288	14170	3724
2	Nalgonda	210	210	3419	1157
3	Prakasam	205	205	3285	820
4	Karimnagar	196	196	5496	1491
5	Mahbubnagar	189	189	3949	1304
6	Nellore	176	176	2096	817
7	Kadapa	157	157	4532	913
8	Guntur	119	119	2383	736
9	Chittoor	95	95	1934	537
10	Krishna	94	95	1748	448
11	Khammam	91	91	982	365
12	Kurnool	80	84	894	418
13	Medak	59	59	2222	1250
14	Nizamabad	44	44	784	296
15	RR & Hyd	42	42	2083	465
16	Vishakapatnam	37	40	1104	504
17	East Godavari	30	30	489	122
18	Vizianagaram	27	27	443	66
19	Adilabad	16	16	487	106
20	Ananthapur	13	15	330	120
21	Srikakulam	11	11	503	117
22	West Godavari	10	10	429	156
Total		2189	2199	53762	15932

of southwest monsoon seems to have a profound 'cooling effect' that extends to include northeast monsoon period as well, in stark contrast to the most prevalent HS.

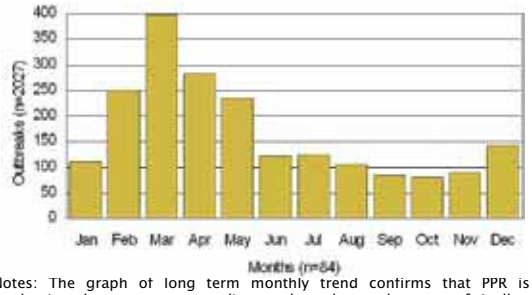
The gross disease distribution pattern within the state is so intriguing in that it literally 'runs' in the middle of the state from north to south. This stretch of high endemic 'longitudinal central zone' – Karimnagar, Warangal, Nalgonda, Prakasam, Kadapa and Nellore from north to south, flanked by Mahbubnagar on the west and Guntur on the east (Table 9) provides an immense real time opportunity to tackle the disease outbreaks most effectively through pulse-vaccination.

PPR virus primarily affects sheep and goats and has no 'alternate' hosts for its survival. Also, the recovered and the vaccinated (sero-converted) small ruminants are immune for life; it is this nature of the disease supported by retrospective long term epidemiological disease trends help to initiate a state wide pulse vaccination.

In AP, the epidemiological evidence suggests that the PPR virus is maintained within an underlying 'endemic situation' from which periodic epidemics might arise especially in the above heavily entrenched districts. The disease situation in the neighbouring states also plays a major role in the sustenance of PPR primarily due to cross-migration and marketing of animals.

The long term PPR epidemic curve shows two peaks – major peak during November to March and a declining low intensity peak from April to September (Table 10 and Figure 5). These peaks correspond to the lambing seasons in Andhra Pradesh and field investigations in recent times indicate that lambs between one and six months of age are affected most severely. In addition, the disease often occurres in sheep flocks without affecting the goats living in close proximity indicating that sheep are perhaps more susceptible than goats. Building up of hot weather from

Figure 5: PPR in AP - State level Monthly long term trend



Notes: The graph of long term monthly trend confirms that PPR is predominantly a pre-monsoon disease through out the state of Andhra Pradesh (unlike HS, which occurs in monsoon period). Broadly, outbreaks start from November, peak in March and end mostly in June. This trend has many epidemiological pointers towards PPR control/eradication through a feasible 'pulse-vaccination' programme for the state – this immediately freezes the virus activity and dramatically brings down the disease burden in the population. Tissue culture PPR vaccine confers lifetime immunity.

Table 10: PPR in AP – Monthly Outbreaks during 1998-2004

Month	Number of Outbreaks	Villages Affected	Number of Attacks	Number of Deaths
January	115	119	1871	636
February	262	262	7095	1924
March	432	432	11316	2961
April	330	330	8842	2794
May	257	259	6538	2037
June	130	130	3039	851
July	129	129	1944	746
August	110	112	2484	686
September	95	95	1840	521
October	91	91	2239	1151
November	91	91	2414	703
December	147	149	4140	922
Total	2189	2199	53762	15932

March until May appear to be favourable for its spread and maintenance.

Seasonal incidence of PPR outbreaks

The macro-epidemiological observations on PPR outbreaks during the review period of seven years (1998 to 2004) are presented as state/district trend graphs, which are self-explanatory (Figure 6; Annexure 2).

The disease outbreaks, recorded round the year, clearly indicate a very conducive endemic disease situation supporting virus sustenance in the small ruminant population, which have a short 'turn-over' life cycle. This warrants long term strategic approaches to 'freeze' the virus activity in the population, preferably through pulse-vaccination for its control in the years to come.

Proposed plan of action

Based on the above analysis, a field based pragmatic approach for result oriented PPR control, especially in the top ten districts that account for more than 80 per cent of the outbreaks in AP, is recommended. It is the 'timing and nothing but timing' of vaccinations that matters in the disease control. For example, the proposed pulse-vaccination for PPR is an innovative approach totally directed by the ground epidemiological realities of the disease incidence and prevalence in AP state. The disease pattern, the nature of the virus and the availability of 'rugged' PPR vaccine are the cornerstones to plan and execute PPR control programme in the state – like Rinderpest.

PPR pulse-vaccination in ten high-risk districts (which account for 80 per cent of the annual outbreaks) will immediately freeze the virus survival in the population for good within two to three weeks of vaccination, leaving hardly any viable virus to spread to other districts. In low outbreak locations, selective 'combing' vaccination of the previously infected villages/Mandals further eliminates the virus activity in the state – which substantially supports the pulse-vaccination campaign. This helps to build up good herd immunity levels to ward-off any lurking infection foci. There is direct economic gain to the farmers by preventing this most devastating sheep and goat disease.

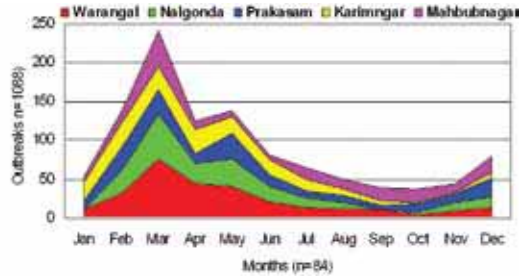
However, there is an absolute need to confirm the success of pulse-vaccination through post-vaccinal sero-conversion of vaccinated sheep and goats in all the districts. It must be remembered (also from the lessons learnt from the Rinderpest mass vaccination campaigns), that it is the good quality of vaccine, vaccination procedures (cold chain) and systematic sero-monitoring of vaccinated animals, that matter most in the end than the number of repeat vaccinations. In this regard, a sound laboratory based sero-monitoring system is recommended as an adjunct to pulse-vaccination campaign, as was done in rinderpest eradication. This has to be as per the OIE norms and the Indian field kits developed by PD_ADMAS, Bangalore and IVRI, Mukteshwar, considered on their respective merits. The ELISA laboratory infrastructure created by the National Rinderpest Eradication Project, Govt. of India at VBRI, Hyderabad should be strengthened and utilized.

District wise Plan of Action

The 'top five' and the ''next five' PPR high incidence districts (Figures 6 & 7) contribute to 53 and 30.8 per cent of the outbreaks, respectively in the state. This amounts to 80.8 percent the outbreaks confined to these ten districts – which is also the 'magical figure' of herd immunity level that is required to squeeze the virus to extinction. This heavy disease concentration in ten out of the 22 districts, coupled with natural dead-end coastal barrier along the Bay of Bengal, provide perhaps the best PPR control/eradication opportunity to go in for pulse-vaccination. This will have a profound impact on the livestock economy with AP ranking the first in small ruminant population. This is achievable with strengthening of vaccine infrastructure, delivery system and importantly, post-vaccination sero-monitoring system in place and backed by 'absolute political willingness'.

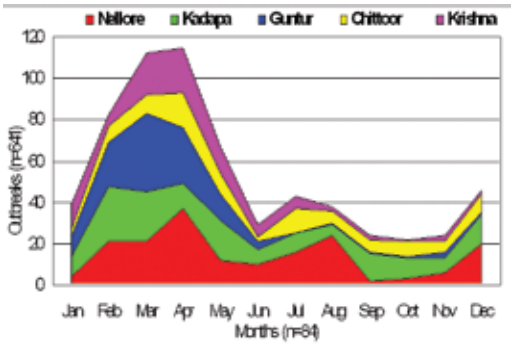
The perfect annual vaccination period against PPR in high-risk ten districts is October and November months (extendable

Figure 6: PPR - Area map of top five districts



Notes: PPR outbreaks (1088) in these top five districts account for 53 per cent of the total outbreaks (2027) recorded in all the 22 districts of the state. The disease events in these core PPR districts appear to be the foci in sustenance, spread and production of the disease in the state.

Figure 7: PPR in AP - Area map of the 'next five districts' - Relative trends



Note: the select 'next five districts' amounted (641) to 30.8 per cent of the outbreaks reported in the 22 districts. This implicitly indicates that bulk of the PPR outbreaks occur during November to May; with the outbreaks in Guntur district restricted to February to April. In addition, these five districts especially, Nellore, Chittoor and Kadapa districts have discernible disease presence during June to September. Nellore, Kadapa and Chittoor districts appear to build up infection right from September while, Guntur and Krishna are rather inactive during the same period

up to December also), which produces lifetime protection. Vaccinations in this 'favourable period', ensures temporary protection of young stock through colostral antibodies during the peak disease period and reduces high mortality rates currently encountered in this vulnerable group. In addition, the young stock will be free of maternal antibodies (which last six-eight months), and are ready for regular vaccination. The disease trend at the district level along with recommended schedule for each of the districts is given in Annex 2.

PPR vaccine requirement

The annual requirement of PPR vaccine for the state is around 150 lakh doses to cover all its small ruminant population. VBRI in the past four years (2000-2001 to 2004-2005) has produced 15.80, 4.70, 4.70, 29.00 and 57.5 lakh doses of PPR tissue culture vaccine, respectively. The immediate vaccine requirement for the top ten districts, which have maximum number of outbreaks, is 86 lakh doses. The district wise break up of annual vaccine requirement for the next 3 to 5 years is Warangal (7.9 lakh), Nalgonda (10.8 lakh), Prakasam (7.9 lakh), Karimnagar (9.6 lakh), Mahbubnagar (19.3 lakh), Nellore (5.4 lakh), Kadapa (7.9 lakh), Guntur (7.2 lakh), Chittoor (7.0 lakh) and Krishna (3.0 lakh). This requirement includes 20 to 25 per cent extra for underutilization of reconstituted perishable vaccine.

Vaccination in the remaining low-incidence 12 districts may require another 50-lakh doses or less for prophylactic vaccination in those villages/Mandals that had PPR outbreaks in the past three years. Yet another 10 lakh reserve doses for ring vaccination are required in new outbreak locations.

To meet this demand from its current production levels of around 57 lakh doses per annum, the VBRI needs strengthening immediately. Effective and result oriented vaccination approach demands this quantity of vaccine to be available in about 3 months period from October to December – it may not be possible for VBRI to produce this level of vaccine at the present juncture. The VBRI has the expertise for the production of PPR vaccine and scaling it up to meet the current requirements, need immediate attention, infrastructure and other inputs. Sourcing of PPR vaccine from other states may ease the supply and demand situation and the AP state needs to consider this seriously. The proposed time-and-location specific vaccination schedules specifically targeted at different districts will definitely help to regulate supply and optimize the use of precious vaccine with predictable results.

In addition, there is a definite need to create an interstate buffer immune belt of about 50 km to ward off incursion of infection from the endemic neighbouring states. This long term disease-safe approach is recommended to be initiated after the

disease burden within the state declines and when the vaccine supply position improves.

A special state plan/scheme with assistance from the Central Government/external sources deserves immediate attention as this may cripple the rapidly growing sheep and goat sector in the state.

The area map of the 'top five' districts depicts PPR preponderance for November to April months and persistence of its subdued outbreaks throughout the year. Of particular interest is the PPR profile in Mahbubnagar where the disease is sustained significantly in the leaner outbreak months as well– the most obvious event in what appears to be an effective 'lateral incursion' of the virus from the 'longitudinal central zone' described above. In addition, early build up of infection process during October onwards in Prakasam and Mahbubnagar districts has epidemiological significance in evolving control strategies.

2.3 Black Quarter (BQ)—Some unusual opportunities

Black quarter (BQ), a soil-borne clostridial infection of bovines, ranks fourth as an economically important disease of livestock in the country. It is most frequent in AP and Karnataka states. The survival of clostridial spores in different kinds of soil types is not well understood and there seems to be some relationship between the soil type and the number of rainy days for the disease to precipitate in a given location. Frequent soil contamination with infective spores due to poor carcass disposal adds to building up and sustenance of soil infection.

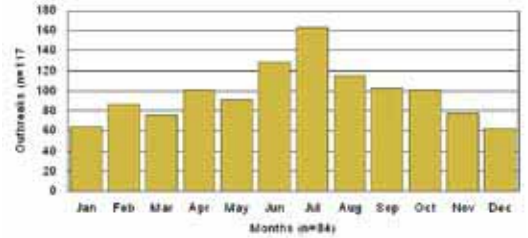
Table 11: BQ in AP – District level outbreaks during 1998-2004

District Name	Number of Outbreaks	Villages Affected	Number of Attacks	Number of Deaths
Mahbubnagar	251	251	942	520
Ananthapur	244	247	720	466
Khammam	125	125	440	236
Srikakulam	93	93	363	191
Chittoor	74	74	223	144
Karimnagar	55	55	196	106
Adilabad	50	50	337	143
Nalgonda	45	45	128	62
Kadapa	36	36	131	99
East Godavari	36	36	203	148
Medak	30	31	183	83
Kurnool	27	27	90	51
Visakapatnam	23	28	217	185
Prakasam	21	22	55	27
Nellore	18	19	52	25
Warangal	10	13	118	95
West Godavari	9	9	31	14
Nizamabad	8	8	62	26
Krishna	5	5	8	6
Guntur	4	4	44	26
RR & Hyd	3	3	7	3
Vizianagaram	3	3	8	5
Total	1170	1184	4558	2661

Epidemiology of BQ infection

AP recorded 1170 BQ outbreaks with 4558 attacks, 2661 deaths of cattle and buffaloes in 1184 villages during 1998-2004 (Table 11). In this period, 593811 post-outbreak vaccinations were undertaken. Mahbubnagar, Ananthapur, and Khammam districts had maximum number of outbreaks ranging from 125 to 251, with other districts below 100. Disease is prevalent round the year with a monthly range of 63 to 163 outbreaks during the past seven years of this review (Table 12 and Figure 8). It is interesting that BQ was never absent in the state but, on the contrary, remained above 63 outbreaks in a year. This strongly reflects that soil is heavily infected and/or contamination is continuing.

