Economic Impact of Foot-and-Mouth Disease in India

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Importance of Livestock Sector in India

- Livestock is an important sub-sector of Indian agriculture contributing 25% of the output of the agricultural sector.
- The contribution of livestock sector to the total GDP during 2007-08 was about 4.4% (National Accounts Statistics, 2009).
- India has a total livestock population of 485 million and poultry population of 489.01 million.
- The country ranks first with respect to cattle and buffaloes, second in goats, third in sheep and seventh in poultry production in the world.
- About 22.45 million people work in the livestock sector and the sector plays a vital role in improving the socio-economic conditions of rural masses (DAHDF, 2009-10)

Contd..

- National Agricultural Policy (NAP 2000) emphasizes livestock as an important driver for achieving the targeted 4% growth in the agricultural sector by 2020.
- The XI Five Year Plan also envisages an overall growth rate of 6%-7% for the livestock sector with milk group achieving 5% growth and meat and poultry achieving 10% growth.
- The targeted growth rate for the livestock sector can be achieved by focusing on
  - a uniform livestock breeding policy,
  - generation and dissemination of improved livestock related technologies,
  - improved market access and performance,
  - management of feeding areas and sources,
  - establishment of disease-free zones and
  - involvement of co-operatives and the private sector

Importance to Livestock Health

- Animal husbandry practices have changed to a great extent following the introduction of newer technologies (crossbreeding and upgradation of indigenous breeds).

- With the liberalization of trade, the chances of ingress of exotic diseases in to the country have increased.

- For ensuring the maintenance of disease free status and to be compatible with the standards laid by the Office International des Epizooties (OIE), several animal health schemes have been initiated in the states and centre.

  - Assistance to States for Control of Animal Diseases (ASCAD)
  - National Project on Rinderpest Eradication (NPRE) and CBPP Eradication (NP-CBPP)
  - Foot & Mouth Disease Control Programme (FMD-CP)

Estimated annual loss due to livestock diseases in India

Disease	Annual loss (Rs in crores.)
FMD[1]	4000 15000-20000
PPR[2]	1690-1800
HS[3]	100
Avian Flu[4]	245.517*

Source:
1 – Bandyopadhyay (2003) Prabu *et al*. (2004)
2 – Kumar *et al*. (2004), Venkataramanan *et al*. (2005)
3 – Singh *et al*. (1996)
4 – Ganesh Kumar *et al*. (2008)
* - The figures correspond to losses in Manipur state only

FMD, a major threat to Livestock Sector

- One of the major obstacles in achieving the targeted growth rates in the sector is the prevalence and outbreaks of diseases, particularly List A OIE diseases like FMD.

- It is generally not fatal in mature livestock, but increases the risk of spontaneous abortion among pregnant animals and of mortality among young livestock.

- The disease situation is complicated by several factors
  - Large population of susceptible animals (more than 470 million),
  - No systematic vaccination
  - Unrestricted movement of animals within the country.

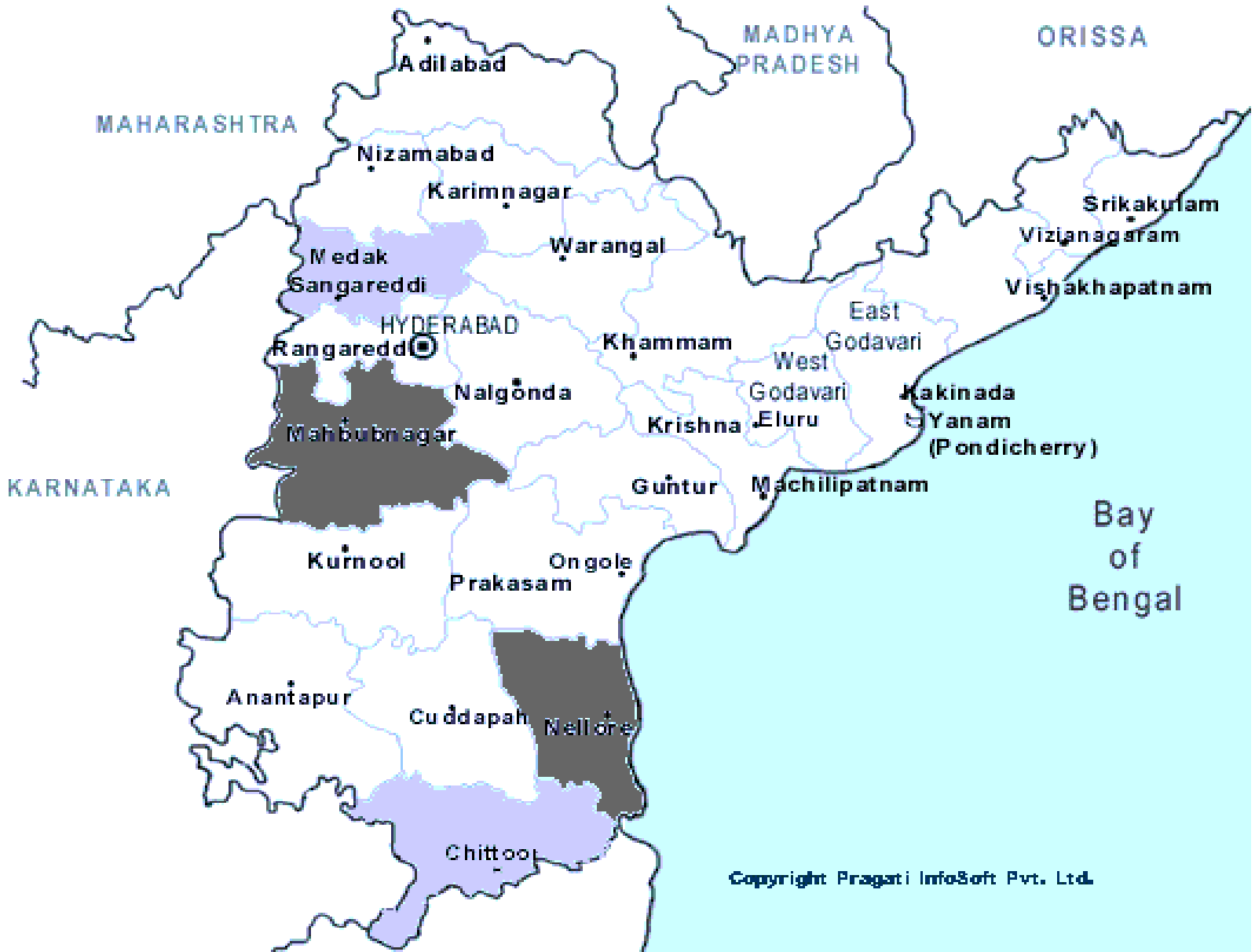
Contd..

- FMD leads to reduced productivity and require increased expenditures on feed, medication and shelter (Rich and Winter-Nelson 2007).
- The economic losses caused by the disease are mainly due to losses in milk production and reduction in working capacity of work animals (Bandyopadhyay, 2003; Venkataramanan *et al*. 2005).
- In addition, milk and milk products, meats and hides are not accepted by the disease-free importing countries causing reduction in the export potential of the livestock industry.

Rationale

- FMD has been ranked as the highest priority disease for control and eradication by India.
- The government of India has initiated the FMD-CP in 54 districts in 8 states of the country in the X Plan. Recently, in August 2010, the Govt. of India has expanded the FMD-CP from 54 to 221 districts for wider coverage and better control of the disease.
- All the cattle and buffaloes in these target districts are vaccinated twice a year. Despite this, new outbreaks of FMD are reported every year in the country.
- Though the benefit of FMD-CP is widely recognized, policy makers still need empirical evidence to get convinced.

Sample districts in Andhra Pradesh



Methodology

Quantitative impacts

Direct losses

- **Loss due to milk yield reduction (L_Y)**

$$L_Y = (M_{Pre} - M_{Post}) * D * P$$

where,

M_{Pre} = Milk yield at pre-FMD period (Litres/day)

M_{Post} = Milk yield at post-FMD period (Litres/day)

D = Duration of infection in in-milk animals

P = Price / litre of milk (Rs.)

Quantitative impacts

Direct losses

- **Loss due to draught power reduction (L_D)**

$$L_D = [\,(\,H_{Pre} - H_{Post}) / 8] * D * W$$

where,

H_{Pre} = Draught power at pre-FMD period (Hours/day)

H_{Post} = Draught power at post-FMD period (Hours/day)

D = Duration of infection in bullocks

W = Hiring charges / day (Rs.)

Quantitative impacts

Direct losses

- **Loss due to treatment costs (L_T)**

$$L_T = (C_P * N) + C_I$$

$$C_P = F + M$$

where,

- C_P = Cost of professional treatment (Rs)
- F = Fees for veterinarians / visit (Rs)
- M = Cost of medicines / visit (Rs)
- N = No. of visits to animal health services
- C_I = Cost of indigenous treatment during the infected period (Rs)

Quantitative impacts

Direct losses

- **Loss due to mortality (L_M)**

$$L_M = \sum A_{ij} * V_{ij}$$

where,

A_{ij} = Species-wise category of bovines

V_{ij} = Average value of animals (Rs)

i = Species of animal, viz. Indigenous cattle, crossbred cattle, local buffalo and upgraded buffalo

j = Category of animals, viz. In-milk, dry, bull, bullock, immature males, heifer, male calf and female calf

Factors influencing compliance to vaccinating the animals against FMD

Probit Model

$$Y = a_0 + \beta_1 AGE + \beta_2 EDN + \beta_3 FAMILY + \beta_4 EXP + \beta_5 FARM + \beta_6 TINC + \beta_7 CASTE\ (D_1) + \beta_8 CASTE\ (D_2) + \beta_9 CASTE\ (D_3) + U_i$$

where,

Y = Compliance to vaccination (1 for 'Yes' and 0 for 'No')

AGE = Age of the farmer

EDN = Education level of the farmer (No. of years of formal education)

FAMILY = Family size of the farm household

EXP = Experience in dairying (No. of years)

FARM = Farm size (No. of bovines in the farm household)

