

# **Economic Impact of Foot-and-Mouth Disease in India: An Evidence from Andhra Pradesh**

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# Importance of Livestock Sector in India

- ❑ Livestock is an important sub-sector of Indian agriculture (**29%** of the AgGDP and **4.11%** of total GDP).
- ❑ India has a total livestock population of **>500 million** and bovine population is about **300 million** (*19<sup>th</sup> Livestock Census, 2012*).
- ❑ Milk production during 2015-16 was **>155 million litres**, produced mostly by the smallholder farmers and consumed domestically.
- ❑ Meat production was **7 million tonnes**, of which 25% enters export market.
- ❑ The sector provides **employment to about 16 million** people and it plays a vital role in improving the socio-economic conditions of rural masses (DAHDF, 2016-17).

# Livestock Health & FMD... in India

- ❑ The share of crossbred bovine is increasing over the years, due to which susceptibility to various diseases has increased.
- ❑ The country has a comprehensive scheme on '**Livestock Health & Disease Control**' (health care against FMD, PPR, Brucellosis and CSF).
- ❑ The flagship programme is **FMD-CP**, being implemented in 351 districts in 13 states and 6 union territories with the funding of Rs. 170 crores (~28 million US\$) during 2015-16.
- ❑ The country accords the **highest priority for the eradication of FMD**, because it causes enormous economic losses to the millions of smallholder farmers, besides meat industry.

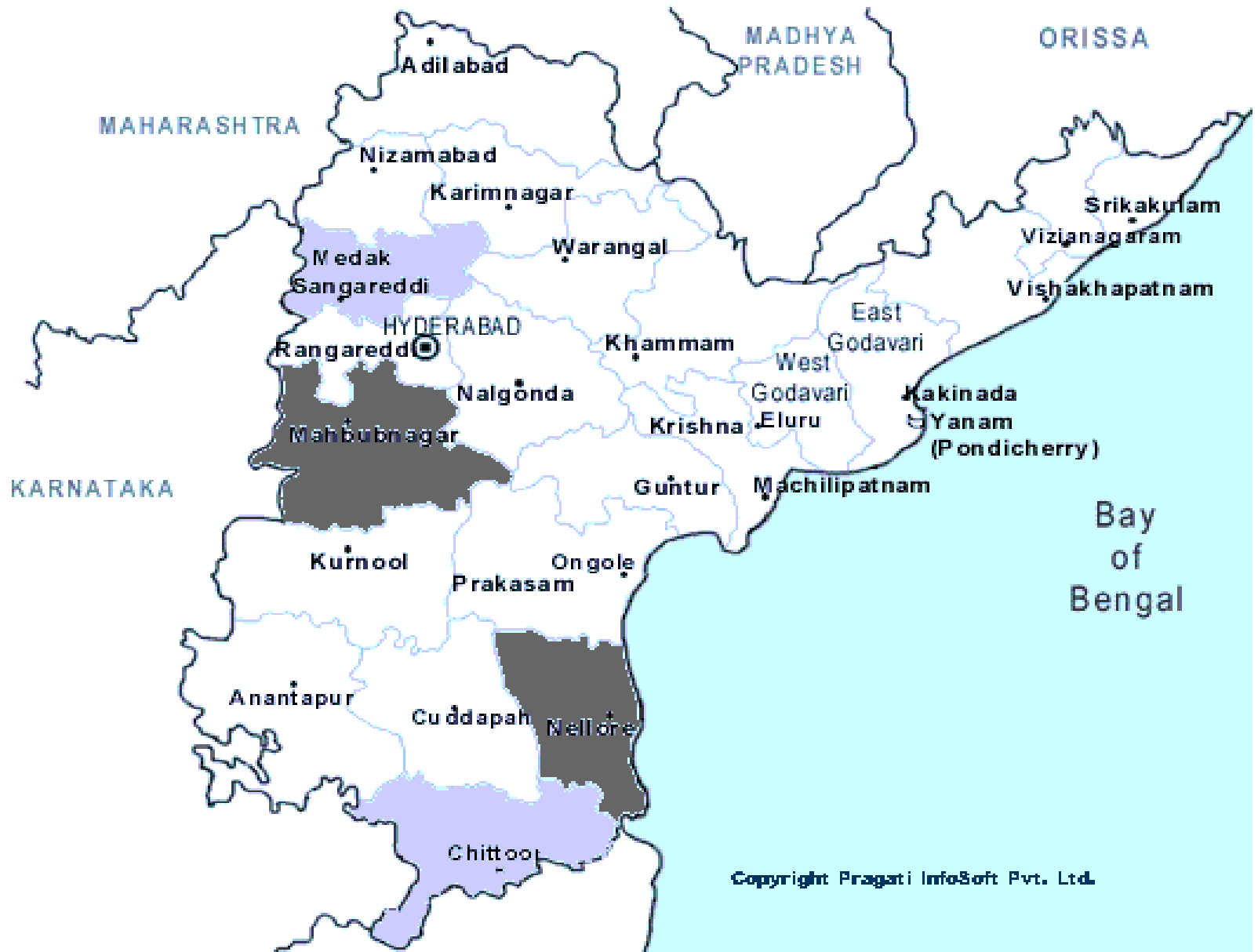
## FMD-CP and its continuance

- ❑ India has established three zones as '**FMD free Zones where vaccination is practiced**', as per OIE guidelines and dossier has been submitted to OIE for their recognition.
- ❑ Though the benefit of FMD-CP is widely recognized, **policy makers in our country still need empirical evidence** for continuous support.
- ❑ In this context, this study was conducted during 2009-11 in India, in order **to assess the farm-level economic impact** due to FMD in 2 different settings (area where FMD-CP is in operation and the area where it is not there).

# Impact due to FMD

- ❑ It is generally **not fatal** (mature livestock), but increases the risk of **abortion** (pregnant animals) and of **mortality** (young livestock).
- ❑ 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.