Figure 8: Black Quarter in Andhra Pradesh - Monthly long term trend



The line graph of the long term trend of BQ in Andhra Pradesh confirms the disease prevalence all the year round with a bottom line of sixty plus outbreaks in any given month. The outbreaks start in January and reach a peak in July and interestingly begin to decline with the onset of southwest monsoon.

There is a definite increase in the outbreaks during June to October (104 to 163) possibly due to surfacing of spores following the monsoon rains and subsequent infection through ingestion. The epidemiology of BQ provides a unique opportunity to pre-empt disease outbreaks, which can only occur in locations that have a pre-deposit of infectious spores in the soil due to improper disposal of infected carcasses. This requires identification of the infected villages/Mandals and introducing zoo-sanitary measures as long term control measures.

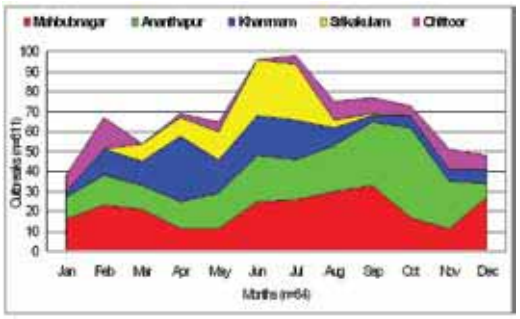
The BQ outbreaks in AP provide an interesting epidemiological reading. The top five districts - Mahbubnagar, Ananthapur, Khammam, Srikakulam and Chittoor - accounted for 67.3 per cent of the 1170 outbreaks reported during 1998 and 2004. The 'next-five' of the top five districts accounted for a mere 19 per cent (and, these put together amounted to 86.3 per cent; Figures 10 and 11) with the remaining 12 districts reporting 13.7 per cent of the outbreaks. The most significant aspect of BQ is that sporadic outbreaks with 10 or less annual outbreaks occurred in seven districts.

The moot question in planning BQ control policy - what if NO regular vaccination is undertaken in these seven low incidence

Table 12: BQ in AP – Monthly outbreaks during 1998-2004

Sl.no	Month	Number of Outbreaks	Villages Affected	Number of Attacks	Number of Deaths
1	January	65	65	320	163
2	February	86	86	307	197
3	March	74	74	239	147
4	April	101	102	546	253
5	May	93	93	370	233
6	June	130	135	496	318
7	July	162	163	603	355
8	August	115	116	479	292
9	September	103	103	311	179
10	October	101	104	350	206
11	November	77	77	273	149
12	December	63	66	264	169
Total		1170	1184	4558	2661

Figure 9: BQ in AP, Area map of the top five districts – Relative trends



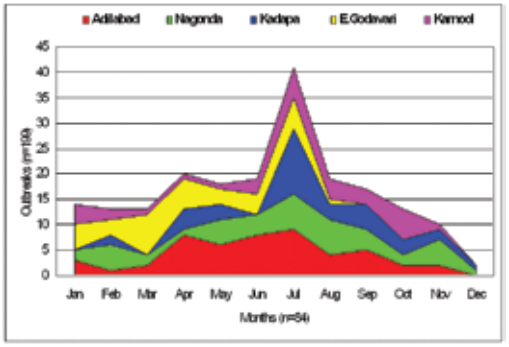
Notes: The BQ outbreaks in the 'top five districts' accounted for 1170 outbreaks (67.3 per cent) reported during 1998 and 2004. In addition, this area map of the top five districts depicts BQ outbreaks in a district-specific perspective, which is so different and intriguing. Perhaps the soil profiles and the number of rainy days seem to play a major role in initiating the outbreaks. Mahbubnagar seem to sustain outbreaks through out the year with a slight preference for monsoon period. So is the BQ outbreak pattern in Ananthapur district. Chittoor, Khammam and Srikakulam districts have outbreaks during the beginning of the season and decline during monsoon period. These diverse patterns provide opportunity for evolving district specific control strategies.

districts and can we do away with vaccination - in anticipation of outbreaks to surface in the future, to indicate lurking foci of soil infection. The answer is a definite 'YES', and should outbreaks occur, resort to ring vaccination – as is being done presently with BQ and other diseases. Let this mindset that vaccinations must go on forever, a false perception, change for the better.

Priority vaccinations for the top-five districts and for the selective location/ village specific vaccinations in the 'next-five' districts where the outbreaks had occurred during 2003 and 2004, is recommended. Outbreaks earlier to these 'cut-off' years (say 1998 to 2002) should be monitored closely and ring vaccination initiated immediately for the next 3-5 years. The vaccine savings from these second-rung districts can be used for high-risk districts.

In addition, the area map of the 'top- five' districts depicts BQ outbreaks in a location specific (district) perspective, which is so different and intriguing. Perhaps the soil profiles and the number of rainy days seem to play a major role in initiating outbreaks. Mahbubnagar seems to sustain outbreaks through out the year with a slight preference for monsoon period. So is the BQ outbreak

Figure 10: BQ in A P Area map - 'next five' of the top districts – Relative trends



Notes: BQ outbreaks in the 'next-five' after the top-five districts accounted to a mere 19 per cent of the reported outbreaks during 1989-2004, though, all these ten districts put together amounted to 86.3 per cent outbreaks and the remaining 12 districts reported 13.7 per cent.

pattern in Ananthapur district. Chittoor, Khammam and Srikakulam districts have outbreaks during the beginning of the season and decline during the monsoon period. These diverse patterns provide an opportunity to evolve district specific control strategies.

The area maps of the second-rung five districts depict a sort of 'diffuse' BQ outbreak pattern. Adilabad and East Godavari have most of their outbreaks during the pre-monsoon period while, Nalgonda, Kadapa and Karnool districts prefer extended monsoon periods. These disease assertions are useful in planning vaccinations targeting bulk outbreaks.

Seasonal incidence of BQ outbreaks

This essentially involves time and location specific regular vaccinations. Proper disposal of infected carcasses are critical for managing /containing BQ outbreaks. A sustained vaccination of susceptible population for 3-5 years will drastically reduce, if not eliminate, the foci of infection through building up sustainable herd immunity in endemic villages.

The area maps of these second-rung five districts depict a sort of 'diffuse' BQ outbreak pattern. Adilabad and East Godavari have most outbreaks during pre monsoon period while, Nalgonda, Kadapa and Kurnool districts prefer extended monsoon periods. These disease assertions are useful in planning the vaccinations targeting the bulk outbreaks.

2.4 Enterotoxaemia (ET) in Andhra Pradesh

The bacterial toxins of Clostridium perfringens type D cause ET in sheep and goats. The bacteria are present in the soil and digestive tract of sheep and goats. The disease is sudden in onset and causes high mortality and economic loss. The toxin-production in the intestines triggered by 'favourable' high level of grazing/nutritional conditions results in the disease. ET is rated as the fifth most prevalent disease in the country. The local disease precipitating situations are difficult to comprehend and toxin inducing nutritional factors during April to August (183 to 330) need to be explored.

In the past seven years (1998 to 2004), 21 districts of AP reported 1827 ET outbreaks with no outbreaks recorded in the East Godavari district (Table 13). These outbreaks resulted in 16897 attacks and 11535 deaths in 1879 villages in the state (Table 14). Ananthapur, Kadapa, Nellore, Mahbubnagar and Kurnool have emerged as the top five districts with 1240 out of 1827 (67.9 per cent) ET outbreaks. The 'next five' districts - represented by Nalgonda, Karimnagar, Prakasam, Chittoor and Nizamabad – reported 392 out of the 1827 outbreaks (21.4 per cent). Thus, the top- ten districts of AP accounted for 89.3 per cent of the ET out breaks in the past seven years.

It is intriguing that the drought prone Ananthpur district has twice the number of outbreaks (502) compared to its immediate second - Kadapa district with 206 outbreaks. Disease precipitating feeding/ nutritional, migration and management factors specific to Ananthapur district may provide discernible clues for better disease prevention. There is a need to study these

Table 13: ET in A P – District level outbreaks during 1998-2004

Sl.no	District Name	Number of Outbreaks	Villages Affected	Number of Attacks	Number of Deaths
1	Ananthapur	502	525	2674	2459
2	Kadapa	206	212	1041	976
3	Nellore	204	204	905	825
4	Mahbubnagar	168	168	4247	1020
5	Kurnool	160	160	714	641
6	Nalgonda	96	96	654	424
7	Karimnagar	92	92	1535	945
8	Prakasam	88	88	619	518
9	Chittoor	60	60	376	331
10	Nizamabad	56	56	642	502
11	Khammam	47	47	243	180
12	Vizianagaram	42	42	904	634
13	Medak	23	46	771	759
14	Warangal	23	23	603	542
15	Krishna	14	14	206	151
16	RR & Hyd	14	14	228	156
17	Adilabad	11	11	294	282
18	Srikakulam	11	11	92	90
19	Visakapatnam	7	7	65	37
20	Guntur	2	2	43	22
21	West Godavari	1	1	41	41
Total		1827	1879	16597	11545

– especially in the pre-monsoon period of March to June when the disease outbreaks peak and suddenly drop with the onset of southwest monsoon. Vishakapatnam, Guntur and West Godavari districts reported below ten outbreaks, which confirm unfavourable conditions for the disease incidence.

2.4.1 Seasonal incidence of ET outbreaks

There seems to be no specific period in the year that is most conducive for the occurrence of ET outbreaks - based on this seven-year data analysis. Yet, the least number of outbreaks (56 and 59) is reported in the months of November and October restrictively with most of the outbreaks occurring during April to July. This could be due to the fact that the causative organism is already present in the soil and the intestines of normal animals and extraneous factors such as over-eating or changes in feeds and feeding habits precipitate toxin production resulting in acute disease and sudden death.

However, the long term data analysis suggests that the number of outbreaks during April to August is more as compared to the other months (Figure 12). This period coincides with pre-and-early monsoon situation, where there are substantial changes in the quality and type of feed and poor grazing opportunities. This may lead to critical micro-environmental changes in the intestine that may trigger epsilon toxin production. From disease control point of view, there is very little we can interfere in the initiation of toxin production process except to prepare the animals to neutralize the effects of toxin through prophylactic vaccination.

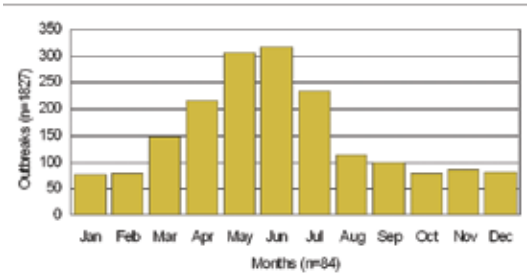
Action plan – Vaccination strategies

ET is an insidious disease and factors that precipitate sudden outbreaks may vary from place to place and curative interventions are difficult to implement. This leaves the only choice of annual prophylactic vaccinations. In addition, immensely migratory shepherd traditions that are determined predominantly by the prevailing drought/non-drought conditions put organised vaccination programmes in jeopardy. Generally, shepherds are very receptive and actively co-operate in vaccinating their animals. In this context, a flexible vaccination campaign to suit the Sheppard's migratory habits is required and a road map developed for this purpose for each region of AP. The Sheppard's "green card" which records all the details of vaccinations etc. during their migration ventures is a big success in Karnataka state

Table 14: ET in A P – Monthly outbreaks during 1998-2004

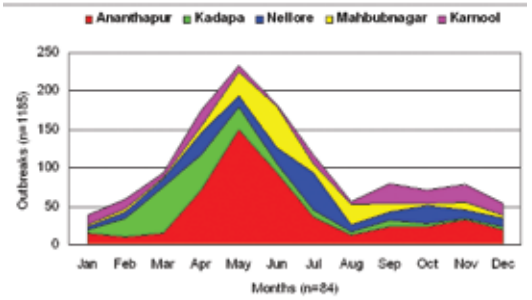
Sl.no	Month	Number of Outbreaks	Villages Affected	Number of Attacks	Number of Deaths
1	January	120	120	1732	1129
2	February	140	145	540	502
3	March	104	104	679	449
4	April	330	340	2115	1908
5	May	231	231	1403	1203
6	June	227	250	5170	1911
7	July	202	202	1155	968
8	August	183	196	783	760
9	September	78	78	1654	1293
10	October	59	59	597	491
11	November	56	56	361	290
12	December	97	98	708	631
Total		1827	1879	16897	11535

Figure 11: Enterotoxaemia in A P - Long term outbreak trend



Notes: The long term ET epidemic curve during the seven years presents a simple 'bell-shaped' outbreak pattern starting from February until August months. The onset of southwest monsoon seems to have a dampening effect on the outbreaks. In the northeast monsoon period, the disease is subdued mostly.

Figure 12: ET in A P - Area map of top five districts - Relative trend



Notes: Most livestock diseases occur round the year, but bulk of the outbreaks happen only when everything - be it host or environment related – is most conducive for the successful survival, spread and establishment of the pathogen in the population. The disease is just incidental to the pathogen's survival game plan.

and deserves a similar attempt in Andhra Pradesh.

With highest sheep and goat population in the state, the requirement of ET vaccine is enormous and the present production levels at VBRI, Hyderabad is not commensurate with the demand. There is an urgent need to update the vaccine production technology at VBRI. Until the upgradation of vaccine production, intensive vaccination in the high-risk areas would need to be delayed.