TINC = Total income of the farmer

D_1 = Dummy (Other backward caste)

D_2 = Dummy (Scheduled caste)

D_3 = Dummy (Scheduled tribe)

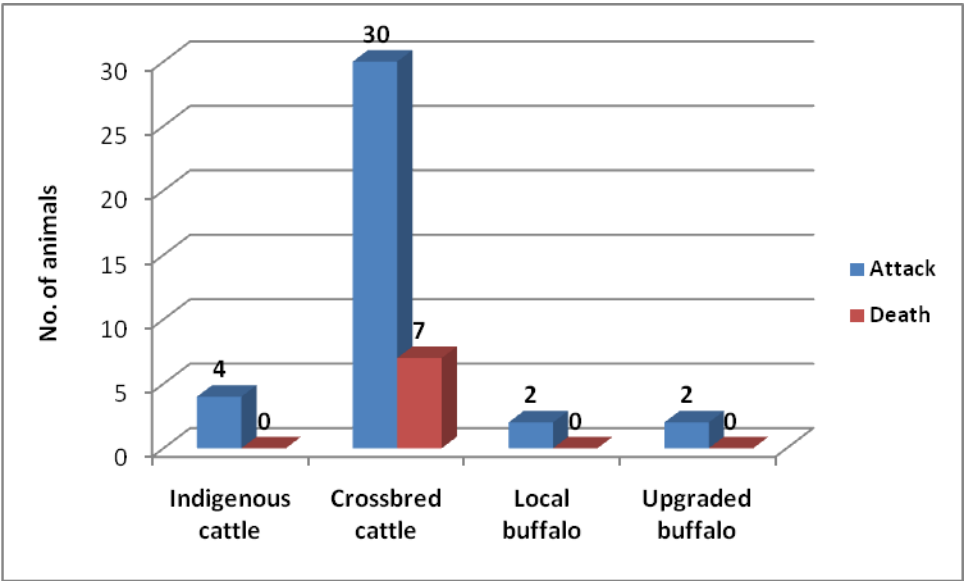
U_i = Error term

FMD attacks and death in the sample farms

Impact	FMD CP districts		FMD non-CP districts	
	Chittoor	Medak	Nellore	Mahbub nagar
Total animals	203	240	482	345
Attacks	38 (18.72)	80 (33.33)	98 (20.33)	122 (35.36)
Deaths	7 (18.42)	8 (10.00)	21 (21.43)	27 (22.13)

Note: *Figures in parentheses under 'attacks' indicate percentages to total no. of animals in the affected households*
Figures in parentheses under 'deaths' indicate percentages to total no. of animals attacked

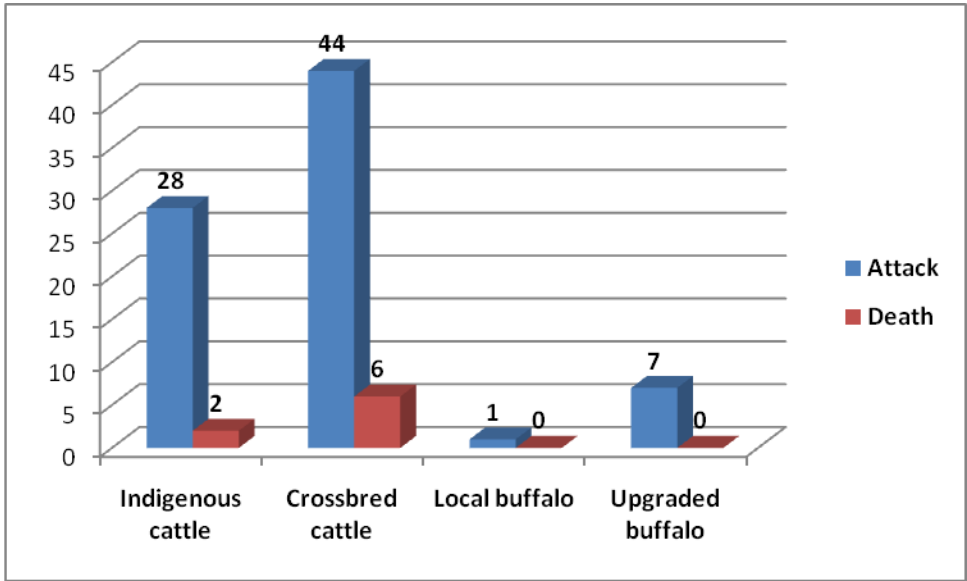
FMD attacks and death in farm by different species of dairy animals



FMD CP districts

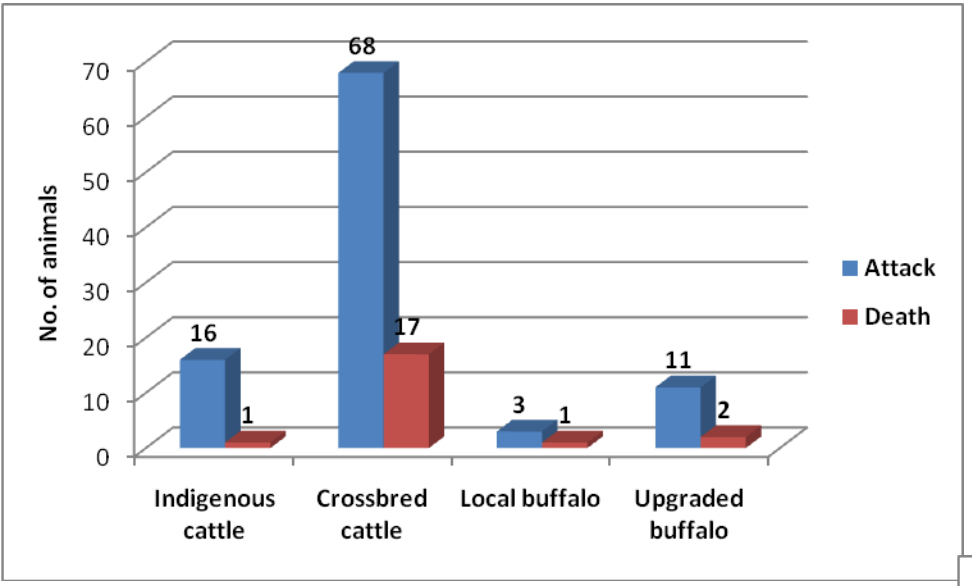
Chittoor

Medak



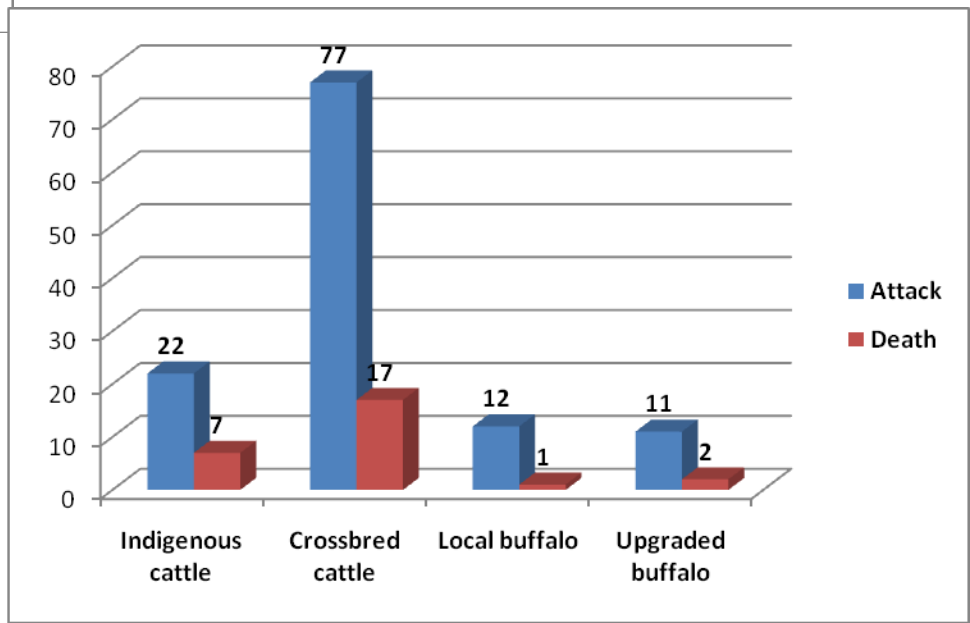
FMD attacks and death in farm by different species of dairy animals