# Sample districts in Andhra Pradesh (India)



# Direct losses due to FMD

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

## □ 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.)



## □ 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.)

## □ 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)

## □ 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)

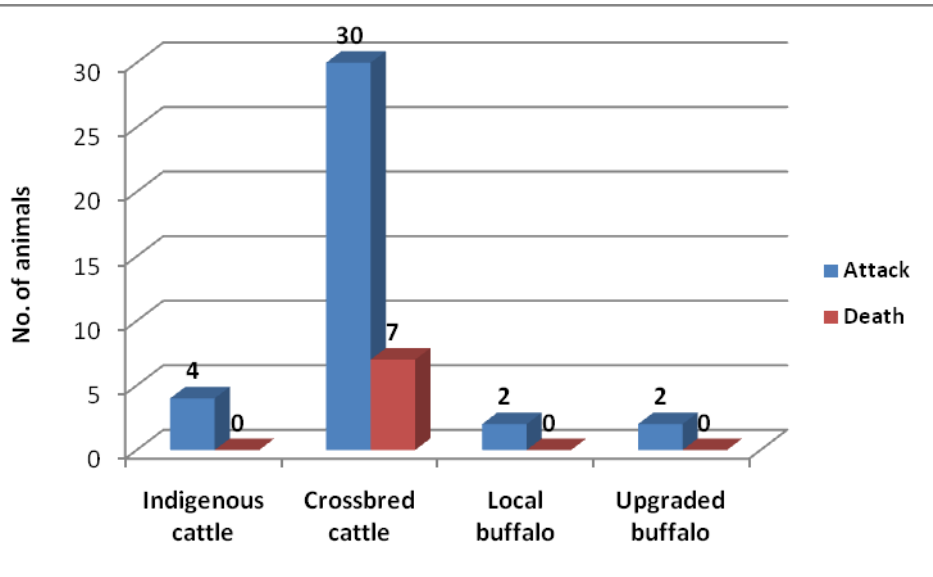
$U_i$  = Error term

## 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)

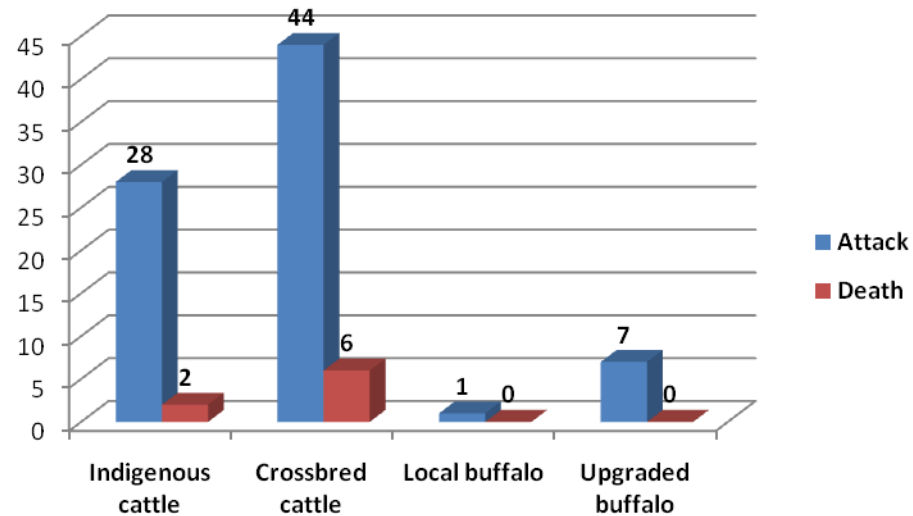
*Note: Figures in parentheses under 'attacks' indicate percentages to total no. of animals in the affected households*  
*Figures in parentheses under 'deaths' indicate percentages to total no. of animals attacked*