The top-five ET districts account for 67.9 per cent (1240 out of the 1827) outbreaks during the past seven-year period (1998-2004). This area map, like the above bar graph of the top-five districts, depicts preponderance of the ET outbreaks during February to August months, but unlike them, discretely presents the inherent differences in the time and magnitude of the outbreak incidences between them. For example, in Ananthapur district, bulk of the ET outbreaks occur in March to August, while in Kadapa, they occur during January to May; in Nellore during June to August; in Mahbubnagar during April/May to August and, in Kurnool mostly during August to December. These intricate and selective underlying epidemiological overtures need further understanding as they certainly help to fine-tune vaccination initiatives for each district.

The area maps are of immense value to pre-empt bulk of the outbreak incidences through timely vaccinations. For example, in Kadapa district, vaccinations in November and December are bound to eliminate the anticipated bulk of the outbreaks in January to May. On the contrary, in Ananthapur district, vaccinations in January and February are ideal to prevent bulk of the outbreaks during March to August. Therefore, the area maps effectively supplement/provide 'vaccination guidelines' to target and prevent bulk of the outbreaks. Area maps are particularly important in mapping the qualitative and quantitative projections of the population's disease burden, the vaccine requirement and the vet. manpower deployment, especially with infectious but non-contagious diseases like ET.

The area maps of the 'next-five' of the top ET districts present a mixed bag of epidemiological situations. Unlike the top-five, the 'next-five' districts exhibit outbreaks in the decline phase of the overall long term disease trend (refer bar and line graphs, above). These districts exhibit distinct patterns of bulk incidence of ET outbreaks in different months and guide us for decisive vaccination timings. To prevent bulk of the ET outbreaks, initiate vaccinations during December/January and February in Nalgonda; September and October in Karimnagar; October and November in Prakasam and, February and March in Chittoor and Nizamabad districts. These aspects are interesting.

2.5 Ranikhet Disease

RD (Synonym: Newcastle disease), a virus infection of domestic poultry and wild free-living birds, is wide spread in the country. There is limited 'carrier status' in the

recovered and apparently healthy birds, especially in free-living wild birds – which are the source of infection to rural birds. The disease produces moderate morbidity and morality in the rural poultry, which are somewhat resistant to this virus infection. The extent of incidence and prevalence is not so well recorded in all the districts of AP although during interactions, the field veterinarians admitted more prevalence of the disease outbreaks. Tables 15 and 16 provide recorded outbreaks during 1998 to 2004, which show wide variations in the eight districts recoding RD.

Virus from free-range wild birds and spill over from organised poultry farms initiate infection in the rural backyard poultry. The disease is under control in the organised poultry sector through rigorous vaccination regimen but not the rural scavenging backyard poultry, perhaps due to smallholding, poor access to vaccinations and other inherent problems.

Vaccination is the only way to protect rural poultry and the ongoing free RD vaccination programme of the Dep. of Animal Husbandry, at all the veterinary institutions in the state, is the right step towards controlling RD. VBRI produces adequate quantities of RD vaccine.

The authorities must address under or not reporting of RD in the state. Extension education and involvement of local Panchayat agencies to promote vaccination awareness among villagers, especially the women folk, are suggested.

3. Institutionalizing Disease Control Programmes In Andhra Pradesh

A long-term approach with detailed planning and professional commitment to execute the plan are essential to succeed the fight against 'ubiquitous' pathogens. The following are the key points that need immediate attention:

1. Disease reporting to be proactive, real-time and preferably, online (internet), than the present non-responsive, sluggish and administrative ritual that benefits none. A change from the present routine monthly consolidation 'statement' to daily telephonic/email messages, if not feasible to weekly reports. Delegation of powers to the lowest veterinary institution in the state to send disease reports directly to the state epidemiologist and copied to other administrative higher ups at district level deserves consideration.

2. The nodal disease information officers, at various levels are to be identified and a working network established with a mandate to circulate/share disease outbreak information within a few hours, if not within 24 hrs, to all the polyclinics, district heads, DIO, diagnostic laboratories, VBRI, state epidemiologist and the top Vet administrators at the head quarters. A hot-line approach from field vets/hospitals to the state epidemiologist should be encouraged and necessary inputs made

Table 15: RD in A P – District wise outbreaks during 1998-2004

District Name	Number of Outbreaks	Villages Affected	Number of Attacks	Number of Deaths
Ananthapur	41	36	275	275
Nellore	7	7	108	108
Srikakulam	5	5	369	109
Kadapa	5	5	161	161
Prakasam	5	5	158	105
Vizianagaram	3	3	62	34
Krishna	1	1	100	100
Nalgonda	1	1	5	5
Total	68	63	1238	897

available. The State epidemiology unit should be strengthened with additional office space, computers, communication lines and especially trained staff with post graduation in animal health subjects.

3. A state level computerized database of all veterinary institutions (preferably coded), livestock and disease profiles created to include their operational jurisdiction of villages and Mandals. A GIS based approach is suggested.

4.The Additional Director in charge of livestock health at the headquarters through his respective district officers must ensure timely implementation of the vaccination schedules as recommended in this project report. Three to five years of decisive and well-timed vaccination campaigns will bring down the disease incidences in the state.

3.1 Strengthening of vaccine production infrastructure

In Andhra Pradesh, VBRI and its branch at Samalkota produce the veterinary biologicals required for livestock and poultry. Their product range, production figures and supplies to different districts were presented in Chapter-1. These facilities are one of the oldest in the country and have outlived their infrastructure facilities and vaccine production technology in the modern day concept. There are severe limitations in expanding their activity further in the present premises and immediate effort made to occupy the newly constructed and well-designed laboratory/ production facility. The consultant during his visit observed that this new facility requires GLP and pathogen containment facilities and the VBRI is attending to them on priority basis. The VBRI has projected the vaccine requirements of the state as given in Table 17.

The proposed disease and time targeted vaccination approach for each district will help VBRI to rationalize its production levels and achieve optimal and sustained supplies. The thrust of disease control in the state depends solely on VBRI in its ability to meet the vaccine demands.

3.1.1 Need for new oil-adjuvant HS vaccine

HS is the single most important disease of livestock in AP spreading outbreaks all round the year. Traditionally, in most districts, HS vaccination of animals routinely follows reported outbreaks and is rarely carried out in advance as prophylactic vaccination. This situation could be compared to 'fire fighting' on the face of outbreaks and does not give prior protection. The

Table 16: RD in AP - Monthly Outbreaks during 1998-2004

Month	Number of Outbreaks	Villages Affected	Number of Attacks	Number of Deaths
January	9	4	68	62
February	5	5	89	61
March	1	1	9	9
April	4	4	123	123
May	7	7	42	42
June	12	12	202	173
July	12	12	396	180
August	2	2	115	115
September	1	1	85	23
October	5	5	40	40
November	10	10	69	69
December	0	0	0	0
Total	68	63	1238	897

impact of such vaccination schedule is not appreciable considering the population coverage. For example, VBRI produced and supplied 82.484 lakh doses of HS vaccine to all the 22 districts in the year 2003-04 against the requirement of state's 2101.90 lakh bovine population. This is a fair effort with the constraints faced by the VBRI and it should urgently upgrade its aluminium hydroxide gel HS vaccine to oil-adjuvant vaccine, as the coastal animals require extended protection for more than six months. Commercial oil adjuvant vaccine may fill in this gap until VBRI makes this long acting vaccine available to the state – especially in the top five high-risk districts of Prakasam, Nellore, Guntur, Kadapa and Ananthapur. High capacity fermentors, automated mixing and vaccine-filling equipments are critical to meet the huge vaccine requirement.

3.1.2 Additional requirement of PPR vaccine

The proposed pulse-vaccination to freeze the PPR virus activity in the top ten high-risk districts requires additional vaccine made available to achieve the time-bound vaccination targets. Cell culture and freeze-drying facilities need strengthening and inputs through additional laboratory space, sterile working benches, roller bottle apparatus and freeze-dryer are urgently required to meet the vaccine demand.

Table 17: VBRI-Projected vaccine requirements for 5 years (in Lakh doses

Vaccine Name	2005-06	2006-07	2007-08	2008-09	2009-10
HS	80.00	82.00	87.00	87.00	87.00
Anthrax	7.00	7.00	7.50	7.00	7.00
BQ	30.00	30.00	30.00	32.00	32.00
ET	79.00	80.00	80.00	82.00	82.00
RD (K)	67.00	69.00	69.00	77.00	87.00
RD (F1)	17.00	17.00	17.00	19.00	19.00
Fowl pox	32.00	32.00	37.00	37.00	40.288
Sheep pox	37.5	37.075	39.729	39.465	40.288
PPR (TCV)	80.00	80.00	82.00	82.00	87.00
Samalkota Unit: Vaccine Production Projections - (in Lakh doses)					
RD (K)	92.00	101.00	110.00		
RD (F1)	24.00	27.00	27.00		
Duck plague	7.00	7.00	7.00		
Fowl pox	54.00	60.00	67.00		
HS	23.00	27.00	29.00		
Total					
HS	103.00	109.00	116.00	87.00	87.00
Anthrax	7.00	7.00	7.50	7.00	7.00
BQ	30.00	30.00	30.00	32.00	32.00
ET	79.00	80.00	80.00	82.00	82.00
RD (K)	159.00	170.00	179.00	77.00	87.00
RD (F1)	41.00	44.00	44.00	19.00	19.00
Fowl pox	86.00	92.00	104.00	37.00	40.288
Sheep pox	37.5	37.075	39.729	39.465	40.288
PPR (TCV)	80.00	80.00	82.00	82.00	87.00
Duck plague	7.00	7.00	7.00	-	

3.1.3 BQ and ET vaccines

At least two high capacity special fermentors to culture anaerobic bacteria are required to meet the routine requirements of vaccine for control of these diseases in the high-risk areas.

3.2 Cost of disease control: Some estimates

3.2.1 PPR – first priority for control/ eradication

This chapter deals with the cost of disease control. Control/eradication of these diseases cannot be attempted in one go; therefore prioritisation of diseases for control is necessary. In the context of AP, the diseases causing maximum economic losses and livelihood disruption is HS in large ruminants and PPR in small ruminants. However, PPR is the first priority in the list of control programmes being highly infectious and contagious virus diseases and AP has very large susceptible sheep and goat populations. Organised PPR vaccination can bring about a dramatic change in the perceptible reduction that leads to eradication of the disease in the state. This results in substantial economic gains to the poor and marginal farmers. The technical aspects and implementation of PPR control/eradication program in AP are expected to be the trend setter for other states to follow.

3.2.2 Institutional set-up for PPR control

The institutional set up for disease control will be under the DAH (Table 18) and therefore will be part of the state establishment. Incremental costs for disease control will comprise the additional supervision set up under the DAH: staff salaries (Table 19) and travel and transport costs of the set up. The control programme will initially focus on the top ten high-risk districts: Warangal, Nalgonda, Prakasam, Karimnagar, Mahbubnagar, Nellore, Kadapa, Guntur, Chittoor, and Krishna - that account for over 80 per cent of PPR incidence to sanitise the small ruminant population in general. Specific and contingent vaccination target plans for other districts are recommended in this document.

The approach is to eliminate the virus presence in the population in the shortest period rather than conventional 'eternal' vaccination campaign which is most unsuited for PPR as the target sheep and goats have a shortest population turn-over/replacement time of 2 to 3 years due to slaughter for meat purposes. This population aspect of small ruminants is ideal for PPR persistence and difficult proposition for control/eradication unless approached on 'Mission Mode' basis.

District Project Unit (22 DPUs): Duration 5 years

The District Project Units (DPU) headed by the District Veterinary Officer (DVO) will be the main implementing agency for PPR control programme in all the districts dedicated to the control programme. An Assistant Director will assist the DVO in the project implementation in each district. His implementation team will comprise 4 Veterinary Assistant Surgeons (VAS) as field operations supervisors and 50 -100 vaccinators under them. Each District Project Unit is provided with a data entry operator and a supporting staff. The salaries of staff (other than DVO) are to be budgeted in the project cost.

Table 18: State Project Cell at DAH: Duration 5 years

Coordinating Officer-Deputy Director, Epidemiology at DAH HQ	One
Assistant Directors:	Two
Systems Executive	One
Data Analyst	One
Supporting staff	One

(These staff positions are provided by the Dept. of Animal Husbandry)

Table 19: Salary Head

Designation		Monthly rate		5 year estimates (in Lakhs)	
Assistant Director	(1)	Rs.	15000	Rs.	9.0
Vet. Asst. Surgeons	(4)	Rs.	12000	Rs.	28.80
Data entry operator	(1)	Rs.	7500	Rs.	4.50
Clerk/Accountant	(1)	Rs.	5000	Rs.	3.00
			Total	Rs.	45.30

Vaccine Production Expansion

The state VBRI has just started PPR vaccine production and there is a definite need to strengthen this vaccine production facility to meet the ever-increasing demand. The total vaccine need for the control programme is 610 lakhs in five years or annually variable 115 -125 Lakh doses (Table 20). The expansion costs will include civil works, air conditioning, equipment, raw materials and manpower including training.

Vaccine Delivery

Each Vaccinator will vaccinate 300 or more sheep/goat per day and will work non-stop for the 90-day control programme (Pulse Vaccination) as per the strategy laid out in the project document. Total vaccinators required per district vary from 110 to 225 based on the small ruminant population in low or high-risk locations and the kind of vaccination coverage recommended. The District Cells will organise cold chain for vaccine transport and storage.

Sero-Monitoring

Post vaccination serum samples collected periodically as determined by the sampling frame by the staff of District Project Unit are sent to the Disease Investigation Laboratory of VBRI at Hyderabad to determine sero-conversion as an indicator of successful vaccination campaign. Initially, this activity is limited to testing of a limited number of post-vaccinal serum samples at Mandal level and then a regular random sampling frame for each district population carried out to confirm the sero-conversion in the pulse vaccination programme. The costs of the laboratory equipment, chemicals, plasticware, sero-monitoring kits, cold chain, serum bank and transport are separately budgeted in the control programme.