FMD non-CP districts



Nellore

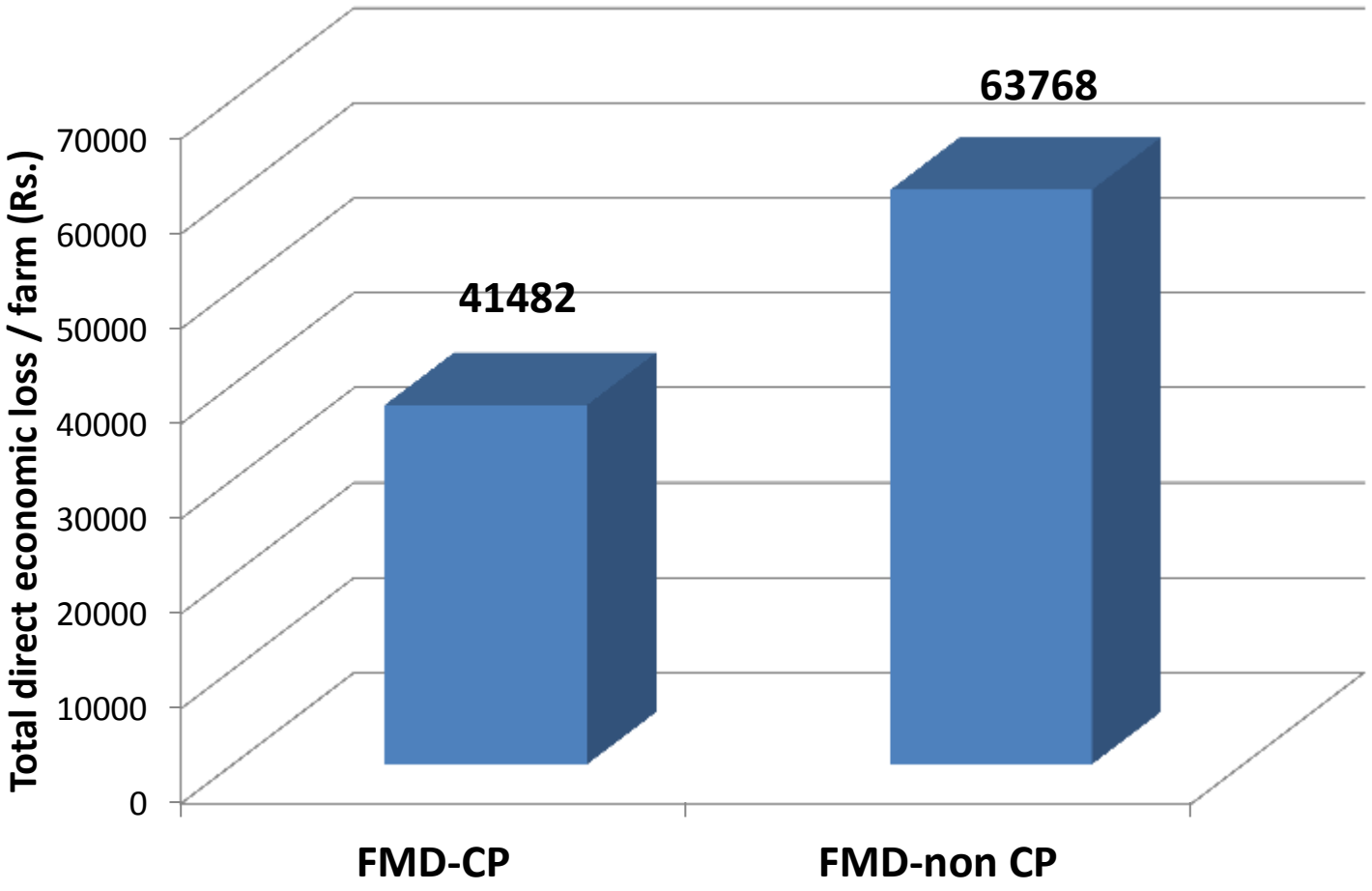
Mahbubnagar



Direct losses quantified

- Milk yield reduction
- Draught power reduction
- Treatment costs
- Mortality
  - for indigenous cattle, crossbred cattle, local buffaloes, upgraded buffaloes

Total Direct Economic Impact due to FMD



Indirect losses…..not quantified

- Permanent reduction in production
- Body weight loss (feed/maintenance/)
- Abortion
- Long intercalving period / service period
- Permanent lameness of draught animals
- Market and price effects
- Trade effects
- Food security and nutrition
- Health and environment effects
- Costs of inspection, monitoring and surveillance

State level projections of impact

- Loss due to milk yield reduction
  - Multiplied with the population of in-milk animals
- Loss due to draught power reduction
  - Multiplied with the population of male animals used for breeding, agricultural operations and bullock cart pulling
- Treatment costs
  - Multiplied with the population of 50% of the adult animals
- Loss due to mortality
  - Multiplied with the total population of animals

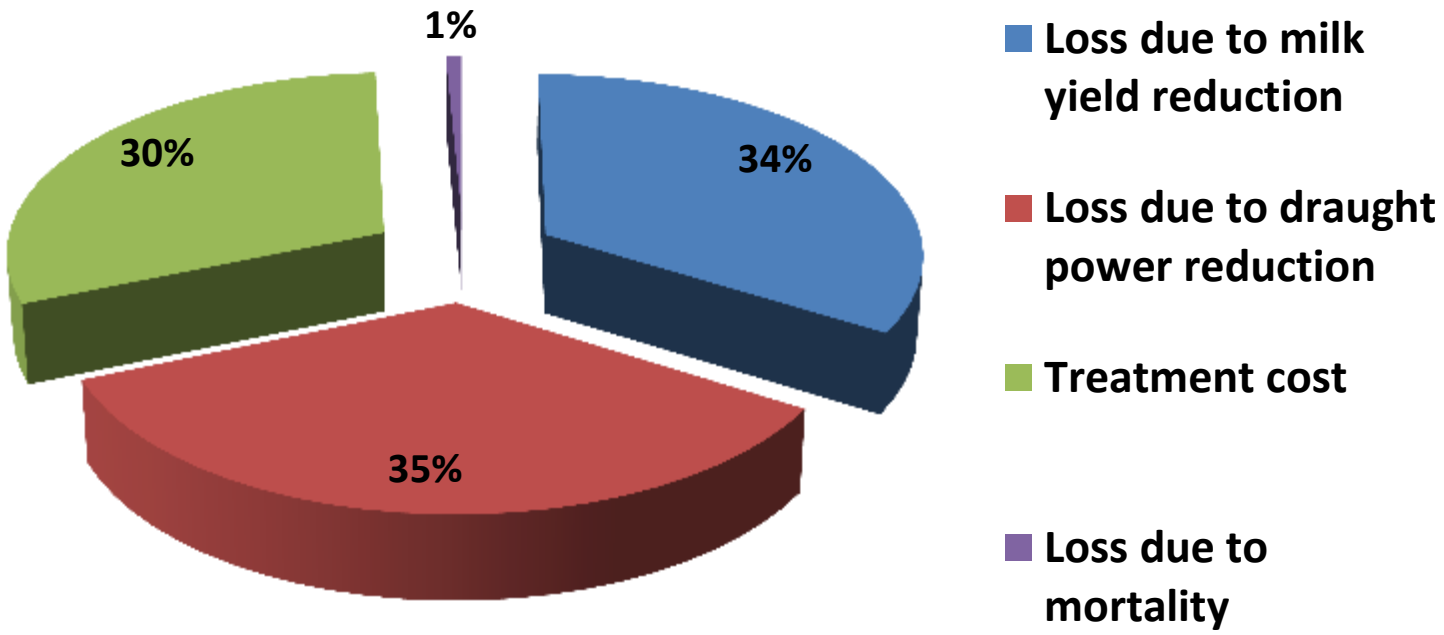
Projections of estimated total direct loss due to FMD in Andhra Pradesh

S.No.	Impact	Loss / animal (Rs.)	Susceptible Population	Incidence rate (%)	Total loss (Rs. in crores)
1.	**Loss due to milk yield reduction**				
	Indigenous cattle	5085	1530651	0.09	71.98
	Crossbred cattle	9256	642362	0.23	137.92
	Buffaloes	8742	4682371	0.04	178.68
				Sub-total	**388.58**
2.	**Loss due to draught power reduction**				
	Indigenous cattle	11044	3897284	0.08	361.42
	Crossbred cattle	9658	166866	0.23	37.37
				Sub-total	**398.79**

Projections of estimated total direct loss due to FMD in Andhra Pradesh

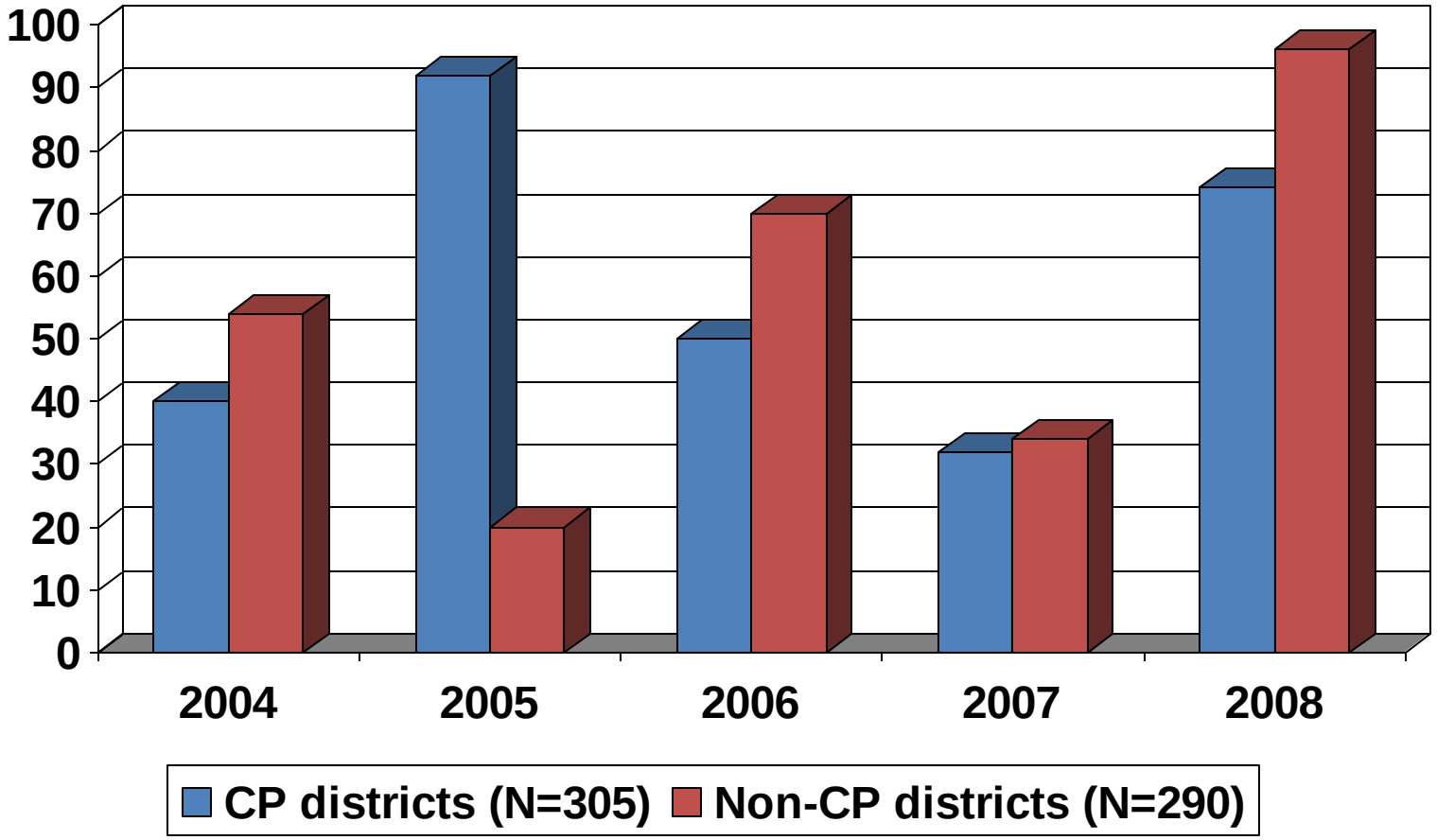
S.No.	Impact	Loss / animal (Rs.)	Susceptible Population	Incidence rate (%)	Total loss (Rs. in crores)
3.	**Treatment costs**				
	Indigenous cattle	2455	13850121	0.06	215.89
	Crossbred cattle	3516	1516264	0.13	102.86
	Buffaloes	1254	9614938	0.03	32.66
				Sub-total	**351.41**
4.	**Loss due to mortality**				
	Indigenous cattle	114	16338975	0.002	0.33
	Crossbred cattle	1596	2305179	0.02	7.55
	Buffaloes	191	15379360	0.002	0.65
				Sub-total	**8.53**

