

Rabies Control Initiative in Tamil Nadu

Analysis of intervention strategies and model
documentation

1 February 2010

Public Health Foundation of India



PUBLIC
HEALTH
FOUNDATION
OF INDIA

Prepared for World Health Organisation by team from Public Health Foundation of India consisting of

Dr Manish Kakkar, MBBS, MD, MPH, FIMSA

Dr Syed Abbas, MBBS, MPH

Dr Garima Pathak, MBBS, MPH

Acknowledgements

This study was commissioned by the World Health Organisation following an agreement for performance of work (APW. 237117). The assistance and guidance of Dr. Sampath Krishnan at WHO, is gratefully acknowledged. The team at PHFI would like to thank the DPH staff in Tamil Nadu including Dr. Elango (Director), Dr. Jayakumar (Joint Director) and Dr Alamelu (Sr Entomologist) for facilitating the study team's visit in Tamil Nadu. We will also like to thank Mr Pitchai (Addl Director), Dept. of Municipal Administration; Dr Venkatesan (Rinderpest Officer), Animal Husbandry Dept. and Mr. Chinnykrishnan of Blue Cross for sharing their insights about the rabies control initiative in the state. We are obliged to our colleague from PHFI, Mr Maulik Chokshi for helping us gain a better understanding of the innovative procurement and supply chain management system in Tamil Nadu.

Contents

Acknowledgements.....	2
Contents.....	3
Figures.....	6
Tables.....	7
Information Boxes.....	7
Executive Summary.....	8
Introduction	8
Objectives	8
Methods.....	8
Results.....	8
Conclusions	9
1 Background	10
Tamil Nadu	11
2 Objectives.....	12
2.1 Major Objectives.....	12
2.2 Minor objectives	12
3 Initial Steps.....	13
3.1 Programme vs Initiative	13
3.2 Framework for Evaluation	14
3.3 Stakeholder Engagement.....	14
4 Programme Description	16
4.1 Rabies Control in Urban Tamil Nadu:.....	16
4.1.1 Historical Perspective.....	16
4.1.2 Policy Environment	16
4.1.3 Change in strategy of rabies control efforts	18
4.2 Rabies Control in Rural Tamil Nadu	23
4.2.1 Regular anti-rabies vaccine availability for human dog bite cases	23
4.2.2 Increasing community awareness and involvement	24
4.3 Role of other Departments/ Stakeholders and other Initiatives	25

4.3.1	State level.....	25
4.3.2	Central Level.....	26
5	Surveillance and Programme Data Analysis.....	27
5.1	Data Collection Methods	27
5.2	Data Quality	27
5.3	Data Analysis Strategy.....	28
6	Results.....	29
6.1	Overall in Tamil Nadu.....	29
6.2	In Rural Tamil Nadu.....	30
6.3	In Urban Tamil Nadu	32
6.4	Rural versus Urban Trends.....	33
6.5	Micro Trends	34
7	Costing of Rabies Control Initiative in Tamil Nadu	39
7.1	Objective	39
7.2	Costing Framework	39
7.3	Animal Side Interventions.....	39
7.3.1	Implementation of ABC-AR in all municipalities	39
7.3.2	Capital Costs.....	40
7.3.3	Recurrent Costs.....	40
7.4	Human Side Interventions	41
7.4.1	Availability and administration of Post Exposure Prophylaxis.....	41
8	Implementation of Rabies Control Interventions	44
8.1	Surveillance.....	44
8.2	Vaccine Administration.....	45
8.3	Community Awareness	46
8.4	Animal Birth Control – Anti Rabies Activities.....	46
9	Discussion.....	48
10	Conclusions & Recommendations	53
10.1	Conclusions	53
10.2	Recommendations	54
10.2.1	Establish surveillance on human as well as animal side	54
10.2.2	Strengthen State-level coordination committee	54

10.2.3	Identify and fill gaps in current implementation	55
10.2.4	Build upon existing intersectoral coordination mechanism at peripheral level.....	55
10.2.5	Adopt phased approach to implementation and scaling-up	55
10.2.6	Document Rabies intervention as a model for replication	55
Annexure: List of Abbreviations.....		56