3.2.3 Cost of control of HS, BQ, ET, and RD diseases

The control of other diseases like HS, BQ, ET, and RD, which are very different, being either insidiously carried by the host (HS, ET) or soil (BQ) or precipitated by management practices (ET) are best handled by annual vaccinations to bring down the mortality and associated economic losses to the poor farmers. The State Animal Husbandry Department which routinely carries out the vaccinations, usually on a post outbreak basis, requires to fine tune its approaches to make it purposeful and result oriented. Strict vaccination timing and priority based vaccine distribution as recommended in the document should provide effective disease control. If rigorously followed for 3-5 years, there is bound to be a drastic reduction in the disease burden in the

Table 20: Long term PPR vaccine requirement projections (in Lakh doses)

Sl.no.	Vaccine	5 yr Quantity	2006	2007	2008	2009	2010
1	PPR	610	115	120	125	125	125

Table 21: Long term Vaccine Requirement Projections (in Lakh doses)

Sl.no.	Vaccine	5 yr Quantity	2006	2007	2008	2009	2010
1	HS	686	131	135	140	140	140
2	BQ	222	42	45	45	45	45
3	ET	560	105	110	115	115	115
4	RD	575	115	115	115	115	115

population – which may even lead to declaring disease free districts and saving on recurrent vaccination expenditure. This demands a paradigm shift in our radical thinking and approaches that vaccinations cannot go on forever for disease control.

Table 22: PPR Control/Eradication Programme: Cost Summary for 5 years

Sl.No.	Cost Components for 5 year programme	Cost in Rs. Lakhs Investment	Costs in Rs. Lakhs Recurring
1	Project Cell Salaries		AHD Est.
2	Project Cell Travel Costs (staff DA)		AHD Est.
3	Project Cell Transport – Purchase of 2 diesel vehicles at Rs. 6 lakhs each	12.00	
4	Project Cell Transport Cost – diesel and maintenance at Rs. 2000 per month each		12.00
5	Project Cell Establishment (office equip/Computers and Peripherals, Xerox, tele-cell phones)	2.00	
6	District Project Unit Salaries – 22 units at Rs. 45 lakhs/year/unit		990.00
7	District Project Unit Transport (vehicle Hire: 1 Jeep @1.80 Lakh/yr for 1 unit) x 22		40.00
8	District Project Unit Travel Costs – DA for outstation visits		13.00
9	Vaccinators 225 each for 10 high risk districts at 50 paisa/animal/300 vaccinations per day – 90 days/yr for 5 years		1520.00
10	Vaccinators 110 each for 12 low risk districts at 50 paisa /animal/300 vaccinations per day – 90 days/yr for 5 years		760.00
11	Training expenses of 335 vaccinators/ 110 staff @ Rs. 200 for 5 days, inputs, refresher courses		2.00
12	Vaccine cost@ Re.1.00 per dose, cold chain, field storage units, filed delivery - 610 lakh doses		750.00
13	Vaccine production expansion cost at VBRI- civil, equipment, training, storage	1000.00	
14	Sero-monitoring - civil works, lab equipment, kits, chemicals, plastic ware, serum bank, etc	20.00	25.00
15	Project monitoring/evaluation/workshops/ documentation, propaganda, Extension etc,		24.00
16	Professional Consultancy and expert services		200.00
Total		1034.00	4336.00
Grand Total		5370.00	

Table 23: HS, BQ, ET, and RD Control Programmes: Cost Summary for 5 yrs

Sl.No	Cost Components for 5 year programme	Cost in Rs. Lakhs Investment	Costs in Rs. Lakhs Recurring
A.	HS control programme *		
1	Vaccine cost@ Re.1.25 per dose - 686 lakh doses		857.50
2	Vaccine production expansion cost at VBRI-civil, equipment, training, storage	150.00	
B.	BQ control programme		
1	Vaccine cost@ Re.1.50 per dose - 222 lakh doses		333.00
2	Vaccine production expansion cost at VBRI-civil, equipment, training, storage	100.00	
C.	ET control programme**		
1	Vaccine cost@ Re.1.50 per dose -560 lakh doses		840.00
2	Vaccine production expansion cost at VBRI-civil, equipment, training, storage	100.00	
D.	RD control programme		
1	Vaccine cost@ 20 paisa per dose - 575 lakh doses		115.00
2	Vaccine production expansion cost at VBRI-civil, equipment, training, storage	50.00	
E.	Professional consultancies, vaccine storage at district level, transport and extension etc		100.00
Total		400.00	2145.50
Grand Total		2545.50	

Note: * Strengthening of infrastructure for change over to Oil Adjuvant HS vaccine
++ Strengthening of infrastructure for change over to new ET vaccine production protocol

The projected vaccine requirement for 5 years (Table 21), the level of population to be brought under vaccination coverage in different districts and the present flaws in vaccine distribution vs. the disease burden with action plans are detailed adequately in this document. However, there is an absolute necessity to closely monitor the disease control programmes on an year-to-year basis and initiate need based midcourse corrections /interventions. The field staff of the Animal Husbandry Department will carry out vaccinations to control these diseases for the next 3-5 years before approaches that are more radical are considered.

ANNEX 1

Haemorrhagic Septicaemia
District Wise Control Action Plan

Prakasam and Guntur together accounted for more than one third of all the HS outbreaks reported during 1998-2004. The major outbreaks in both these districts sustain progressively from March until November involving both south-west and northeast monsoon periods. Carry out vaccinations starting in January until March and, additional selective vaccinations during August and September to provide protection against outbreaks associated with northeast monsoon period – in villages/Mandals where the disease had occurred in the past three years. Initiate ring vaccinations in new outbreak locations. Oil-adjuvant HS vaccine is preferred to provide extended vaccinal immunity.

Nellore stands third among the 22 districts with 439 out of the 4587 HS outbreaks reported during 1998-2004. The major HS outbreaks in this district have preponderance for northeast monsoon period and steep outbreaks start immediately after the end of south-west monsoon in September. This interesting disease pattern provides ample period for initiating vaccinations from March to June and a single vaccination campaign should provide adequate protective immunity lasting up to December- if oil-adjuvant vaccine is used. Initiate ring vaccinations in new outbreak locations.

Kadapa and Ananthapur together accounted for nearly 17 percent of the total outbreaks reported during 1998-2004. It projects a similar HS disease profile as in Nellore district. Major HS outbreaks in these districts have preponderance for northeast monsoon period and outbreaks steadily occur up to December. This interesting disease pattern provides ample period for initiating vaccinations from February to May and a single vaccination campaign should provide adequate protective immunity lasting up to December - if oil-adjuvant vaccine is used. The timing of vaccination should be such that the villages/Mandals receive vaccinations in the month prior to the month in which previous outbreaks had occurred in the previous years – staggered vaccination approach. Initiate ring vaccinations in new outbreak locations.

Nalgonda and Khammam districts depict the typical major pre- southwest monsoon peak from May to September. Vaccinations starting in February, must achieve full coverage of all the villages/ Mandals involved in previously, before May. Identify the few isolated March and April outbreak villages/Mandals and complete vaccinations in January and February. Initiate ring vaccinations in new outbreak locations.

In **Mahbubnagar**, a gradual build up of HS outbreaks starts in May until October, with an abrupt drop by November/ December – thus covering pre-and-both the monsoon periods. A telescoping vaccination programme starting March/ April should be put in place to effectively counter this extended outbreak situation. In this scenario, it is utmost important to precisely locate the previously infected villages/Mandals and initiate vaccinations a month before the onset of fresh outbreaks – the basis for successful disease control. Initiate ring vaccinations in new outbreak locations.

In **East Godavari** HS outbreaks are essentially a pre-and-southwest monsoon phenomenon. Complete vaccination campaign starting February to April to prevent outbreaks. Initiate ring vaccinations in new outbreak locations.

HS outbreaks in **Krishna** district appear to be 'erratic' to recommend any reasonable vaccination approach. A telescoping/ staggered vaccination programme starting January and February continued until September, to prevent outbreaks up to December. Initiate ring vaccinations in new outbreak locations.

Kurnool, Medak, Karimnagar, Warangal and Nizamabad districts depict the typical major pre- southwest monsoon peak from May/June to September followed by a minor peak ending northeast

monsoon period in November/December. Vaccinations starting in February, must achieve full coverage of all the villages/ Mandals involved previously, before April. Initiate ring vaccinations in new outbreak locations.

HS outbreaks in **Chittoor** district appear to be 'erratic' to recommend any reasonable vaccination approach. Start a telescoping vaccination programme in February until September in all the previously infected villages/Mandals – one month before the anticipated outbreaks. Initiate ring vaccinations in new outbreak locations.

HS outbreaks in **Visakapatnam** district appear to be 'erratic' to recommend any reasonable vaccination approach. A telescoping vaccination programme starting November and December, and again in July and August should be adequate to quell already existing infection foci. Initiate ring vaccinations in new outbreak locations.

HS outbreaks in **West Godavari** district occur during both the monsoon periods. Complete vaccination programme during February to April and then selectively during September and October to prevent outbreaks in the subsequent months. Identify all the villages/Mandals, which had reported outbreaks in the past three years and vaccinate at least one month before to induce vaccinal immunity. Initiate ring vaccinations in new outbreak locations.

HS outbreaks in **Ranga Reddy & Hyderabad** districts occur in both the monsoon periods. Carry out vaccination programme during April to May to prevent outbreaks in the subsequent months. Selective vaccinations completed in November to cover December to March outbreaks in villages/Mandals, which had reported outbreaks in the past three years. Initiate ring vaccinations in new outbreak locations.

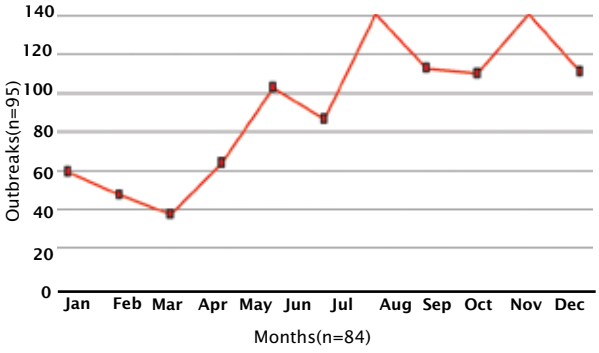
HS outbreaks in **Adilabad** district occur in both the monsoon periods. Vaccination programme during March to May needs to be completed to prevent outbreaks in the subsequent months. Identify all the villages/ Mandals, which had reported outbreaks in the past three years and vaccinate at least one month before to induce vaccinal immunity. Initiate ring vaccinations in new outbreak locations.

A few sporadic and isolated HS outbreaks occur in **Srikakulam** district during January to March and May to September. Identify the villages/Mandals, which had reported the outbreaks in the past 3 years and vaccinate at least one month before to induce vaccinal immunity. Initiate ring vaccinations in new outbreak locations.

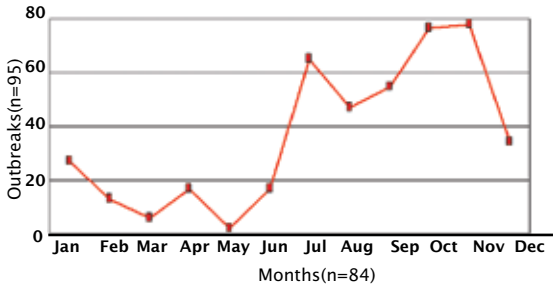
In **Vizianagaram district**, five HS outbreaks - three in 2004 and one each in 2000 and 2003 – occurred during July and September. Vaccinations during May /June in these identified villages/Mandals, are expected to prevent outbreaks. Initiate ring vaccinations in new outbreak locations.