Share of estimated total direct loss due to FMD in Andhra Pradesh

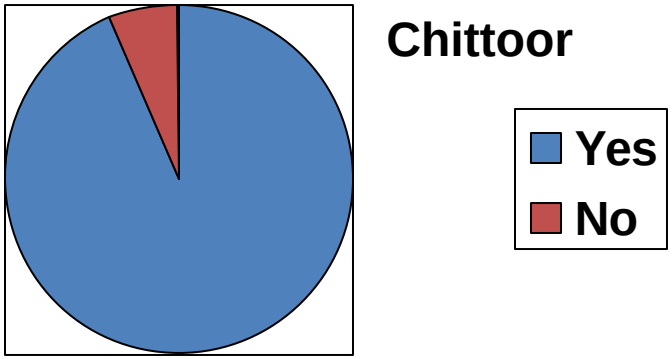


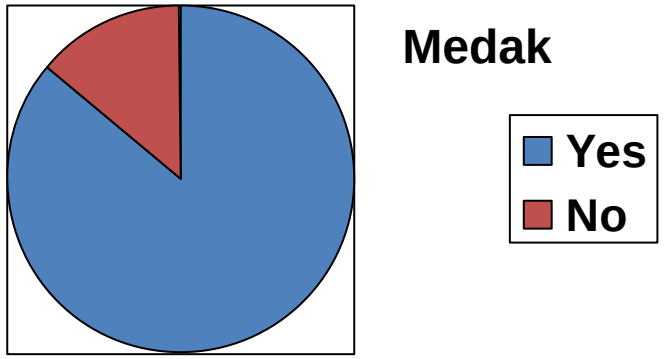
Message 1: Despite the FMD CP, farmers report that FMD outbreaks still persist

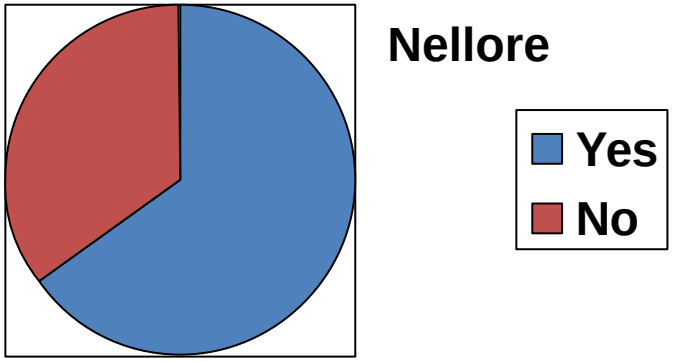
Number of FMD outbreaks in the study area