# FMD attacks and death by different species of dairy animals (FMD-CP districts)

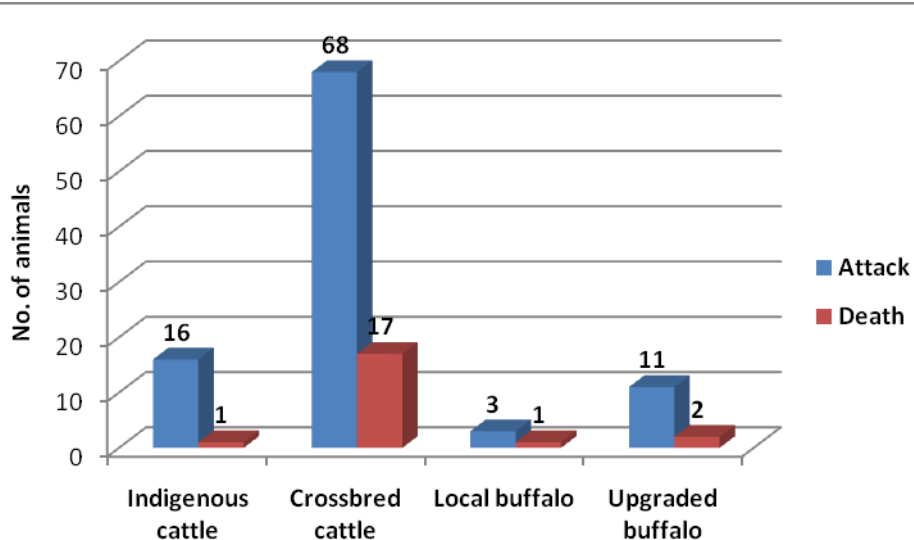


Chittoor

Medak

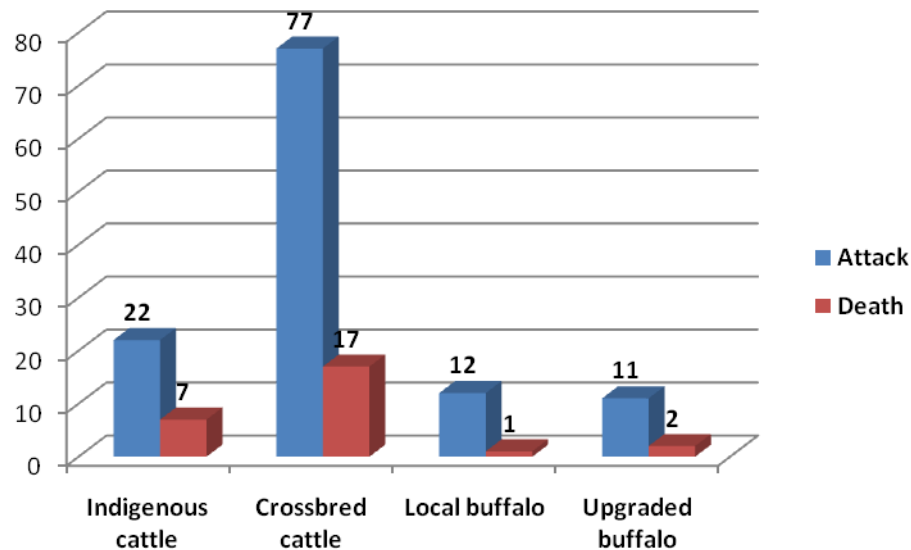


# FMD attacks and death by different species of dairy animals (FMD non-CP districts)



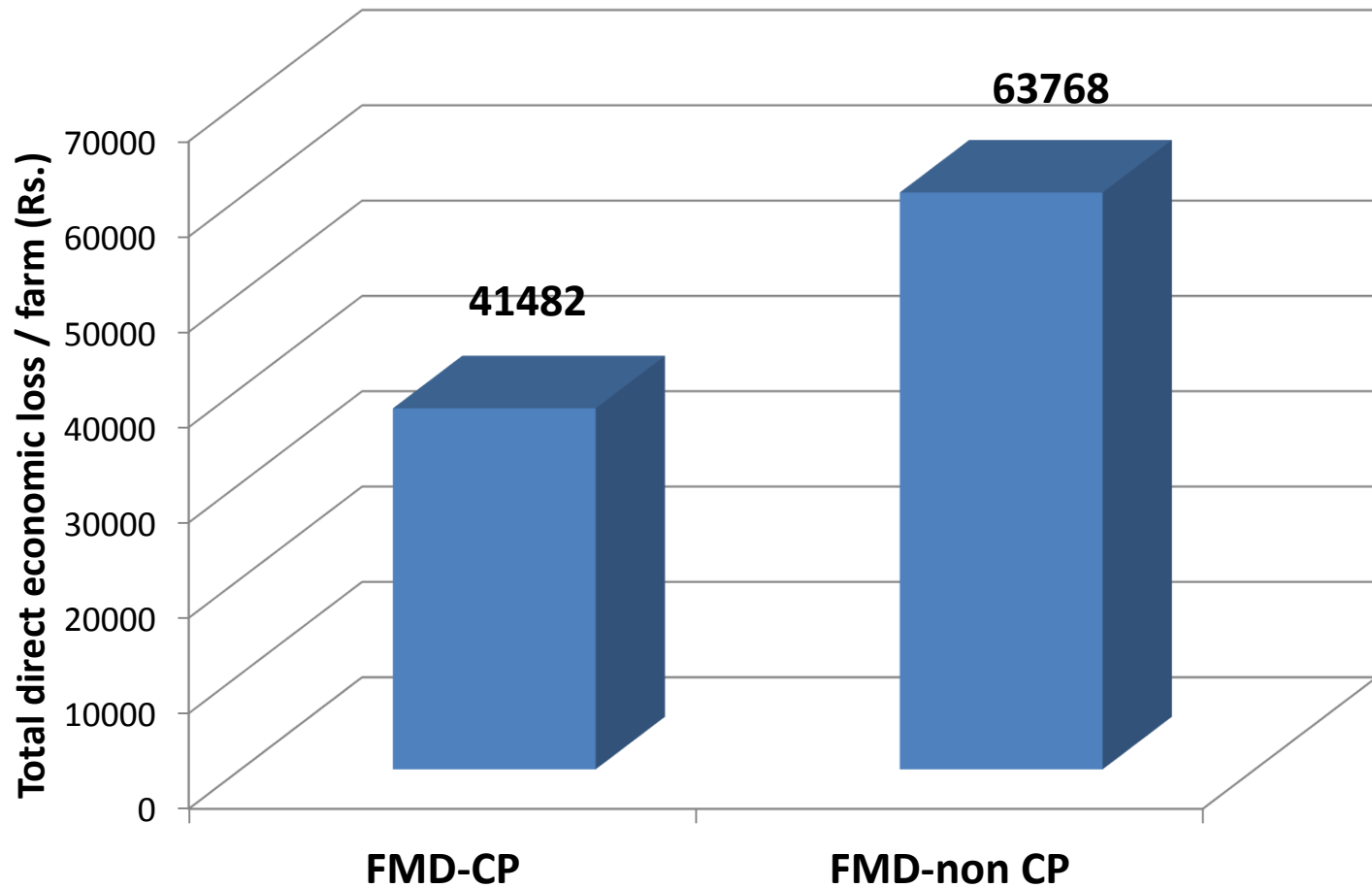
Nellore

Mahbubnagar





# Total Direct Economic Impact due to FMD



# Indirect losses.....not quantified

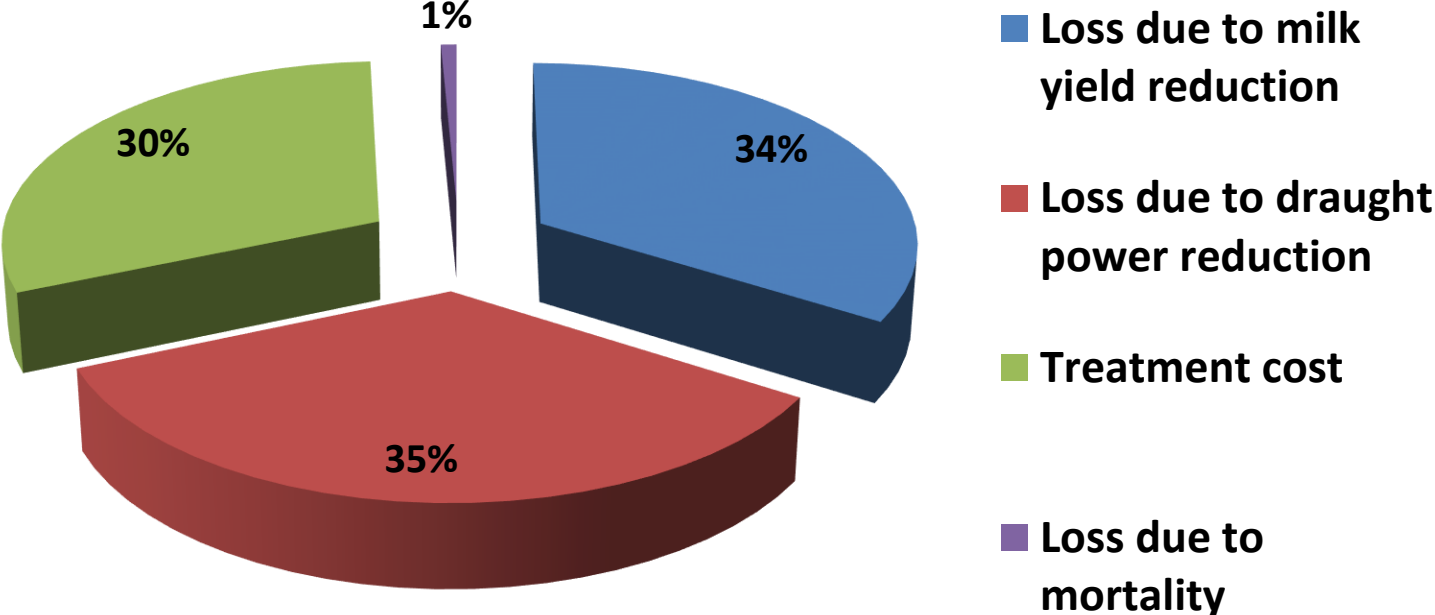
- Permanent reduction in production
- Body weight loss (feed/maintenance/)
- Abortion
- Long intercalving period / service period
- Permanent lameness of draught animals
- Market and price effects
- Trade effects
- Food security and nutrition
- Health and environment effects
- Costs of inspection, monitoring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