Figure A1: Haemorrhagic Septicaemia: District Level Long Term Trends

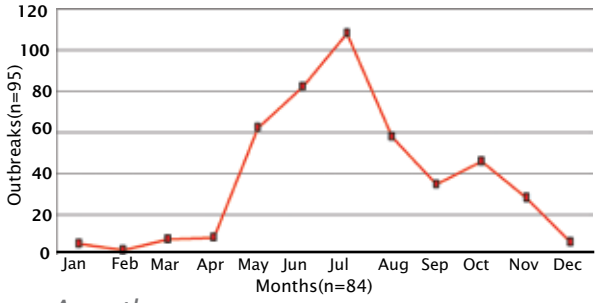
Prakasam



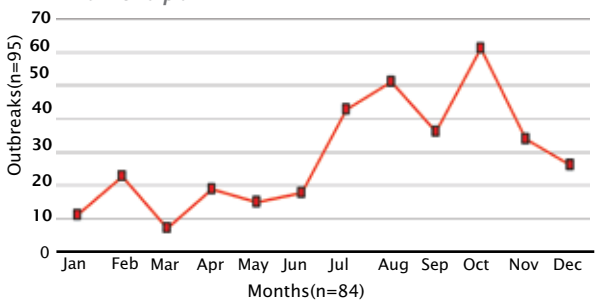
Kadapa



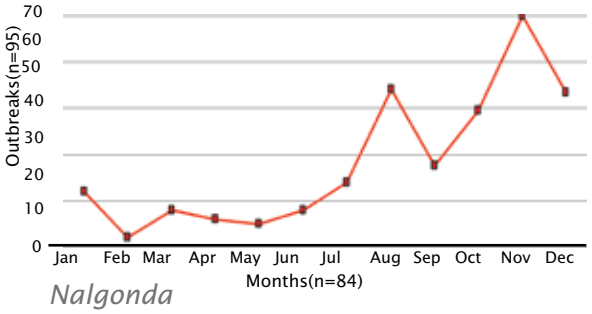
Guntur



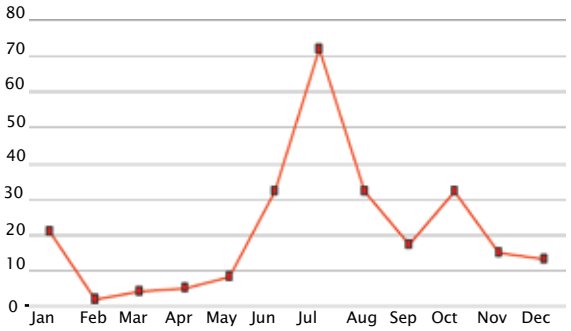
Ananthapur



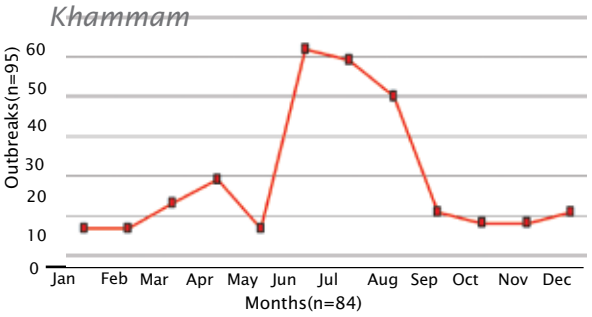
Nellore



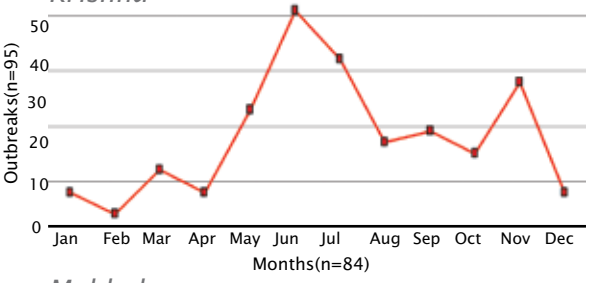
Nalgonda



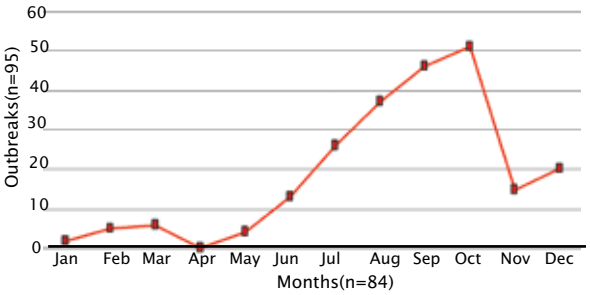
Khammam



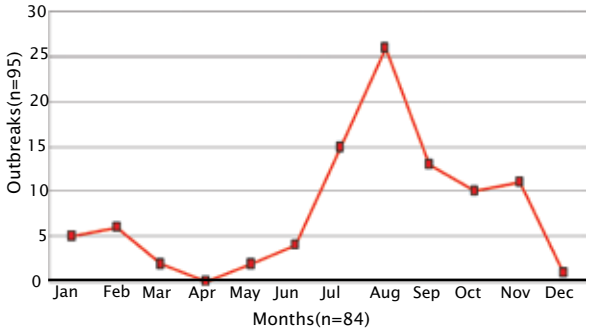
Krishna



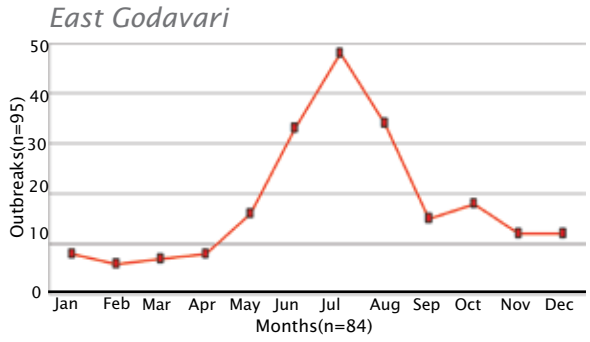
Mahbubnagar



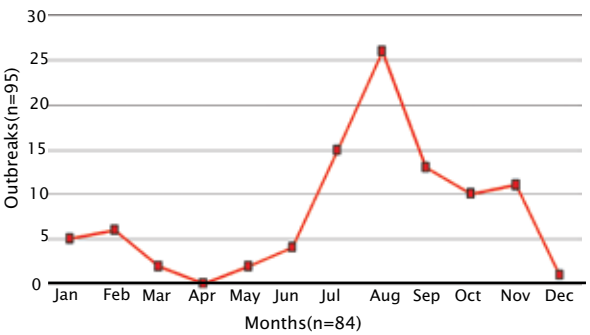
Kurnool



East Godavari

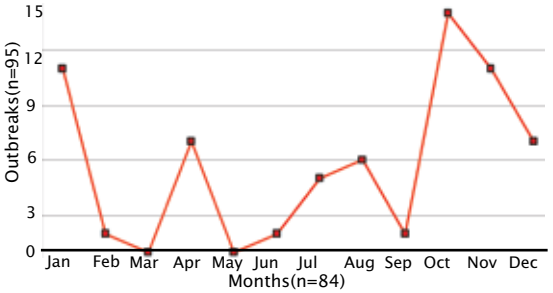


Medak

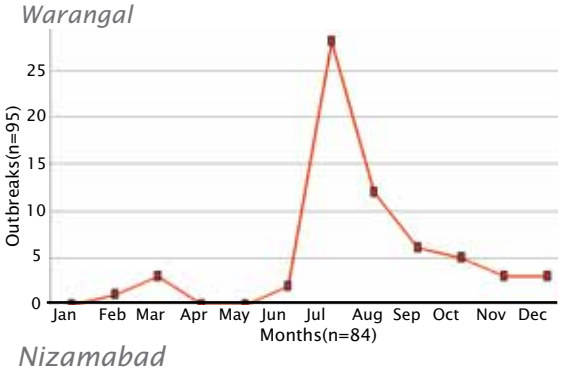


Karimnagar

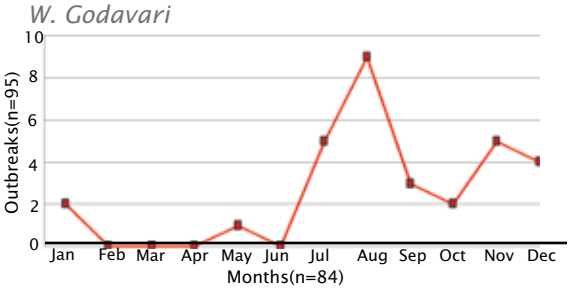
Chittoor



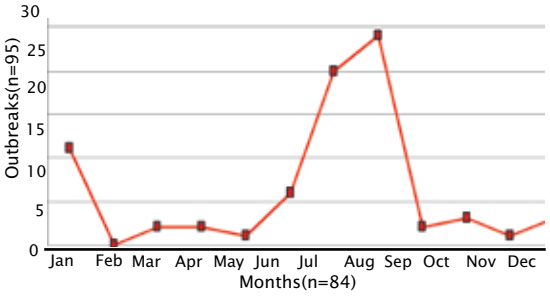
Warangal



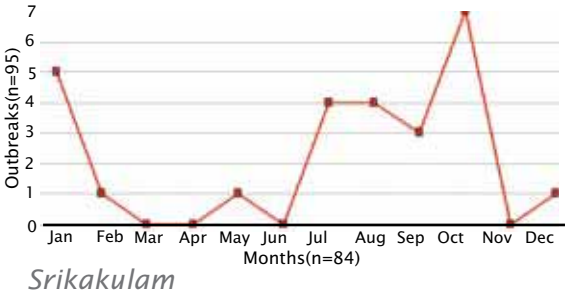
W. Godavari



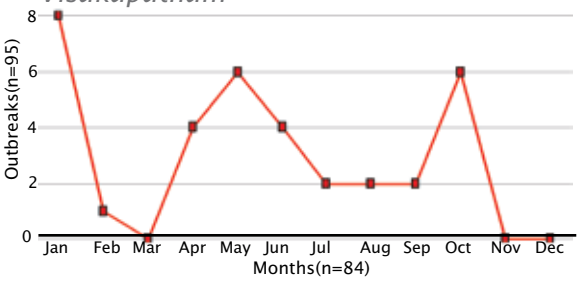
Nizamabad



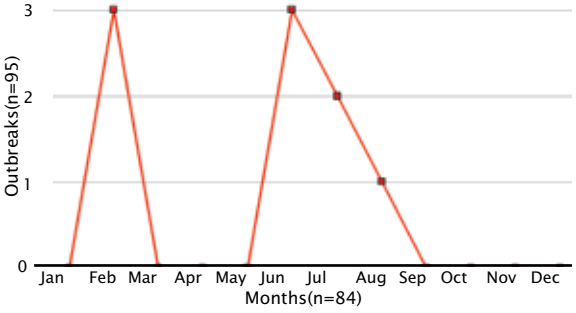
RR & Hyderabad



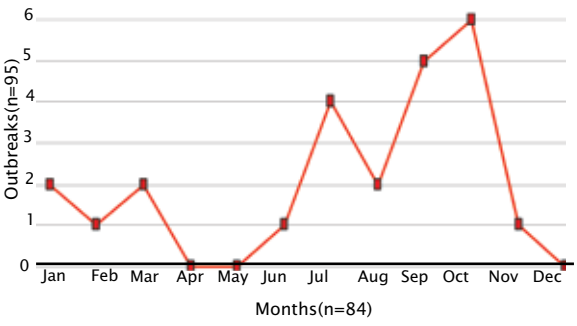
Visakapatnam



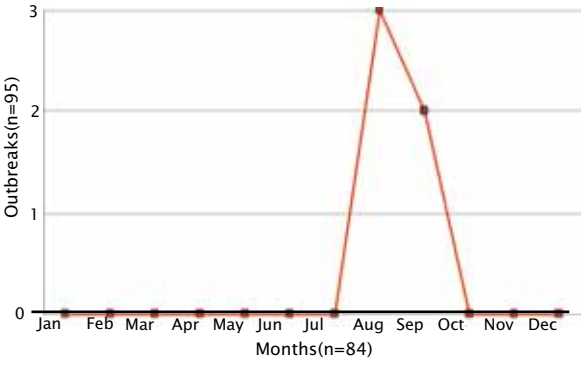
Srikakulam



Adilabad



Vizianagaram



ANNEX 2

PESTE DES PETITS RUMINANTS (PPR)
DISTRICT WISE CONTROL ACTION PLAN

Warangal and Nalgonda together accounted for around 23 percent of 2189 outbreaks reported during 1998-2004, with Warangal alone accounting for almost 13 percent. In both the districts, the major outbreak peak starts from December until June followed by a gradual decline until November and then a new build-up of infection cycle from November onwards. The steady declining number of outbreaks from the peak in March up to October indicates continued virus activity in the population that helps to sustain/establish it. September and October are best suited for pulse-vaccination. Complete pulse-vaccination using tissue culture PPR virus vaccine is recommended in September and October months.

In **Prakasam district**, the major PPR outbreaks occur in January to April with a solitary higher peak in May. Later, the virus activity steadily builds up from September to March. It would be interesting to locate villages/Mandals involved in May, June and July outbreaks, whether or not they are discontinuous to explain the movement of disease in the population. 'Pulse-vaccination' using tissue culture PPR virus vaccine should be carried out in July and August months.

In **Karimnagar district**, the disease typically presents outbreaks staying very aggressive for two months after peaking out in February. The decline is so gradual over seven months from April to October; which gives the virus reasonably active and compromised survival opportunity in the population – an ideal situation for virus to achieve effective endemicity. This fact derives strength from observed moderate number of outbreaks (196) it produces in the district compared to the maximum 288 outbreaks in Warangal. In this district, cleansing up of virus activity through vaccination demands more serious and committed efforts. Pulse-vaccination using tissue culture PPR virus vaccine in September and October months is ideal to eliminate the above disease pattern.

In **Mahbubnagar district**, PPR outbreaks occur from November to April followed by a few minor outbreaks in the subsequent months. Initiate 'pulse-vaccination' using tissue culture PPR virus vaccine in April and May months.

In **Nellore district**, a sustained outbreak situation exists along the year. This provides very little ideal period for 'pulse-vaccination' except the month of September and, perhaps the first two weeks in October. Good planning and execution of vaccination campaign are required.

In **Karimnagar district**, PPR is active all round the year with several peaks every alternate month. This suggests high virus activity and June and July months provide probably a limited option for 'pulse-vaccination' using tissue culture PPR virus vaccine - the best 'leverage' period possible.

In **Guntur district**, PPR is a single event disease – peaking in January to March and bottoming out in another three months – by the end of June. Ideally, pulse-vaccination using tissue culture PPR virus vaccine should be carried out in August and September months.

In **Chittoor**, the disease is more active during January to May and a few outbreaks linger on during the rest of the year. August-September months are ideal for pulse- vaccination using tissue culture PPR virus vaccine.

In **Krishna district**, PPR is active in February until June/July months. Complete pulse-vaccination with tissue culture PPR virus vaccine is recommended during August and September.

In **Khammam district**, PPR presents a simple epidemic curve with outbreaks in February until May. Further, there is no perceptible virus activity except for a sporadic outbreak in September. Pulse-

vaccination using tissue culture PPR virus vaccine is recommended in June and July.

In **Kurnool district**, PPR seems to have a free-run considering multiple outbreaks round the year – a tough call to initiate effective control programme. The pragmatic strategy would be to start 'pulse-vaccination' immediately after the disease has bottomed out at the end of May and mid June (but certainly completed by the end of June) months – right in the middle of the sustained PPR outbreak pattern. This provides the best 'leverage' vaccination period possible.

In **Medak**, PPR is the most frequent in February to May although, a few outbreaks aew recorded until August. Pulse-vaccination in August and September months using tissue culture PPR virus vaccine is ideal.

In **Nizamabad district**, the maximum outbreaks occur during the peak period from January to May with minor peaks in July and September. 'Pulse- vaccination' using tissue culture PPR virus vaccine in October and November months is preferred.

In **Ranga Reddy & Hyderabad** districts, the major outbreaks are noticed during July to November and minor peaks in February to May. Pulse-vaccination using tissue culture PPR virus vaccine may be carried out during late May and June months.

In **Vishakhapatnam district**, PPR spreads over from May to December with no outbreaks in April and November. The peak outbreaks occur during northeast monsoon period of September to November. Initiate pulse-vaccination using tissue culture PPR virus vaccine in February and March months for protection in the ensuing months.

PPR outbreak pattern in **East Godavari district** is exactly opposite to that of Vishakhapatnam district in that, the major peak observed in February to June is followed by two minor peaks, lasting up to December. Pulse-vaccination using tissue culture PPR virus vaccine in December and January is ideal for protecting sheep and goats in this district.

PPR outbreaks, though a few in numbers, in **Vizianagaram** extends from January until December with three peaks – the major peak during Jan to April. It is recommended that the government should initiate pulse-vaccination using tissue culture PPR virus vaccine in November and December for protecting sheep and goats in this district.

In **Adilabad district**, PPR is a low profile disease with mere 16 outbreaks distributed during January until May. The rest of the year is relatively free from outbreaks and provides ideal time for pulse-vaccination during July to October using tissue culture PPR virus vaccine, which provides lifetime immunity.