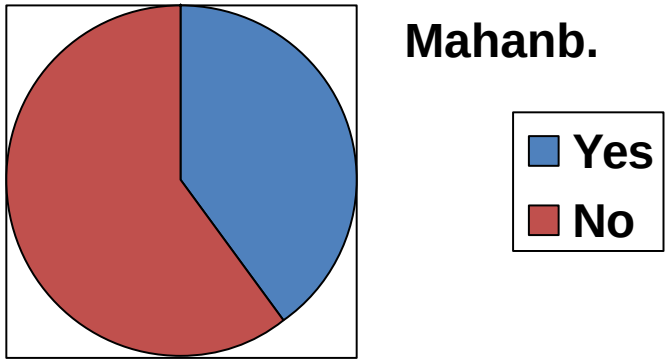


Reported vaccination against FMD in 2008



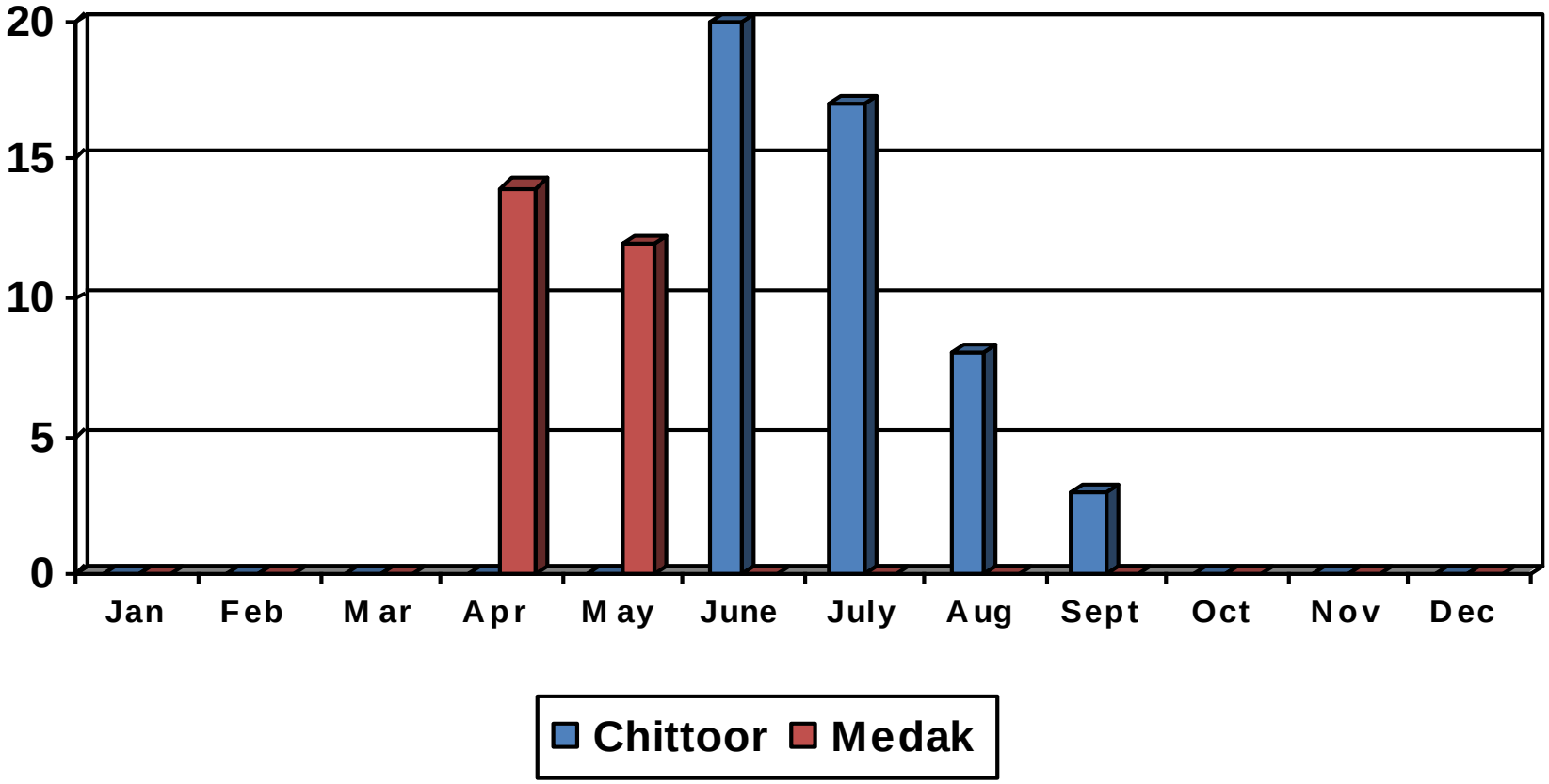




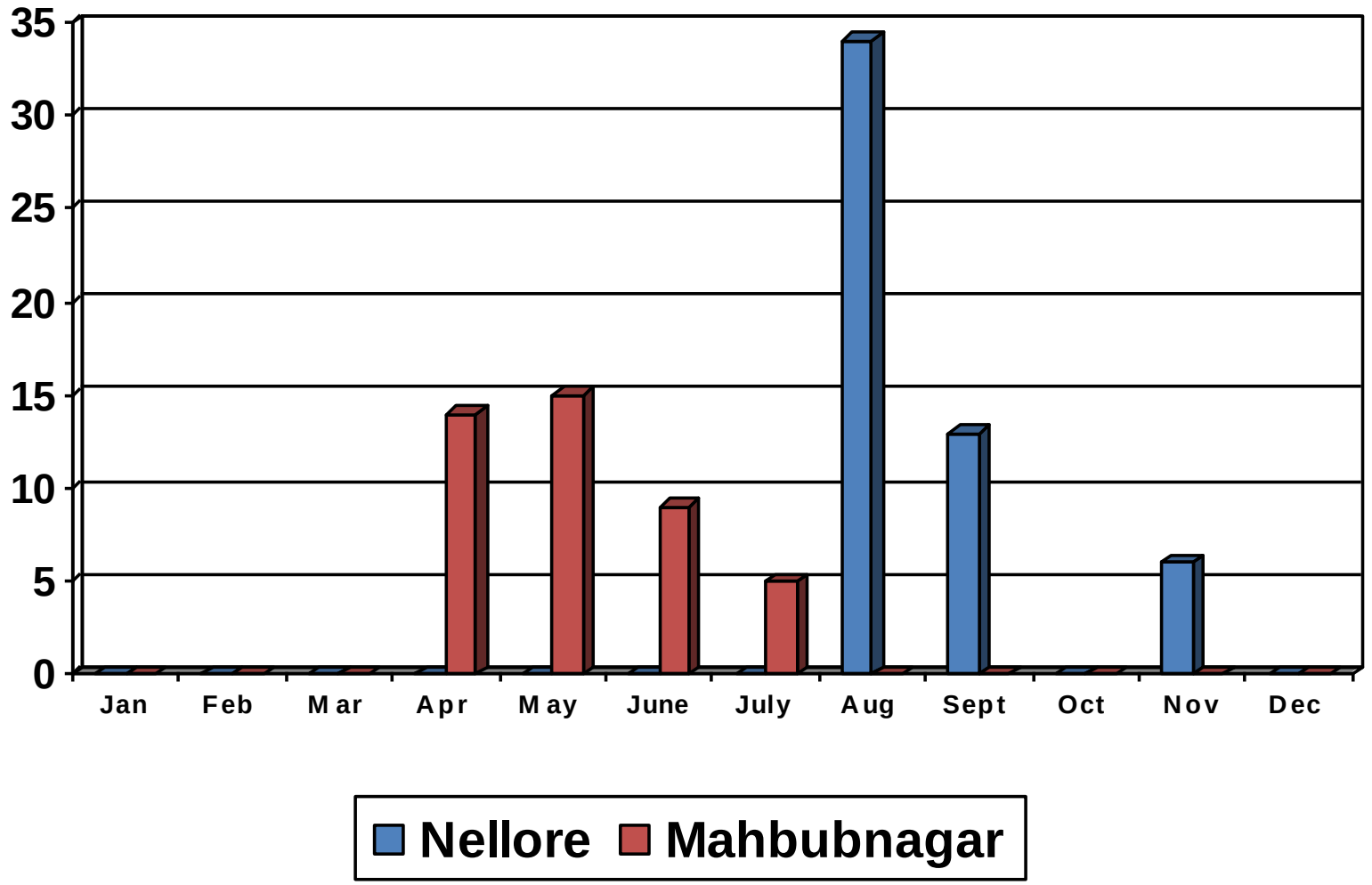


Message 2: Seasonality and spatial hotspots characterize prevalence of FMD in Andhra Pradesh