# 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)
<b>1.</b>	<b>Loss due to milk yield reduction</b>				
	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	<b>388.58</b>
<b>2.</b>	<b>Loss due to draught power reduction</b>				
	Indigenous cattle	11044	3897284	0.08	361.42
	Crossbred cattle	9658	166866	0.23	37.37
				Sub-total	<b>398.79</b>

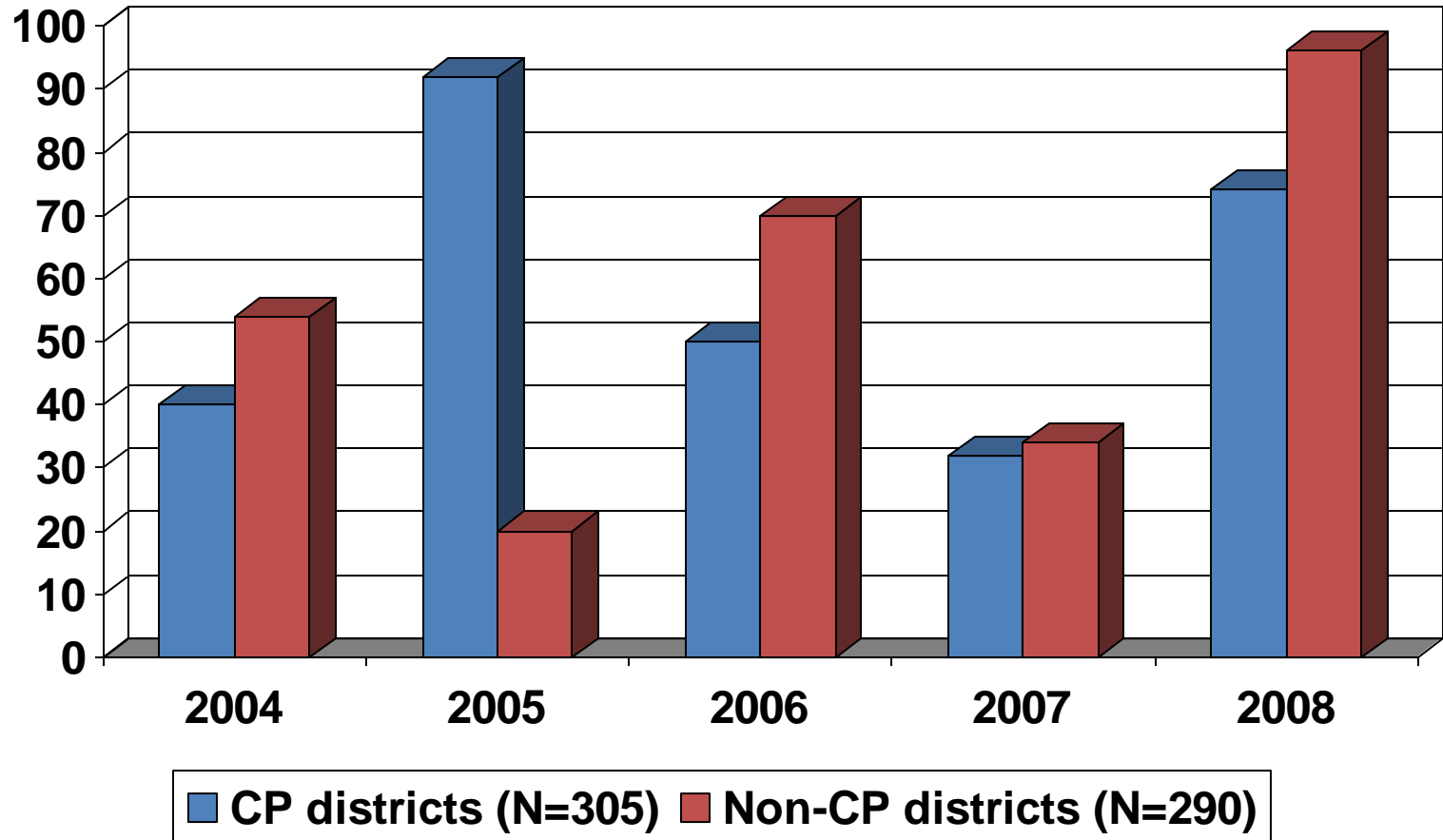
S.No.	Impact	Loss / animal (Rs.)	Susceptible Population	Incidence rate (%)	Total loss (Rs. in crores)
<b>3.</b>	<b>Treatment costs</b>				
	Indigenous cattle	2455	13850121	0.06	215.89
	Crossbred cattle	3516	1516264	0.13	102.86
	Buffaloes	1254	9614938	0.03	32.66
Sub-total					<b>351.41</b>
<b>4.</b>	<b>Loss due to mortality</b>				
	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					<b>8.53</b>
Grand Total					<b>1147.31</b>