PPR, in **Ananthapur district** presents a very interesting, rather intriguing picture in that despite having the second largest sheep (929581) and goat (342915) population in the state; only 13 outbreaks occurred. The incidence of four outbreaks in February and another three outbreaks in December are the highpoints of this disease profile. In stark contrast, Ananthpur stands first in ET outbreak in the state (244 out of 1170 reported during 1998 -2004). It would be rewarding to understand the disease process if the demographic (sheep and goat), agro-climatic, sheep husbandry/ management and migration profiles are critically evaluated and definitely, there is something inherent to learn from this district on PPR epidemiology.

During 2003-2004, a mere 1.15 lakh doses of the PPR vaccine was supplied to this district and as such, may not have any tangible herd immunity impact on the disease outcome in 14.6 lakh susceptible population to explain low incidence of the disease. Vaccine supplied in three consignments of 0.2, 0.2, and 0.75 lakh doses in January, February and March, respectively perhaps, was for dousing the peak outbreaks in these months. Oddly, this is a classical example of wrong vaccination timing and mismatch in supply and demand of PPR vaccine. It could have been richly beneficial if the vaccinations were timed in June and July months – the time recommended now for future pulse-vaccination.

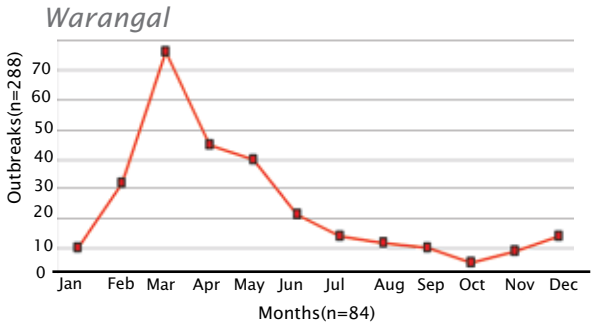
In **Srikakulam district**, January to July is the PPR prone period. Very limited outbreaks provide ample opportunity to clean up the endemic foci in the district through pulse-vaccination in the later part of the year.

Isolated PPR outbreaks occur in different times of the year in West **Godavari district**, initiate pulse-vaccination using tissue culture PPR virus vaccine in June and July months.

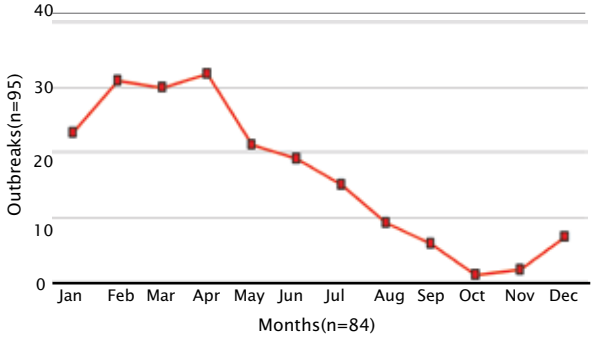
In all the districts, a feasible mechanism for post-vaccinal sero-conversion should be in place to ascertain the success of the vaccination. Active disease monitoring strengthened further and any stray outbreaks should be thoroughly laboratory investigated and ring vaccination instituted immediately.

Figure A2: PPR: Long term district wise trends

Warangal

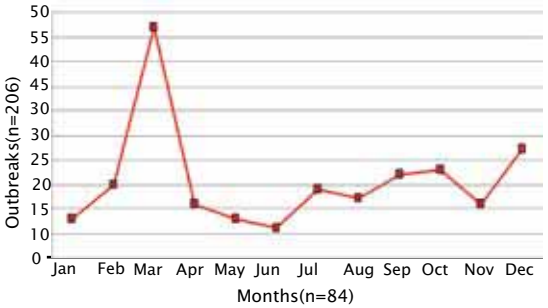


Karimnagar

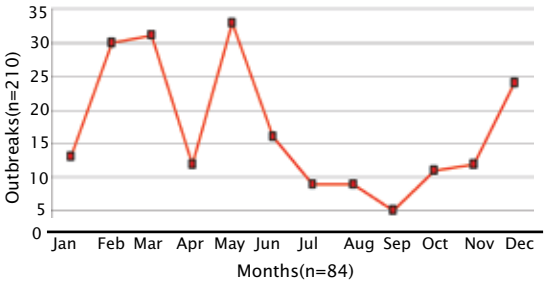


Nalgonda

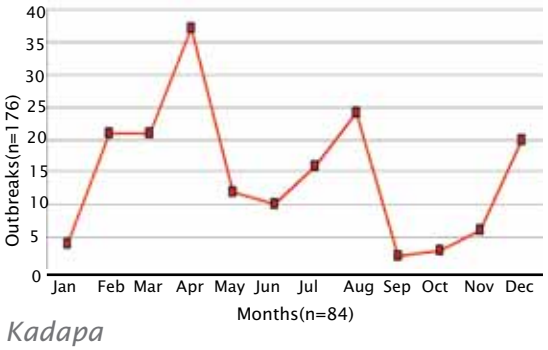
Mahbubnagar



Prakasam



Nellore



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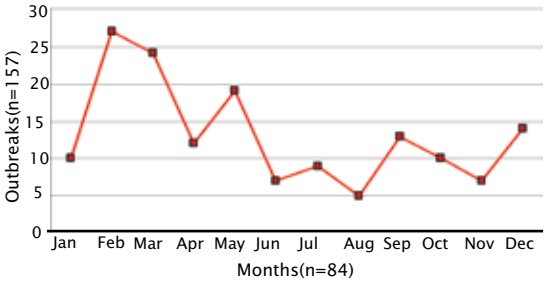

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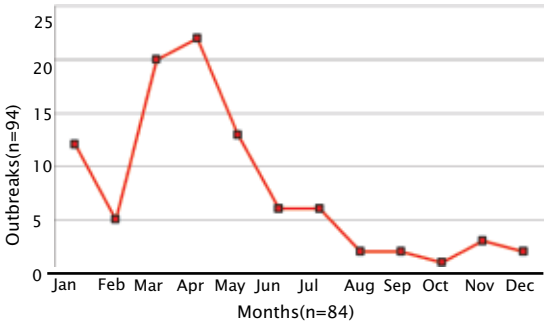
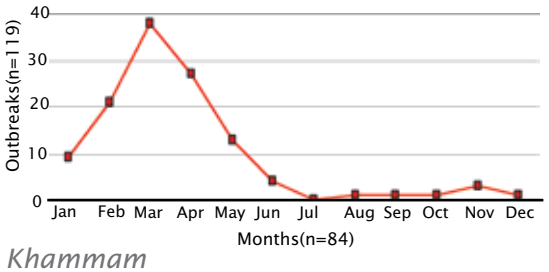


Guntur



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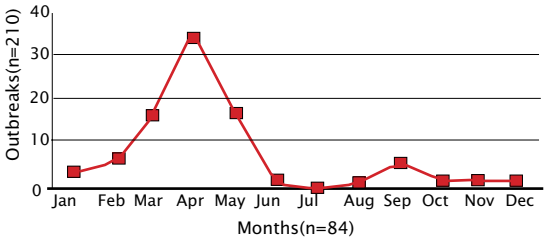

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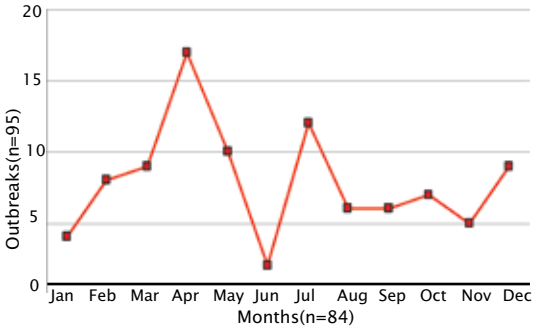

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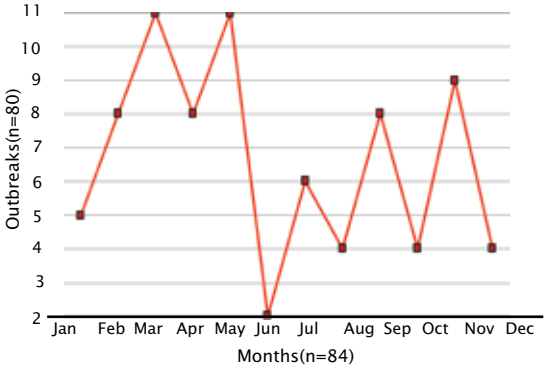

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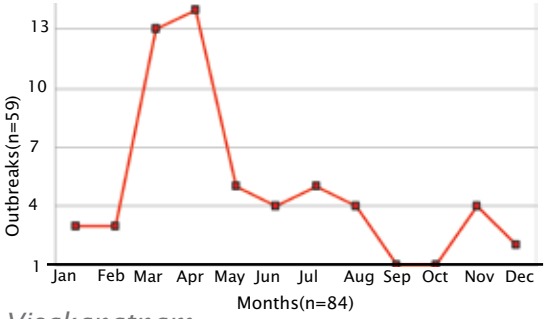

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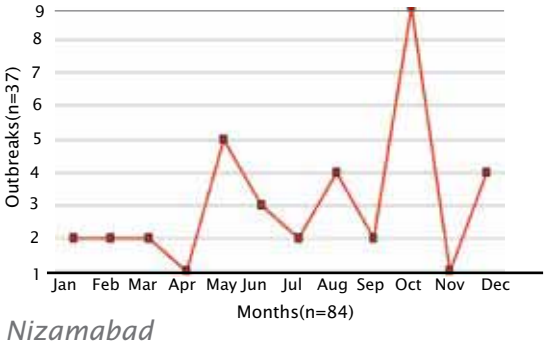

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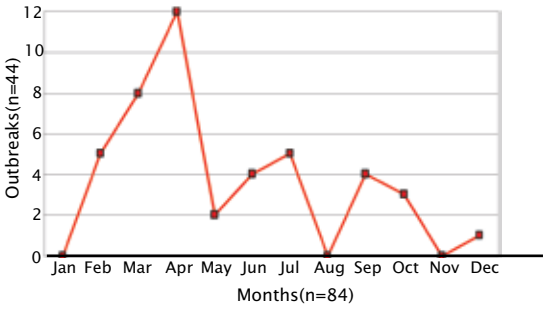
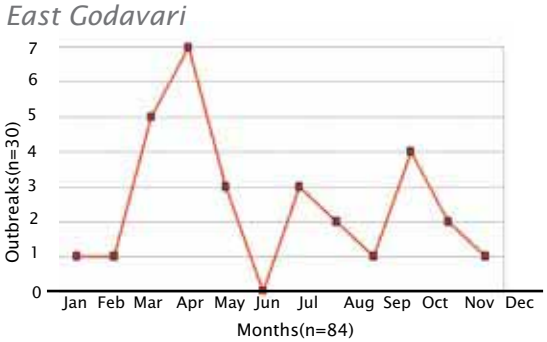
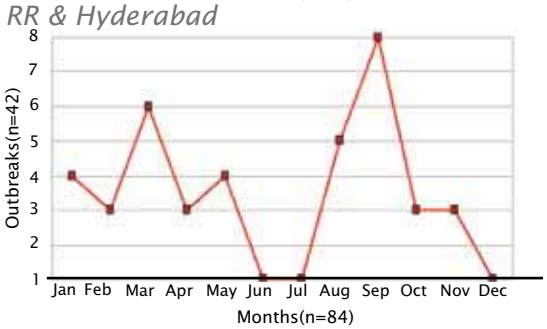


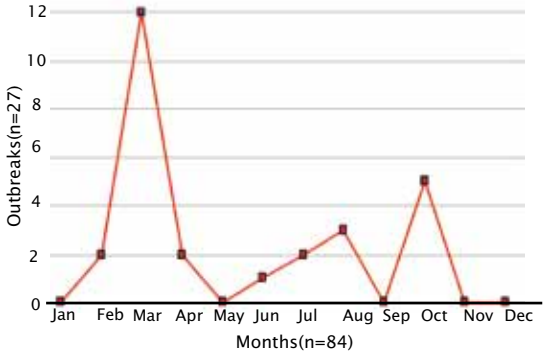
East Godavari



RR & Hyderabad



Vizianagaram



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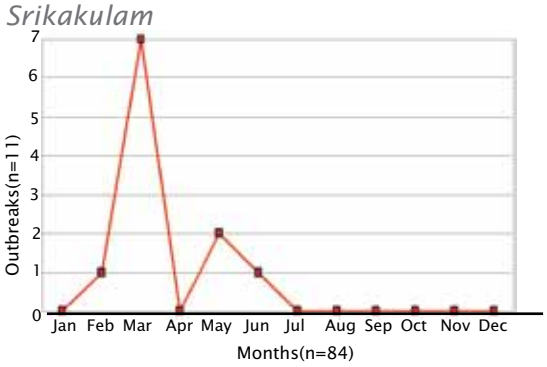

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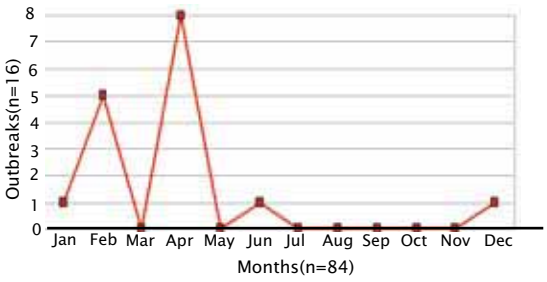
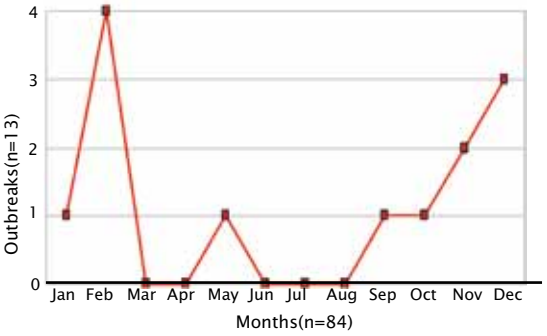