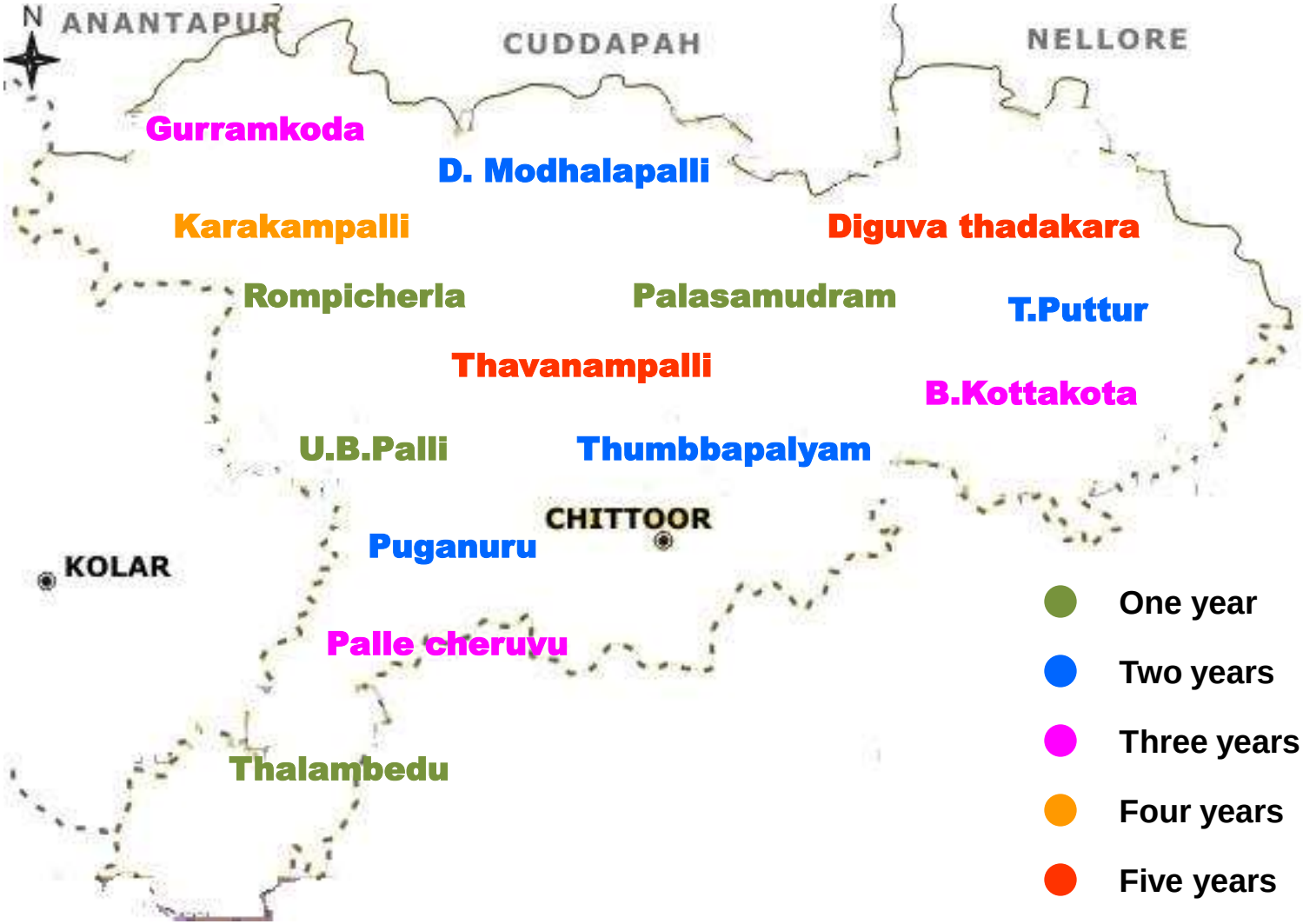
Seasonality of FMD incidences in 2008



Seasonality of FMD incidences in 2008

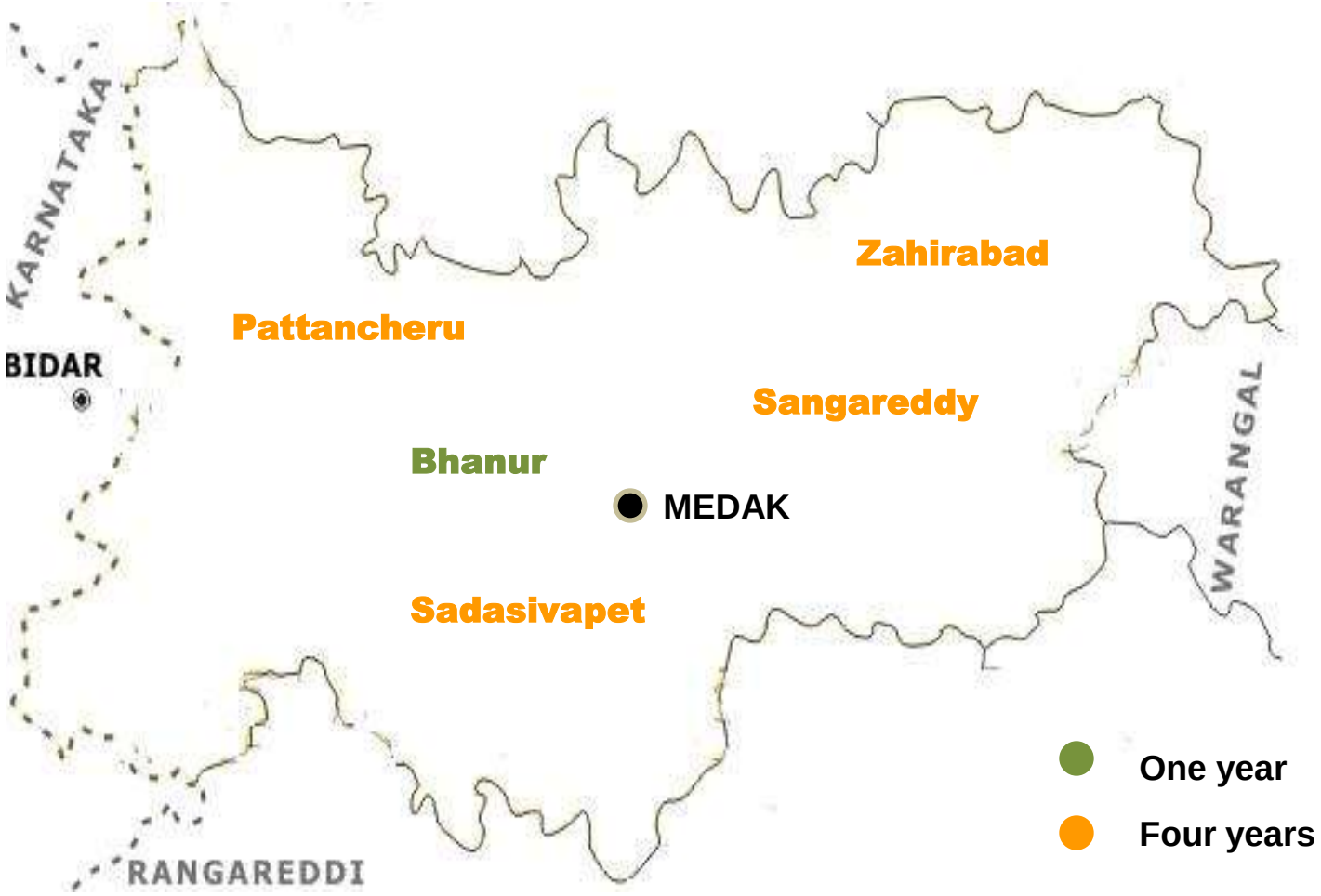


Vulnerability of Chittoor district for FMD

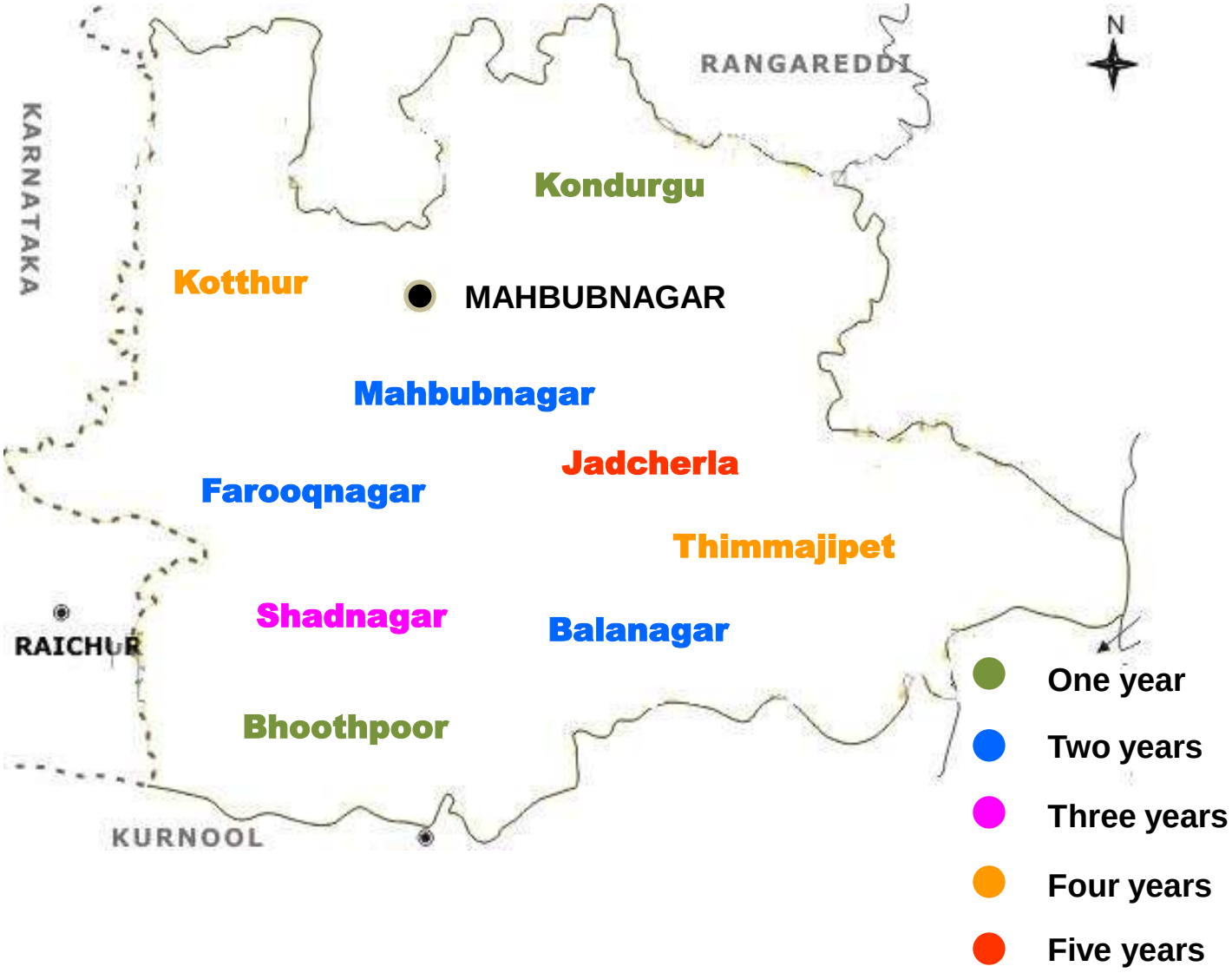


Vulnerability of Nellore district for FMD

Vulnerability of Medak district for FMD



Vulnerability of Mahbubnagar district for FMD



Message 3: Use of vaccination influenced by education level, experience, income and caste of the farmers

Factors influencing compliance to vaccinating the animals against FMD in Andhra Pradesh

Dependant variable: Vaccination in 2008 (Yes-1; No-0)

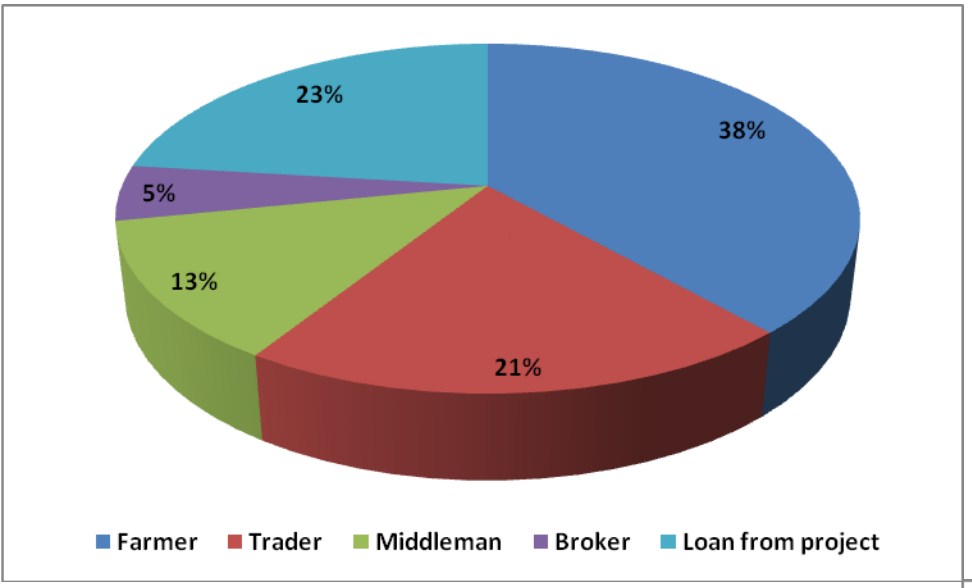
Variable	Coefficients	't' values	'p' values
Constant	-0.1886	-0.532	0.5945
Age	0.0045	0.756	0.4496
Education (No. of years)	0.0647***	4.172	0.0000
Family size	-0.0405	-1.276	0.2018
Experience in dairying (No. of years)	0.0445***	5.255	0.0000
Farm size	-0.0212	-1.587	0.1124
Total income (Rs.)	0.0005***	2.480	0.0131
Caste (D1): OBC	-0.5118***	-3.265	0.0011
Caste (D2): SC	-0.3158	-1.434	0.1516
Caste (D3): ST	-1.0154	-3.805	0.0001

* Significance at 1% level
** Significance at 5% level
*** Significance at 10% level

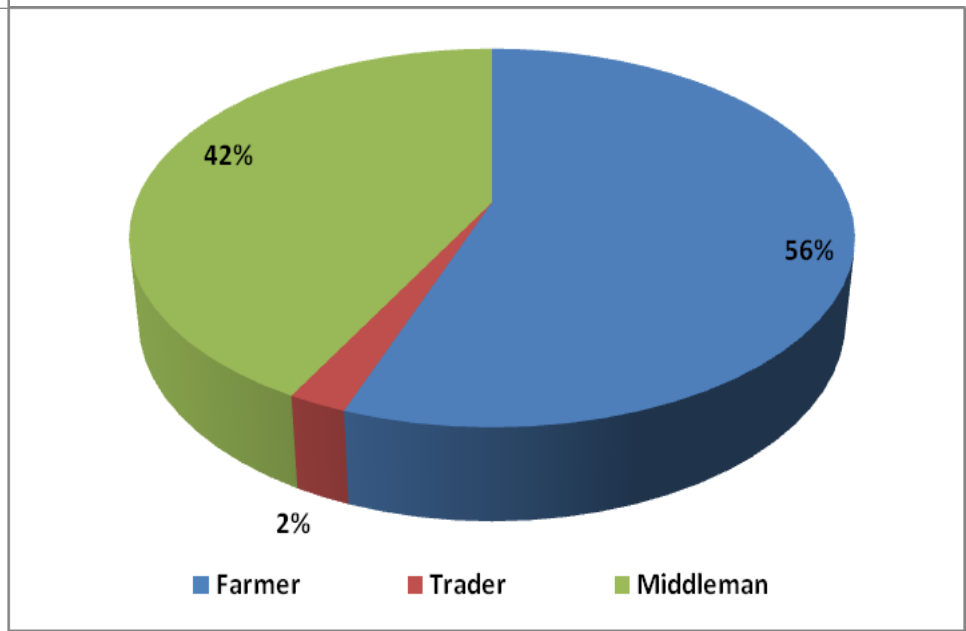
Message 4: Marketing channels and control behavior may influence the persistence of FMD in the study area