# 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**

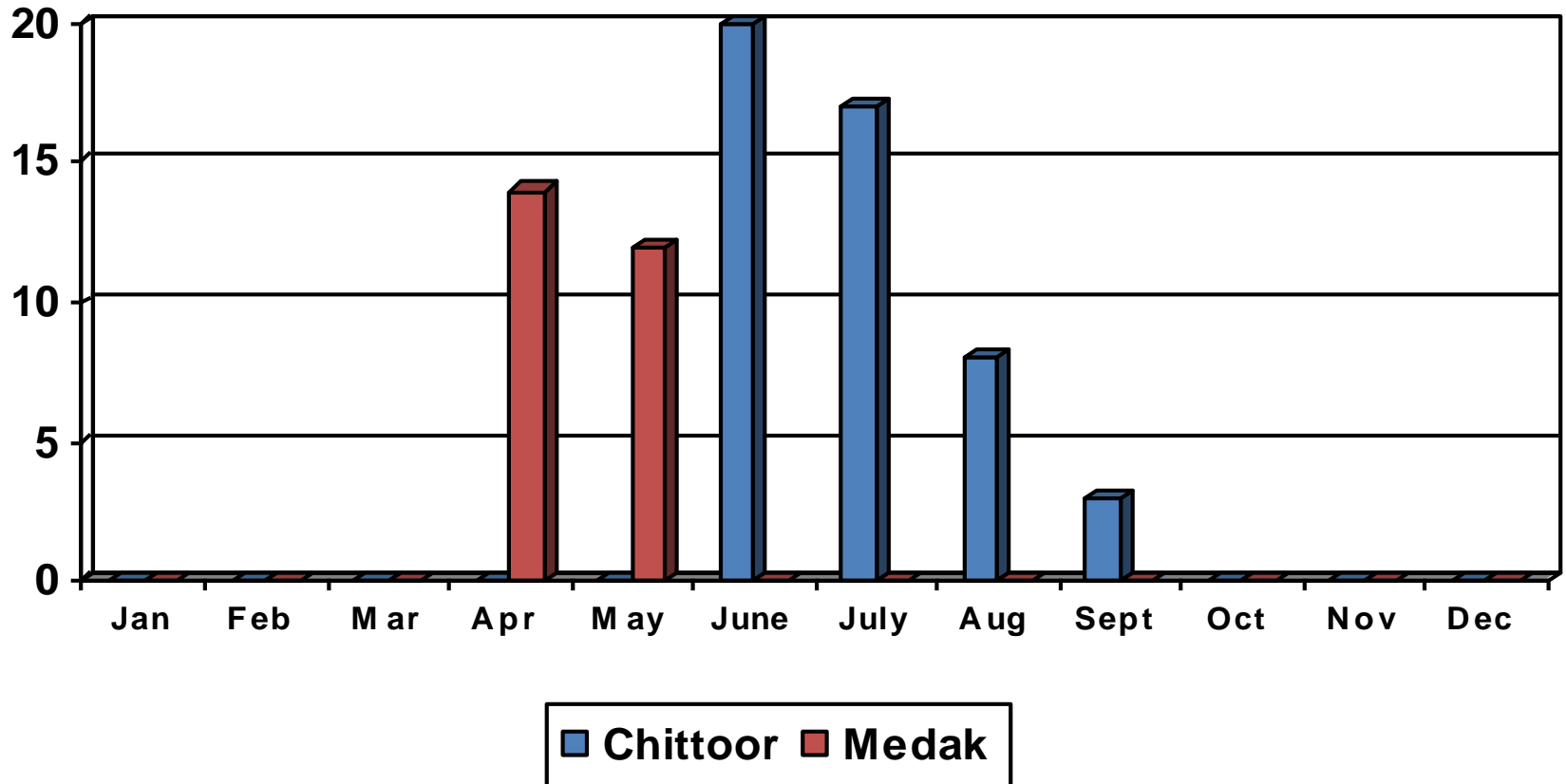
# Number of FMD outbreaks in the study area