Ananthapur



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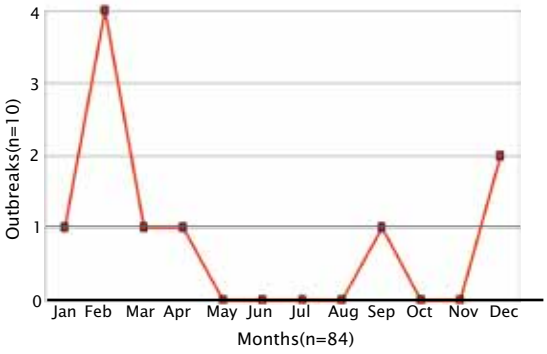


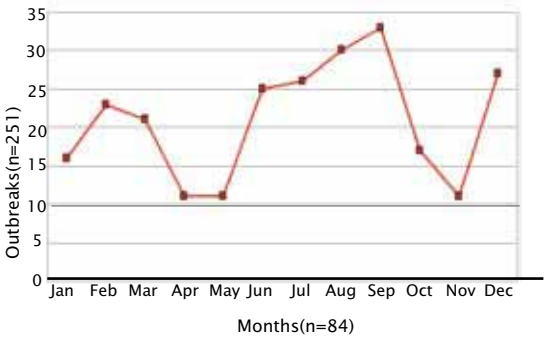
ANNEX 3
Black Quarter (BQ)
Recommended Vaccination Schedule

District	Main time of outbreak	Recommended time of vaccination	Frequency of outbreaks	Remarks
Mahbubnagar	May-October	Mid March, April to early May (in areas where the disease had occurred in the past three years)	-	Vaccinations one month prior to the month in which the disease outbreak had occurred last year(s) Ring vaccinations in fresh outbreak locations
Ananthapur	July- November	May- June	-	
Khammam	January- July	Mid October to December	-	
Srikakulum	February- August	Mid November- January	-	
Chittoor	January and March	Mid November- December and May	-	
Adilabad	10 months	-	Fewer no. of outbreaks	
Nalgonda	Round the year	-	Erratic	
Kadapa	Round the year	-	Fewer no. of outbreaks	
East Godavari	January- August	-	Fewer no. of outbreaks	
Karnool	January, and May-November	November/December and March/ April		
Karimnagar	Round the year except May and September	-	Fewer no. of outbreaks	
Medak	Round the year except April, May and December	Mid March and April	Fewer number of outbreaks	
Vizianagaram	Round the year except January and December	-	Fewer number of outbreaks	
Prakasam	Round the year except in February	-	Few sporadic outbreaks	
Nellore	Round the year except February, May, June and December	May (selective vaccinations for minor outbreaks during January to May)	Fewer number of outbreaks	
Visakapatnam	-	-	Few isolated and patchy outbreaks	
Warangal	-	-	Few isolated outbreaks	
West Godavari	July 2004, December 2001, April 1999 and June 1998 (total 10 outbreaks)	May-June	Isolated outbreaks	Put on hold vaccinations in other villages/ Mandals where outbreaks had occurred until new outbreaks are encountered

District	Main time of outbreak	Recommended time of vaccination	Frequency of outbreaks	Remarks
Guntur	April 1998, March 2000, November 2002 and October 2003 (total 4 outbreaks)	-	-	If fresh outbreaks, initiate and continue vaccinations for 3-5 years Strengthen disease monitoring and reporting
RR and Hyderabad	June 2002, August 2000 and September 1999 (total 3 outbreaks	-	-	
Krishna	January 1998 and October 2001 (total 2 outbreaks)	Vaccinations not recommended on conservative grounds	-	

Figure A3: BQ: Long term district wise trends

Mahbubnagar



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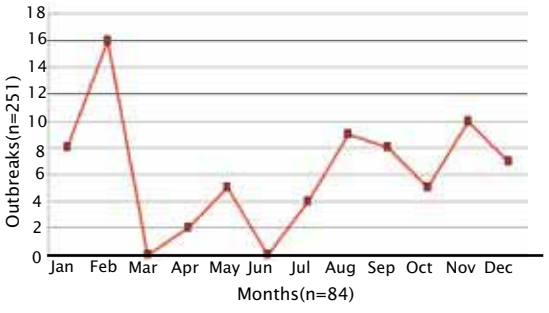

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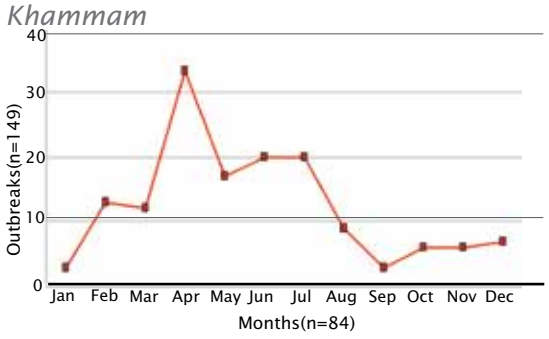
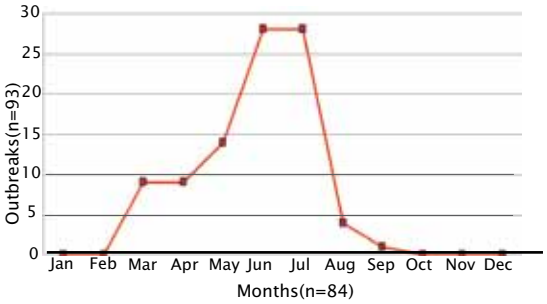
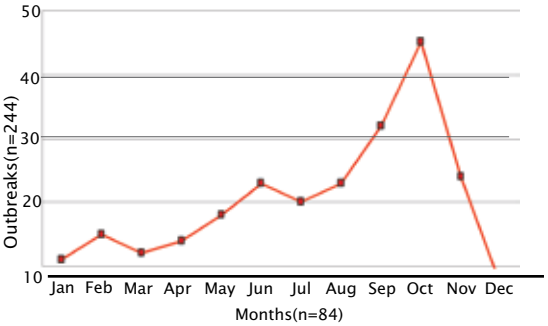


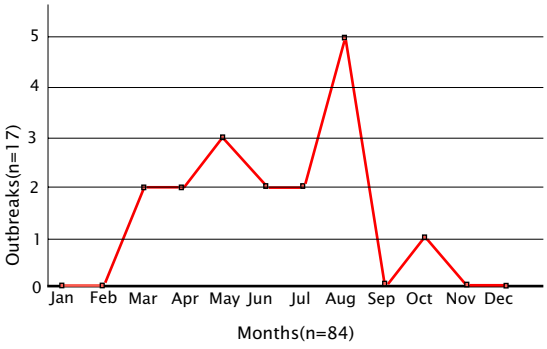
Srikakulam



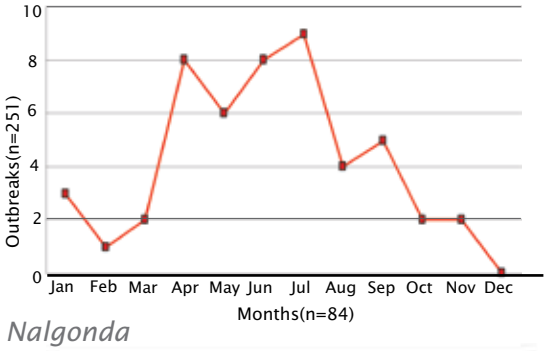
Ananthapur



Visakhapatnam



Adilabad



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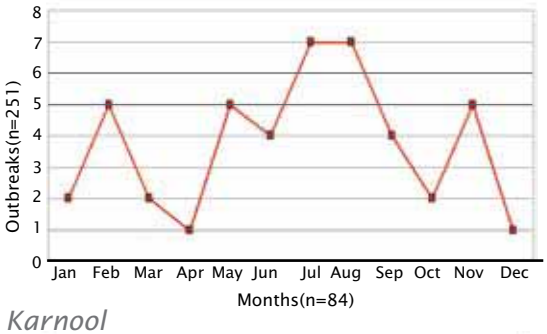

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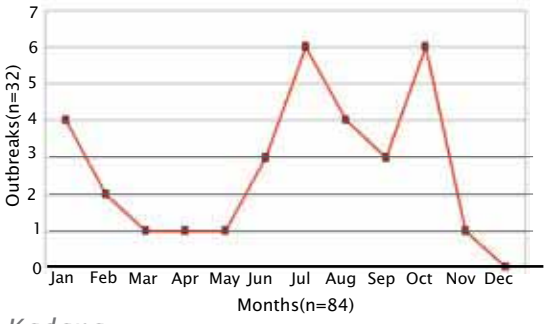

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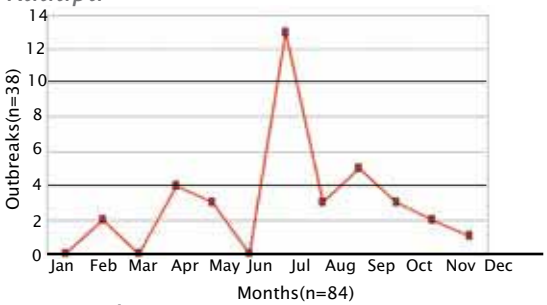
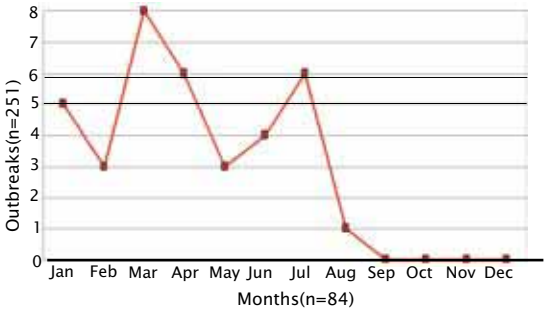
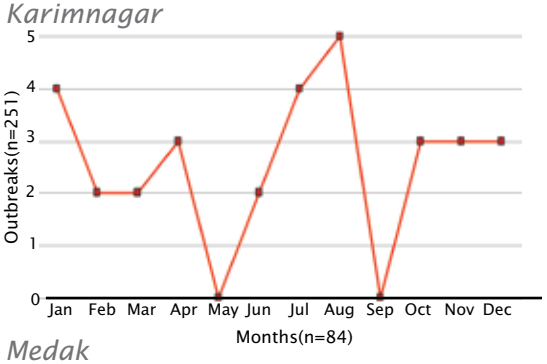


East Godavari



Karimnagar



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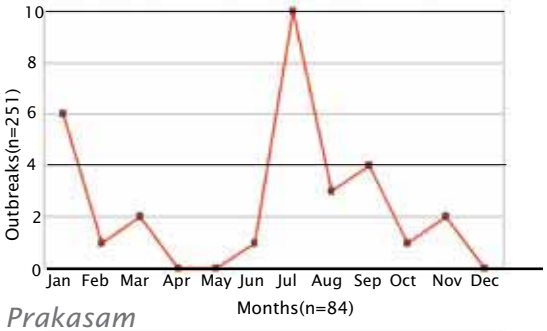

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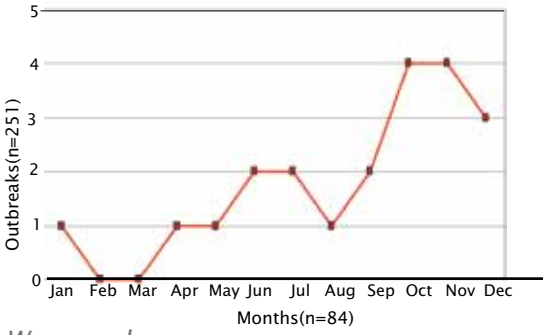
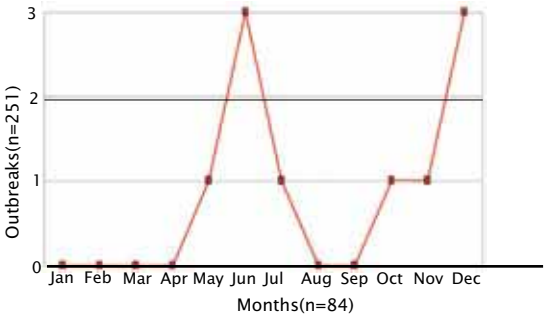


Warangal



ANNEX 4

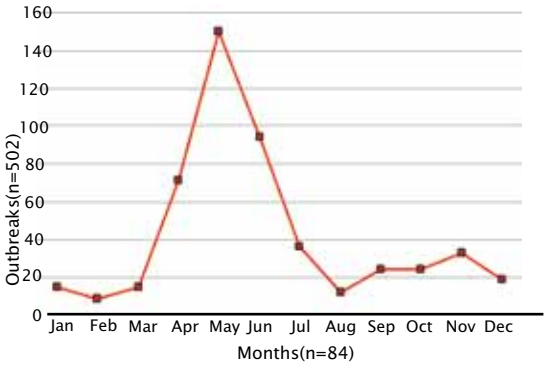
Enterotoxaemia (ET) In Andhra Pradesh

District	Principal outbreak duration	Recommended Vaccination duration	Frequency/ Number of outbreaks	Remarks
Ananthapur	March- July	December- February	Maximum	Initiate ring vaccinations in fresh outbreak locations
Kadapa	January- July with fewer outbreaks in August- September	October- December	Ranks second	
Nellore	June and August	Telescoping vaccination programme from November- July (can be extended to August)	Ranks third Evenly distributed round the year with three peaks	
Mahbubnagar	April- July extending up to September	January-March	Ranks fourth	
Karnool	August- December	June- July	Ranks fifth Erratic outbreaks round the year	
Karimnagar	Three distinct peaks during January- July	September-December and April	-	
Nalgonda	Simple, single distinct peak during March and July	January- late February and early vaccinations in December	-	
Prakasam	Very erratic outbreak peaks during February- September	Telescoping vaccination programme from November- January and location-specific vaccinations	-	
Chittoor	Simple, single distinct peak during April- August	January- late February and early vaccinations in December	-	
Nizamabad	Simple, single distinct peak during May-August	February- April	-	

District	Principal outbreak duration	Recommended Vaccination duration	Frequency/ Number of outbreaks	Remarks
Khammam	Distinct peak during June- September	March –May		Initiate ring vaccinations in fresh outbreak locations
Vizianagaram	Minor peak during February- April and major peak during May- August	January, March and April	-	
Medak	Minor progressive peak from March-July and major distinct peak during July- September	January, February, May and June	-	
Warangal	Multiple peaks during last three quarters of the year	January- March and selective vaccinations in July and August	-	
Krishna	Multiple peaks	Target location-specific vaccinations in January, followed by March and April and finally in June and July	Few outbreaks	
RR and Hyderabad	March –April	January and February	Few outbreaks	
Adilabad	May- October	March and April	-	
Srikakulum	January- August	November and December		