FMD CP districts

Chittoor

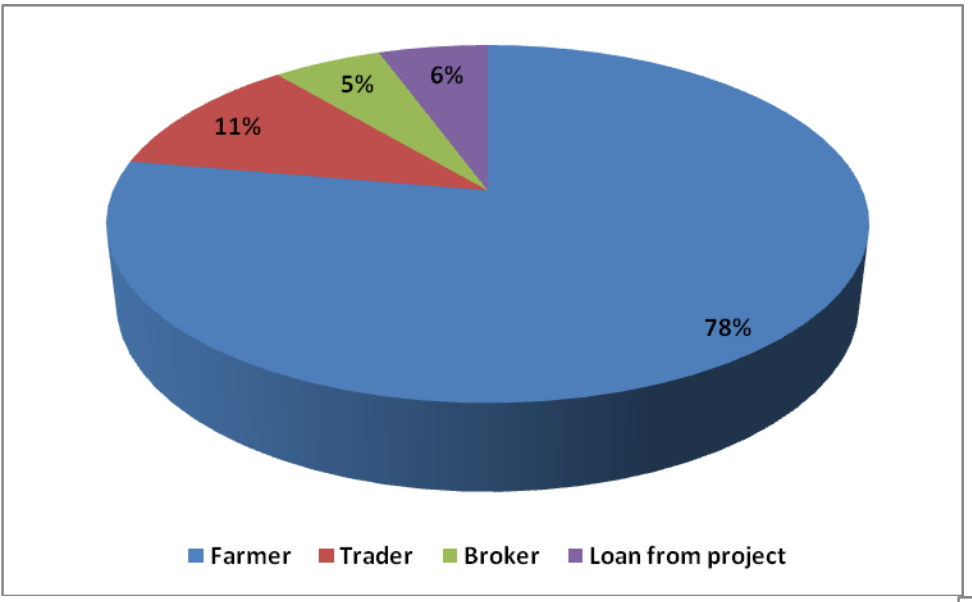


Medak

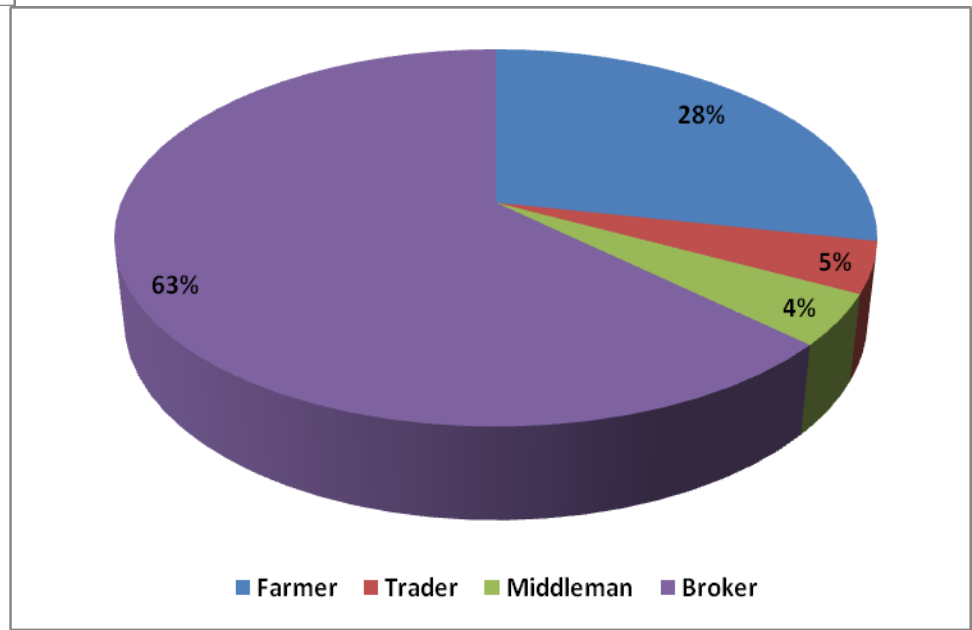


FMD non-CP districts

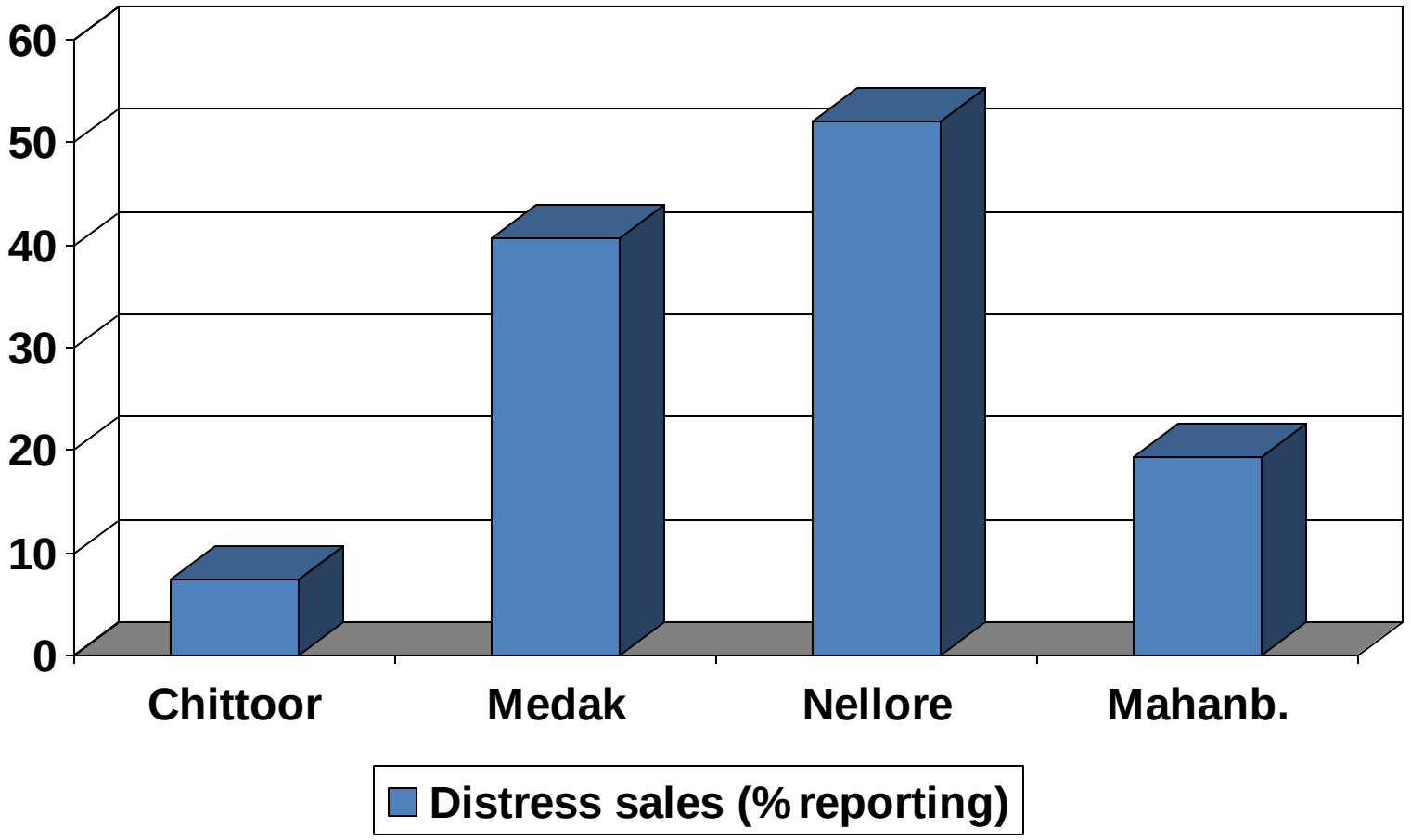
Nellore



Mahbubnagar

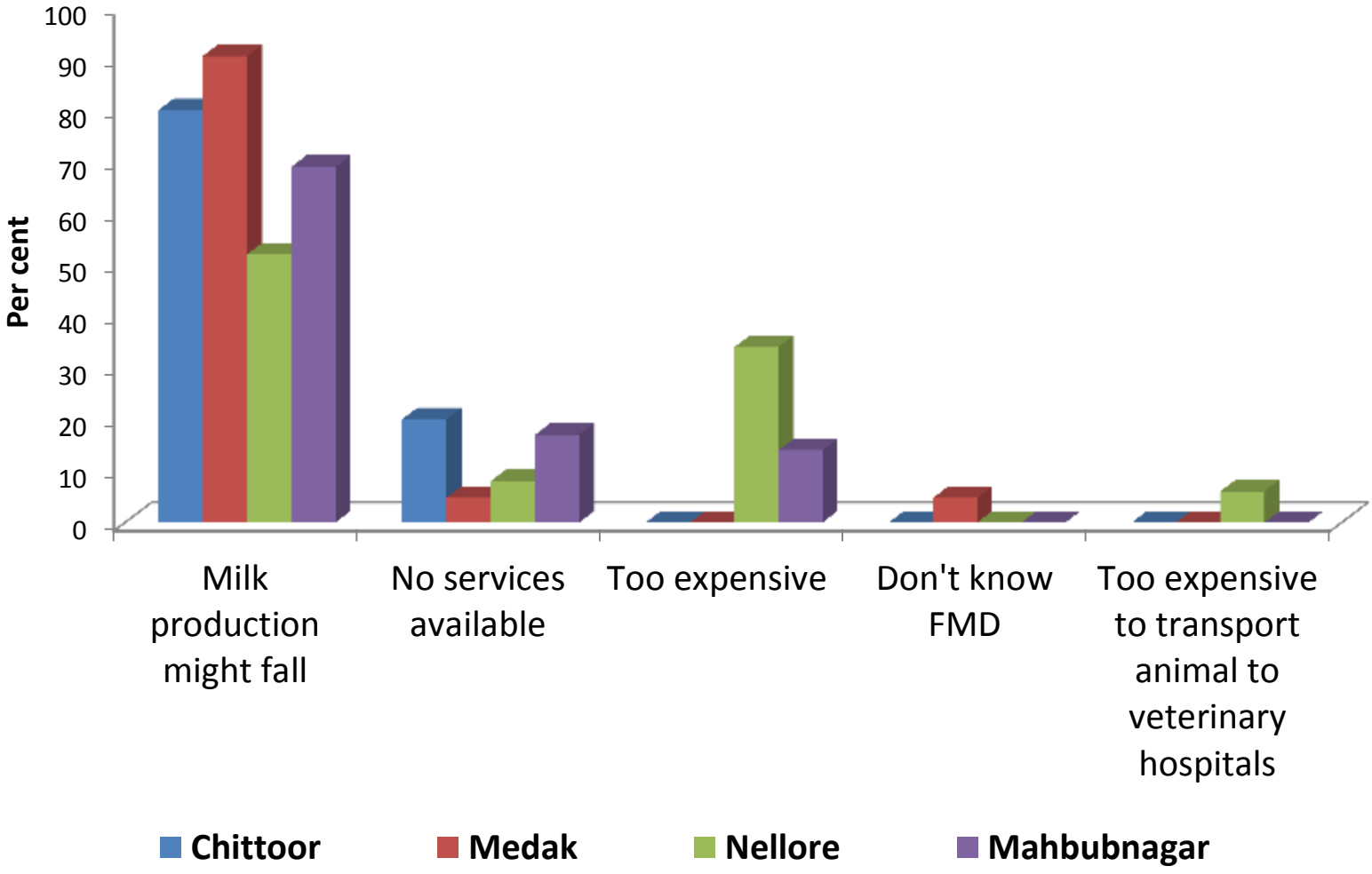


Distress sale of dairy animals in Andhra Pradesh



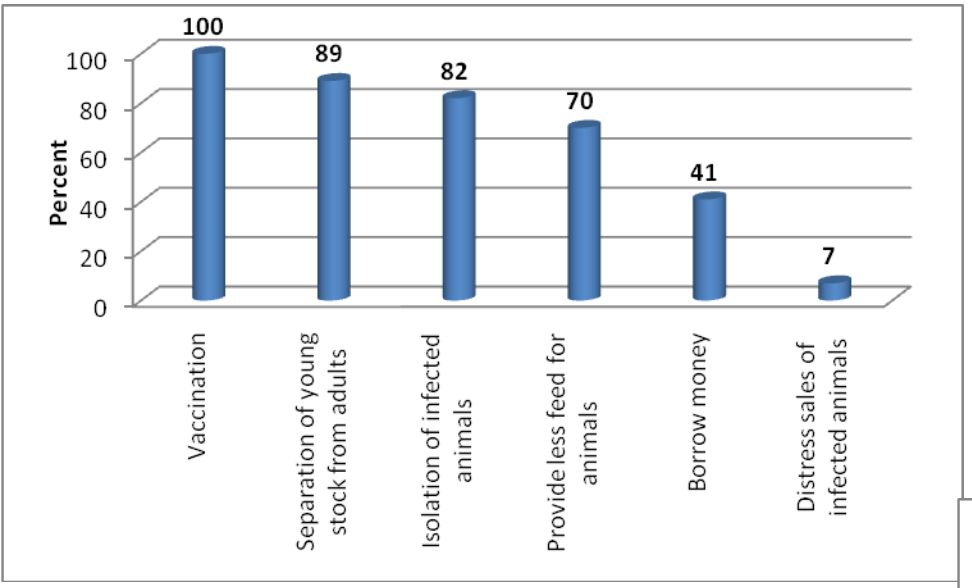
Message 5: Perceptions about FMD vaccine partly explain why some farmers fail to vaccinate their herds for FMD

Reasons for not vaccinating against FMD



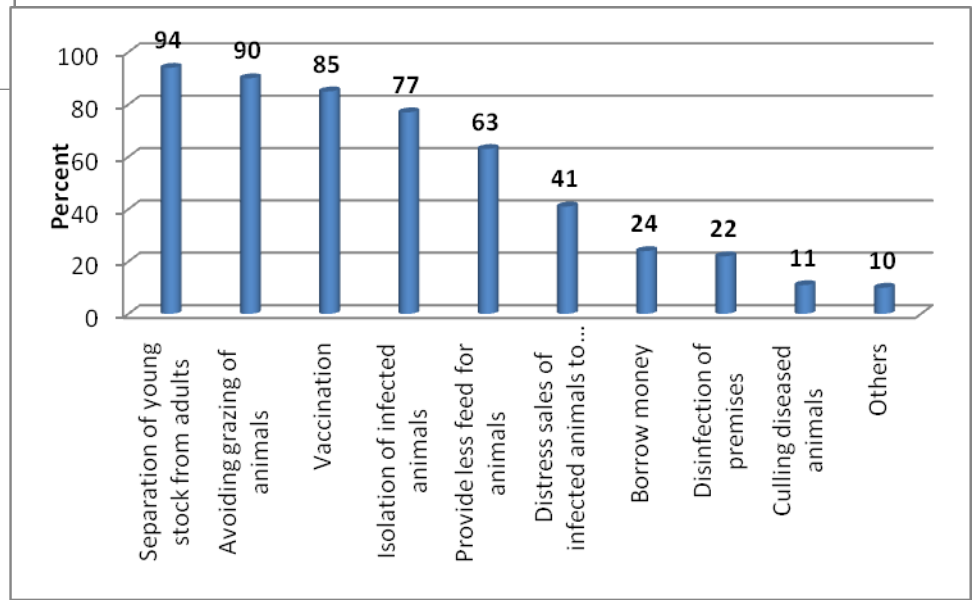
Mechanism and coping strategies employed by farmers during FMD outbreak

FMD CP districts



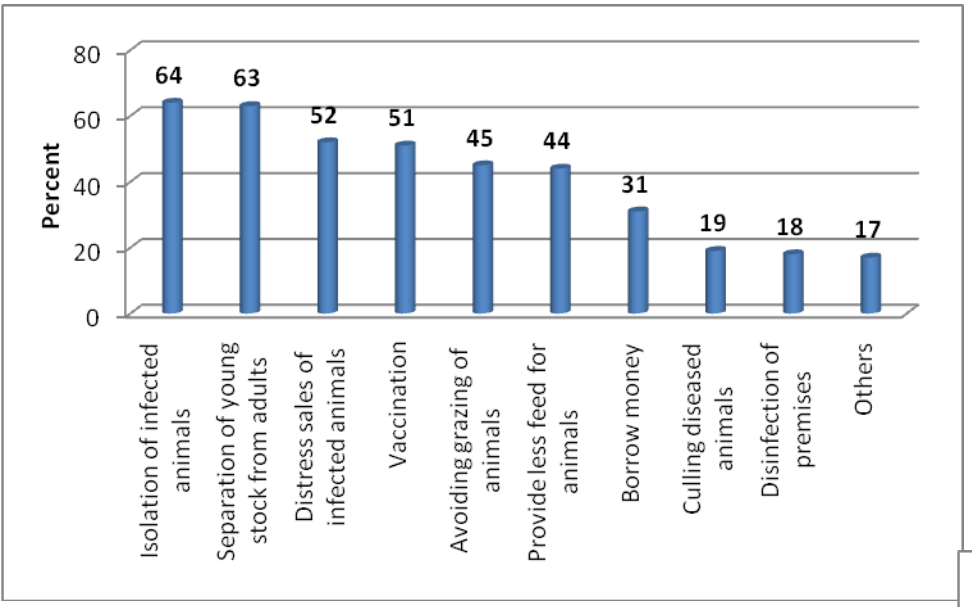
Chittoor

Medak



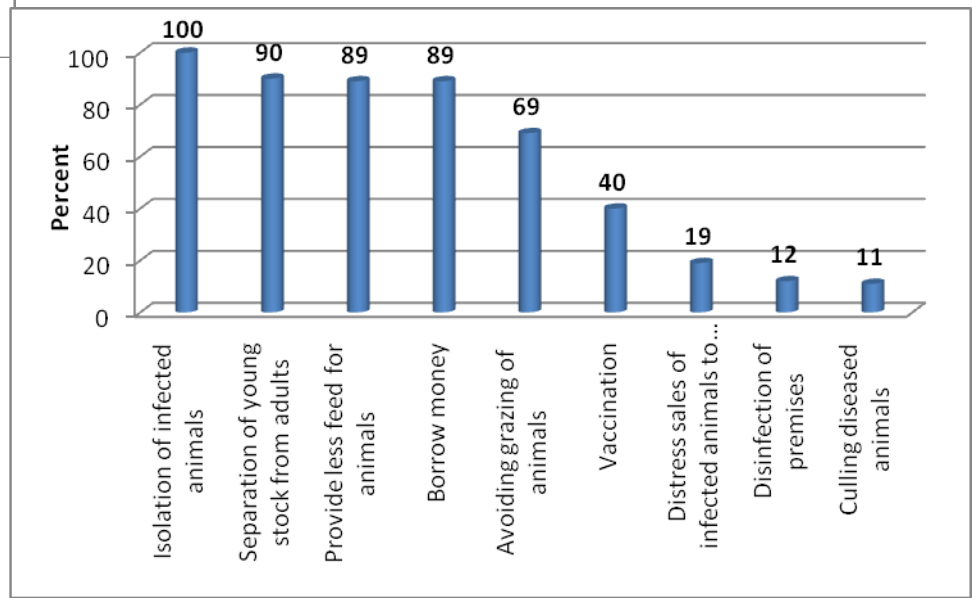
Mechanism and coping strategies employed by farmers during FMD outbreak

FMD non-CP districts



Nellore

Mahbubnagar



Proportion of animals vaccinated to total animals by farm size

Indicator of compliance to vaccination

(Per cent)

Impact	FMD CP districts		FMD non-CP districts	
	Chittoor	Medak	Nellore	Mahbub nagar
Small	26.79	41.77	28.04	52.08
Medium	19.57	31.30	16.47	21.32
Large	7.96	20.82	11.36	10.80

Other aspects studied are…

- Availability of animal health services
- Number of times of visit to animal health services
- Different types of allopathic medications undertaken for animals
- Different types of indigenous treatment undertaken for animals
- Mechanism and coping strategies employed by farmers

Conclusions & some Policy Implications

- FMD is still one of the major economically important diseases affecting bovines.
- The overall financial loss due to FMD was more in non-CP districts than in CP districts, indicating the effectiveness of the vaccination programme.
- It was projected that the state of Andhra Pradesh would stand to loose Rs. 1147 crores only on account of direct impcts, if there is no vaccination programme against FMD. Similarly, the country would incur a total direct loss of Rs. 15575 crores. The indirect costs would be much more than this.
- It was found that the demand for FMD vaccines are far more than the actual supply / capacity of the firms manufacturing the vaccines in India.

Suggestive Policy Measures

- Expansion of FMD-CP to the whole of the state / region
- Ring vaccination
- Incentive system for the farmers to comply for vaccinating their animals
- Complete coverage of the susceptible animal population
- Quick response of the veterinary health care system in the event of outbreaks
- Regulation on movement of the animals across regions.

Thank You