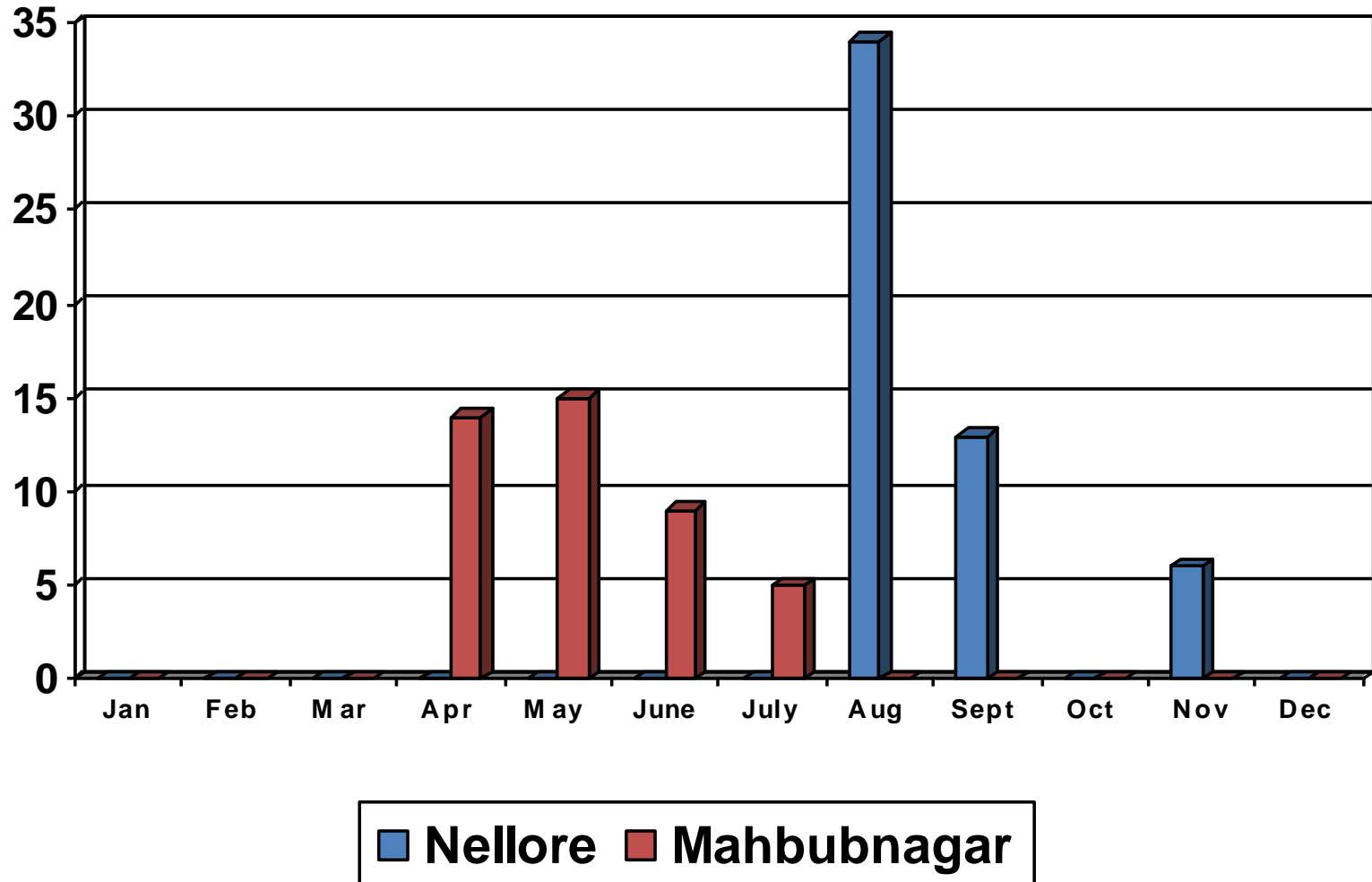
**Message 2: Seasonality and spatial hotspots  
characterize prevalence of FMD  
in Andhra Pradesh**



# Seasonality of FMD incidences in 2008 (FMD-CP districts)



# Seasonality of FMD incidences in 2008 (FMD non-CP districts)



**Message 3: Use of vaccination influenced by education level, experience and income 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