Figure A 4: ET: Long term monthly trends

Ananthapur



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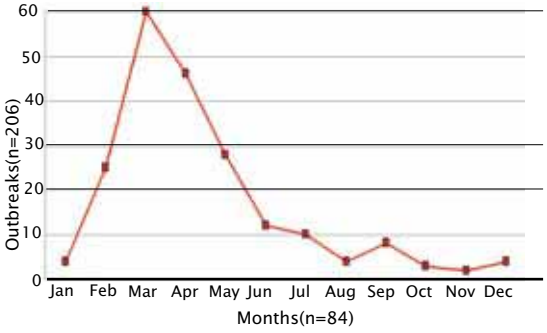
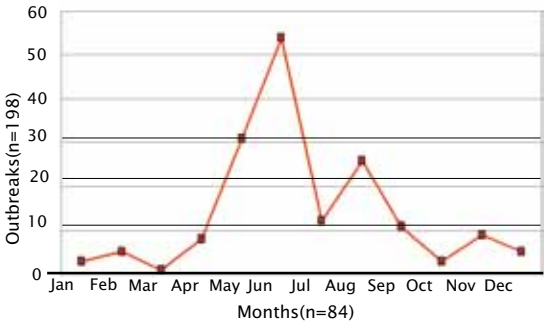


Mahbubnagar



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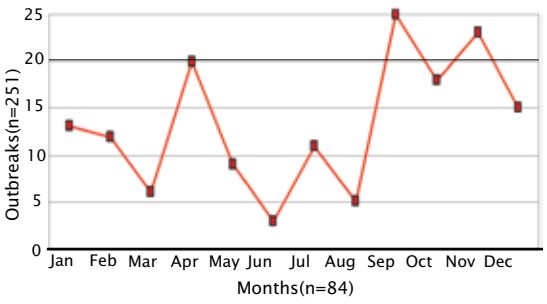

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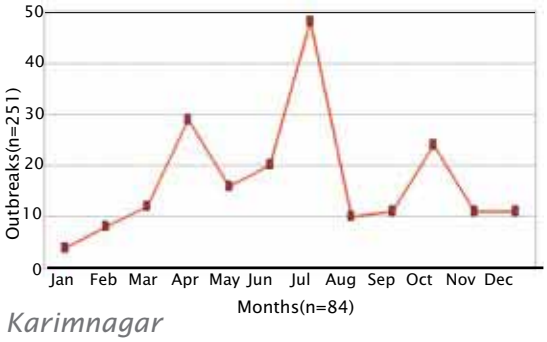

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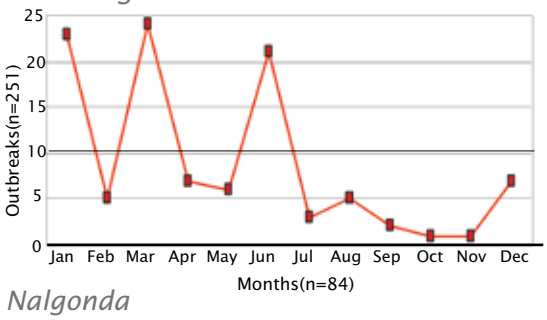

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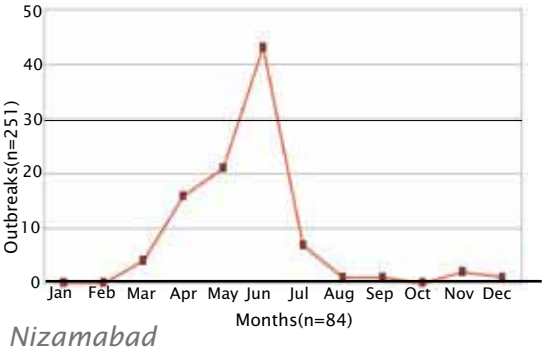

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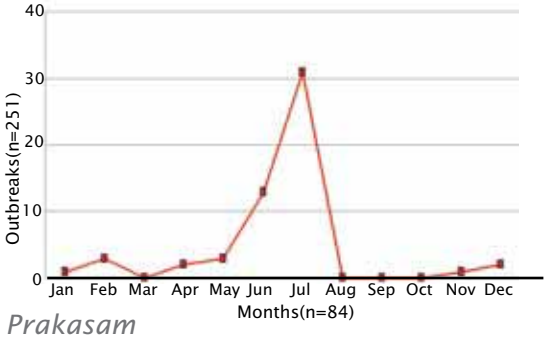

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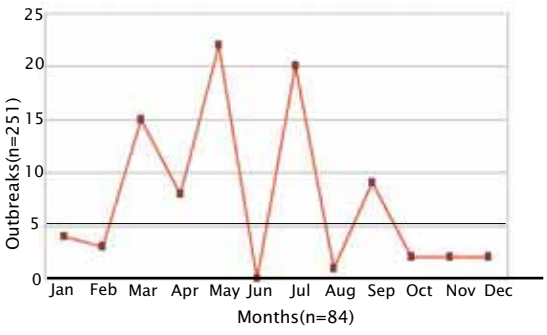

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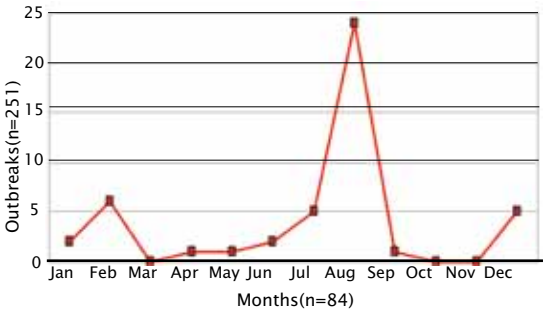
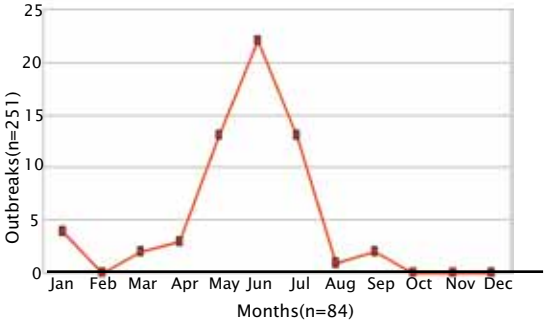
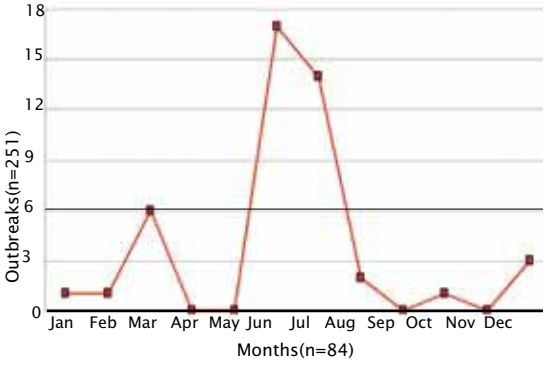


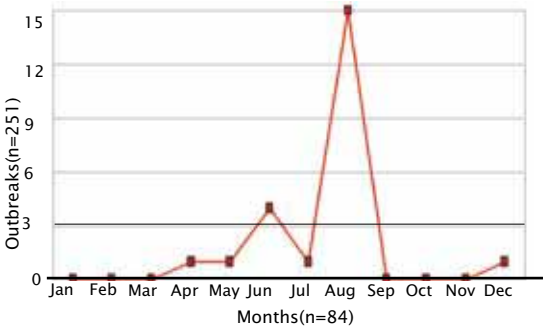
Chittoor



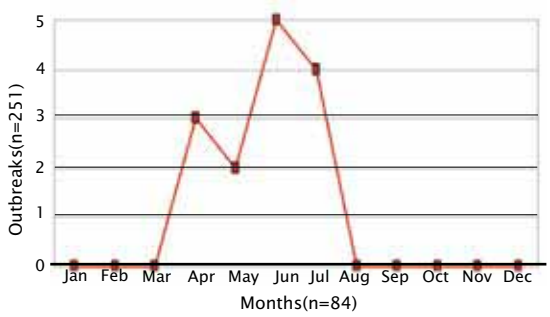
Vizianagaram



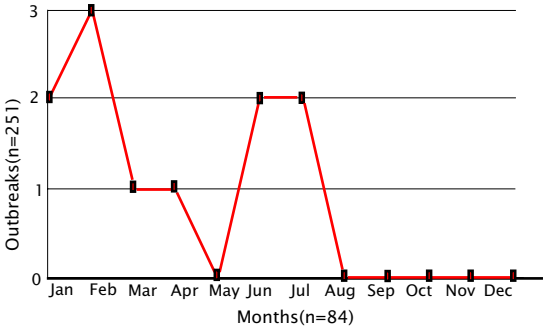
Medak



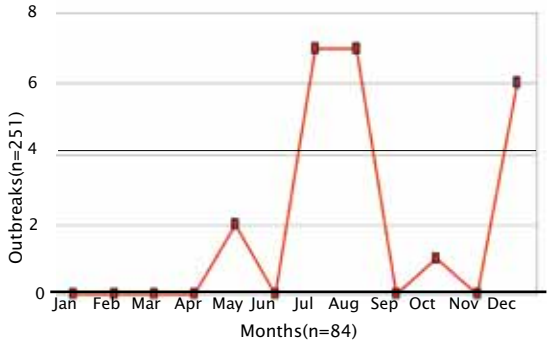
RR & Hyderabad districts



Krishna



Warangal



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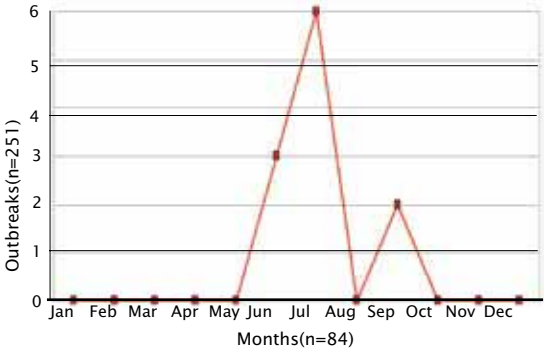

Swiss Agency for Development and Cooperation (SDC)
New Delhi - 110 021
Tel: + (91) 11 2687 7819/20
Web site: www.sdcindia.in

The Swiss Agency for Development and Cooperation (SDC) is the development arm of the Federal Ministry of Foreign Affairs of the Government of Switzerland engaged in international development cooperation. SDC works in India with a focus on poverty reduction in the semi-arid rural regions of the country.

Started in 1963 with a technical collaboration in milk production, SDC's partnership with India's development agenda is spread over a diverse set of engagements covering natural resource management, rural finance and livelihoods, decentralisation, empowerment of the discriminated, environment and pollution, humanitarian assistance as well as human and institutional development. SDC India's partners include civil society organizations, Govt. departments, public sector entities, research advocacy groups, professional associations and other development agencies. Its goal is to support people initiated, people owned and people controlled processes that render sustainable and equitable rural development in India.

Intercooperation in India (IC)
Hyderabad - 500 034
Tel: + (91) 40 2335 5891/2
Web site: www.intercooperation.org.in

Intercooperation (IC) is a leading Swiss non-profit foundation engaged in the development and international cooperation for 25 years. IC is a resource and knowledge organisation with 550 professionals working in 22 countries including Afghanistan, India, Pakistan, Bangladesh and Nepal in South Asia. IC works with a number of agencies like SDC, World Bank, IFAD, GtZ, SECO, EU, ITTO, governments and NGOs.

During its early days, IC focused on providing technical expertise to livestock and dairy programmes of the SDC in many states. Its working domains further expanded to cover institutional development and capacity-building; watershed development and sustainable agriculture; decentralized planning and development and adaptation to climate change. Since 2006, IC operates as a registered entity in India, collaborating with governments and a wide variety of organizations. IC's working domains in India are Livestock, livelihoods and environment; Vulnerability and adaptation to climate change and Local governance & civil society.

The Pro-Poor Livestock Policy Initiative (PPLPI),
New Delhi – 110 029,
Tel: 91 11 26197851/2619 7649
Web site: www.sapplpp.org

The Pro-Poor Livestock Policy Initiative (PPLPI) of the Food and Agricultural Organisation (FAO), launched in 2001, aims to facilitate and support livestock-related policies and institutional changes that have a positive impact on the world's poor. The "Reforms in Livestock Service Delivery Systems – Experiences from a Participatory Process in Andhra Pradesh" constitute a prime example of national and international cooperation leading to an improved mutual understanding with ultimate benefits for the poor.

The South Asia Pro-Poor Livestock Policy Programme (SA PPLPP) was launched in July 2007 as the 'successor' of the PPLPI South Asia Hub through a partnership between the National Dairy Development Board of India (NDDB) and the FAO's PPLPI. The mission of SA PPLPP is 'to ensure that the interests of poor fe/male livestock keepers are reflected in national, regional and international policies and programmes affecting their livelihoods'. Up scaling the lessons learnt from the "Reforms in Livestock Service Delivery Systems" is an important item on the agenda of SA PPLPP.

Capitalisation of Livestock Programme Experiences India
New Delhi – 110 016,
Tel: 91 11 26868536/41829717
E mail: calpi@intercooperation.org.in

CALPI is a programme of the SDC implemented by the IC. Its objective is to capitalise on the rich experiences of SDC-IC to significantly inspire changes in the economic, administrative, legal and policy frame conditions in the livestock sector in such a way that the priorities and challenges of the rural livelihood systems are effectively addressed and the rural poor, particularly women, benefit from the emerging opportunities. In its first phase from May 2002 to July 2006, CALPI supported 17 projects and ten activities spread over seven thrust areas through a network of 27 partners. In its second phase (consolidation phase) of two years from August 2006, CALPI supports nine projects.

All the projects supported by CALPI function on a multi-partner, consortia/resource pooling mode following a participatory process, beginning with the capacity development of the partners and stakeholders. Most of them focus on niche areas and well identified support gaps of high impact potential on the poor. CALPI always focuses on building synergies and convergence with the Governments playing a facilitating and steering role.