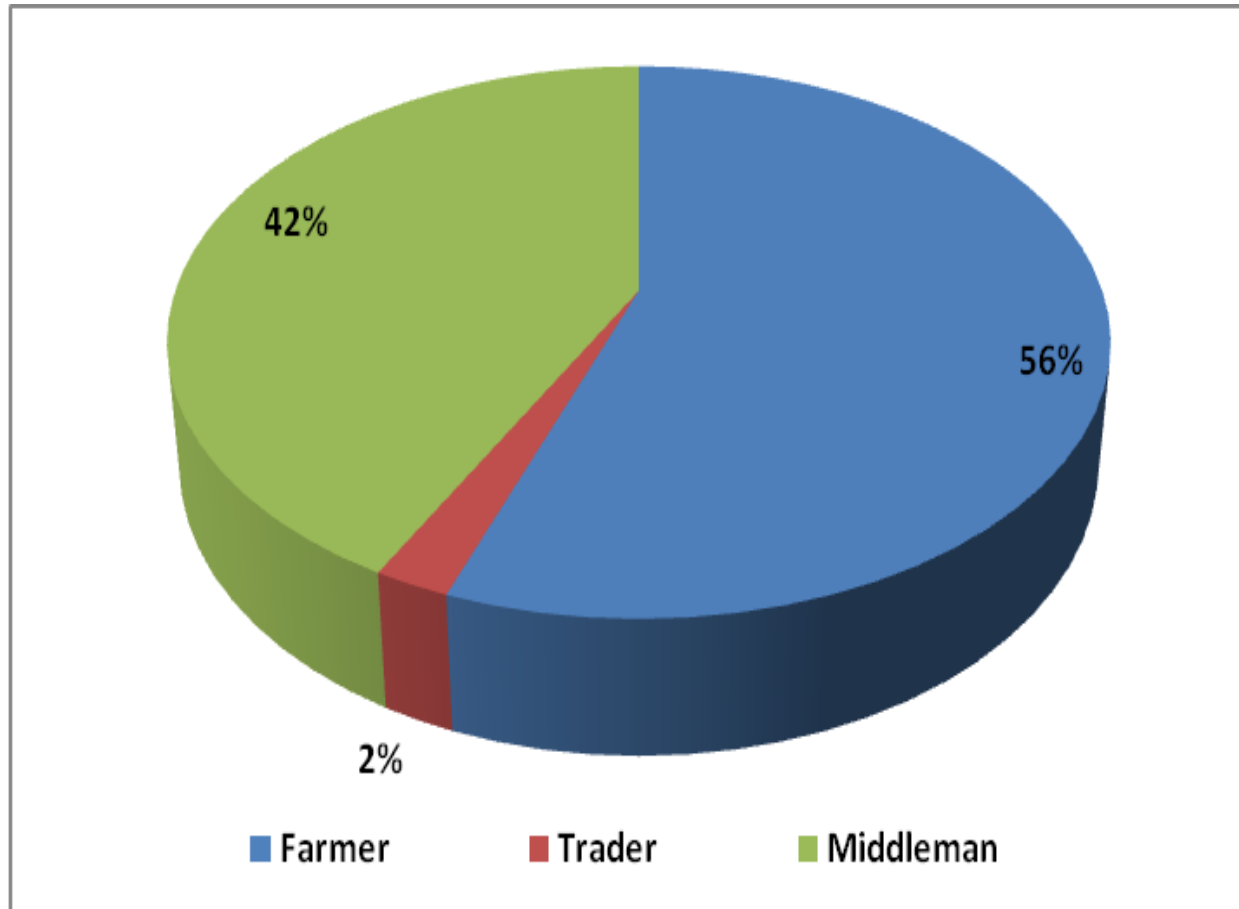
\* Significance at 1% level

\*\* Significance at 5% level

\*\*\* Significance at 10% level

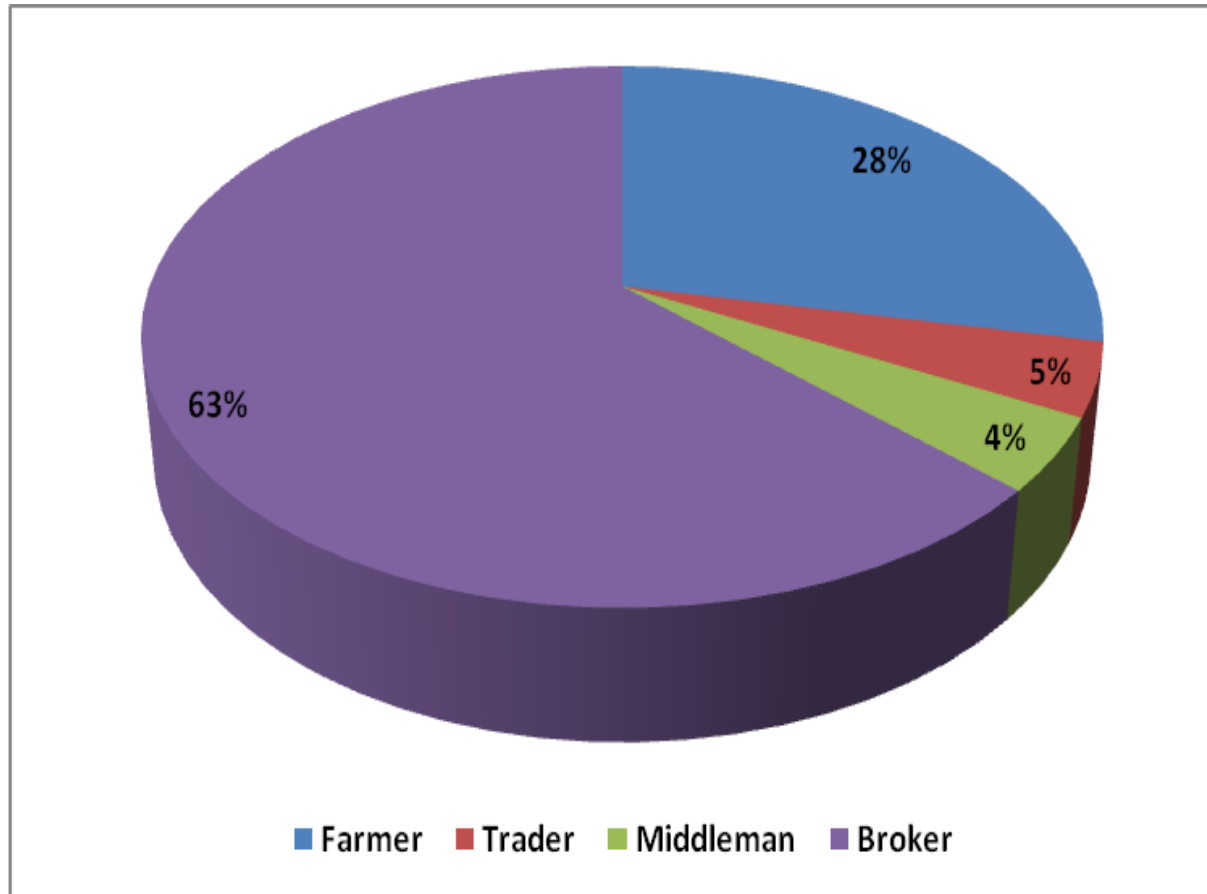
**Message 4: Marketing channels and trade practices may influence the persistence of FMD in the study area**

## Trade of animals between farmer-farmer reduces the outbreak



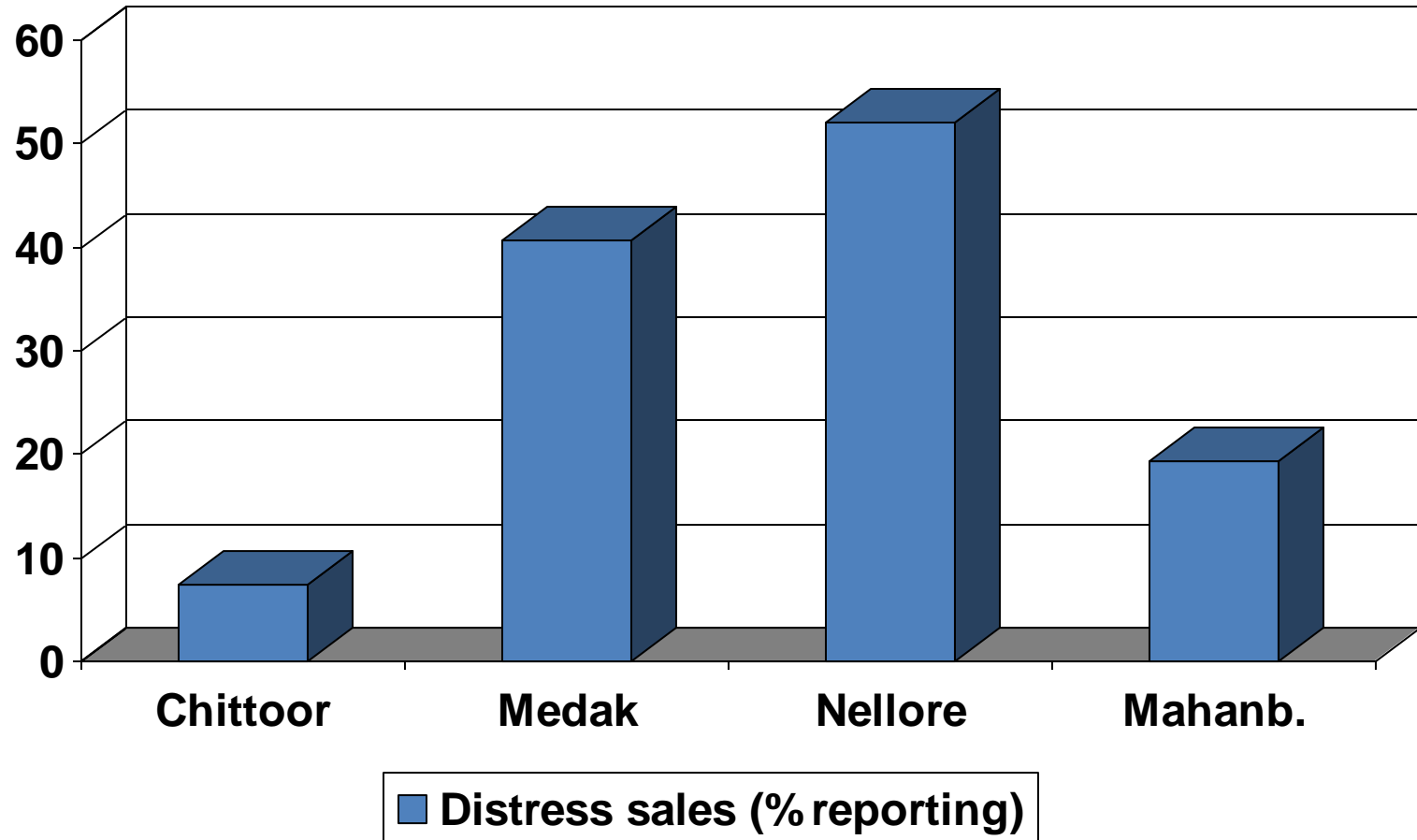
**Medak district (FMD-CP district)**

## Trade of animals through brokers increases the incidence of outbreak



**Mahbubnagar district (FMD-non CP district)**

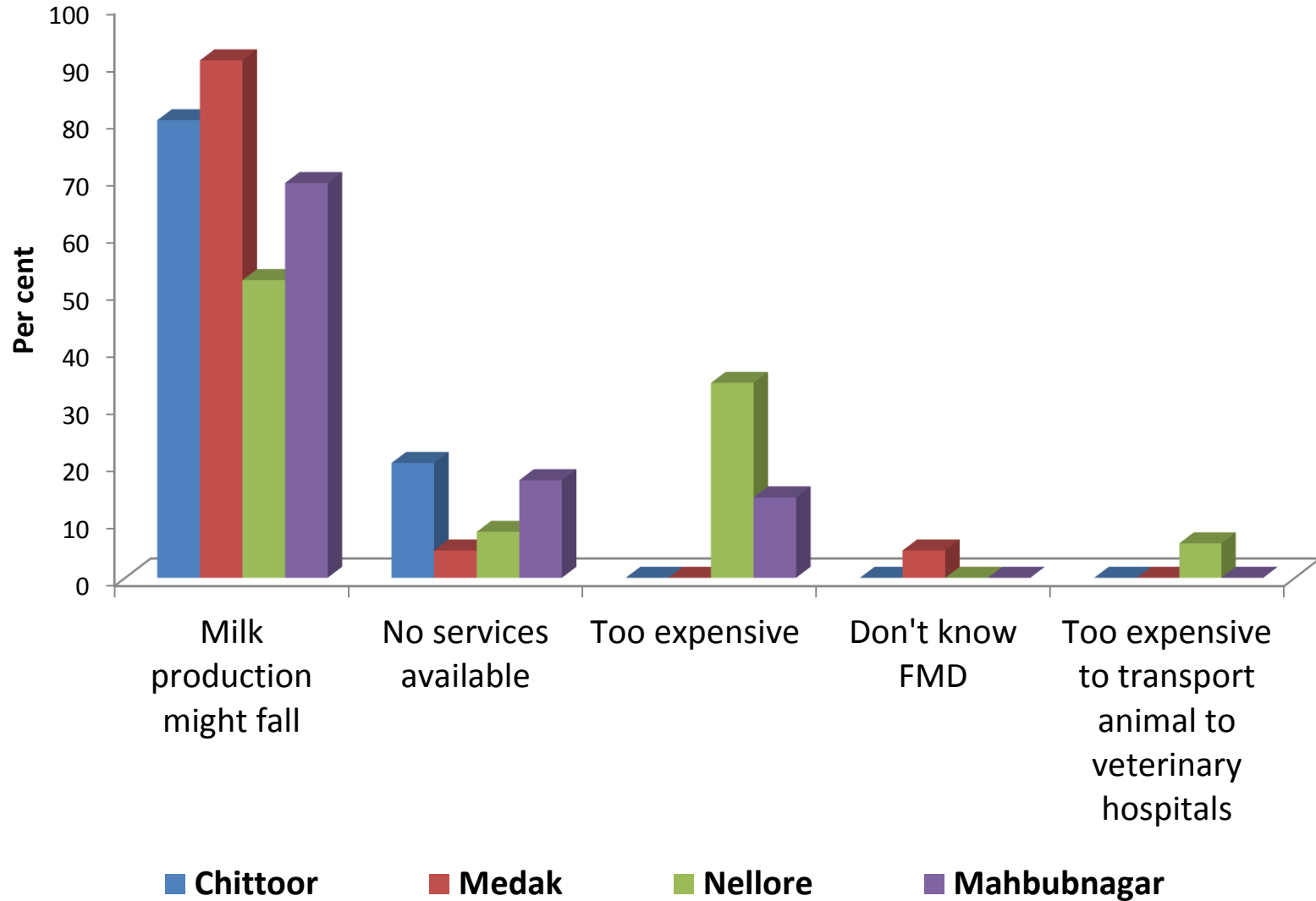
# Distress sale of dairy animals in Andhra Pradesh





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

# Reasons for not vaccinating against FMD



# Conclusions & some Policy Implications

- ❑ FMD is still one of the major economically important diseases affecting bovines in India
  - ❑ though the country is progressing well in PCP.
- ❑ The overall financial loss at farm level 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 lose Rs. 1147 crores (191 million US\$) on account of direct impacts alone , if there is no vaccination programme against FMD.
  - ❑ Similarly, the country would incur a total direct loss of Rs. 15575 crores (2.6 billion US\$).

# Suggestive Policy Measures

- ❑ Expansion of FMD-CP to the whole country.
- ❑ Complete coverage of the susceptible animal population in vaccination.
- ❑ Ring vaccination where there is an isolated outbreak.
- ❑ Alert animal health service system during the most likely season.
- ❑ Incentive system for the farmers to comply for vaccinating their animals.
- ❑ Increase the awareness of the farmers and traders about the implications of FMD.
- ❑ Regulation on the movement of animals across regions.

**Thank You**