Figures

Figure 1: Framework for Programme Evaluation in Public Health. CDC. MMWR 1999;48(No. RR-11).....	14
Figure 2: Principle institutions involved in Rabies Control Initiative in Tamil Nadu	16
Figure 3: Evolution of Rabies Control Initiative in Tamil Nadu: Major Milestones (2004-08).....	18
Figure 5: Logic Model for Rabies Control Initiative in Tamil Nadu	19
Figure 7: Rabies awareness poster in Tamil at the Madurai Medical College, Madurai	23
Figure 9: Dog Population distribution in Tamil Nadu (Source: DAH Livestock Survey, 2004)	30
Figure 10: Dog bites among different tercile districts, Rural Tamil Nadu (2004-09) (Source: DPH&PM) ..	30
Figure 13: Dog bite cases per 100,000 population (Source: DPH, DME)	32
Figure 14: Rabies cases per 100,000 population (Source: DPH, DME)	32
Figure 15: Dog bite cases in Tamil Nadu as reported by different directorates (2008-2009)	33
Figure 16: Estimated dog population density through different data sources.....	34
Figure 17: Tercile distribution of study parameters	34
Figure 18: District dog density (rural) Per 100,000 humans Department of Animal Husbandry Livestock Census (2004).....	35
Figure 19: Dog bite incidence per 100,000 humans Average dog bites per 100,000 rural population (2004-09).....	35
Figure 20: Rabies incidence (rural) per 100,000 population Average rabies cases per 100,000 rural population (2004-08)	35
Figure 21: Number of vaccine vials supplied to district warehouses (TNMSC, 2007)	35
Figure 22: Rural Dog bites incidence in select districts (Source: DPH)	36
Figure 23: Rural Dog bites incidence in select districts (Source: DPH)	37
Figure 24: Rural dog bite incidence in top 7 districts (presence of a plus or minus sign denotes presence or absence of a dedicated district depot, respectively).....	37
Figure 25: IDRV Patient Card being used at a Taluka Hospital in West Tamil Nadu	45
Figure 28: Major strengths and challenges of rabies control efforts in Tamil Nadu	51
Figure 4: ABC-AR Center, Madurai Municipal Corporation	18
Figure 6: Anti Rabies Vaccine being used by Municipal Administration in Tamil Nadu	22
Figure 8: Vaccine consumption in Tamil Nadu, 2002-2007 (Source: TNMSC)	29
Figure 11: Rabies cases per 1000 dog bites among rural population (Source: DPH&PM)	31
Figure 12: No of Dog bites in rural population per tercile (2004-09) (Source: DPH&PM).....	32
Figure 26: No. of patients being administered Immunoglobulin in the same Casualty (through a separate local procurement by the Medical College).....	45
Figure 27: Dog bite Census in the Casualty Ward of a Medical College Hospital	45

Tables

Table 1: Budgeted cost of ABC-AR per dog (Source: Municipal Corporation of Madurai)	21
Table 2: Sources of Reported Data	27
Table 3: Estimating programme targets for ABC-AR Programs	39
Table 4: Capital Costs for establishing ABC-AR facility for 1 lakh population.....	40
Table 5: Annual Recurrent Costs for establishing ABC-AR facility for 1 lakh population	40
Table 6: Costs of implementing ABC-AR programme in all urban areas of Tamil Nadu	41
Table 7: Annual Costs of procuring Anti Rabies Vaccine in Tamil Nadu	42
Table 8: Annual Costs of procuring Anti Rabies Immunoglobulin in Tamil Nadu	42
Table 9: Annual costs of implementing Rabies control interventions among humans in Tamil Nadu	43

Information Boxes

Box 1: Stakeholders involved in Rabies control efforts in Tamil Nadu	15
Box 2: Terms of Reference of State Level Committee	20
Box 3: Functions of the Local Body Monitoring ABC-AR Committee	21
Box 4: Madurai Medical College – Site for Rabies Pilot project of NCDC	26

Executive Summary

Introduction

Human deaths due to rabies in India account for nearly 50% of the global burden. Majority of the rabies victims in the country are from the poorer sections of society and rural areas. There is no organised national rabies control programme and the health system has not been able to provide quality treatment to majority of the dog bite cases. Recent reports suggest that Tamil Nadu has made a coordinated effort involving public health and animal husbandry agencies and put in place interventions like ABC – AR and universal vaccine supply to address this public health challenge.

Objectives

The main objectives of the study are to appraise the rabies control initiative in the state of Tamil Nadu, review the intervention strategies of the programme and document their effect on the status of dog bite and rabies cases in the state.

Methods

Given the widespread nature of interventions and absence of a central database, the study team consulted multiple sources for data collection. Interventions on the animal side were primarily coordinated by the Department of Municipal Administration and supported by Animal Husbandry Department. Information on human cases of dog bites and rabies was collected by the Directorates of Public Health, Medical Education and Rural Health & Medical Services. The vaccines were procured by the Tamil Nadu Medical Services Corporation. All these agencies were consulted for collecting the data.

Triangulation of available data was done to compensate for the variable quality of information gathered from different sources. This allowed us to arrive at the state and district level estimates for four parameters; viz. dog bite incidence rate, rabies incidence rate, dog population density and absolute vials of vaccine consumed.

The study parameters were grouped disaggregated into urban and rural, and into different terciles to provide a more nuanced picture of rabies burden in the state.

Results

There was a steady increase in vaccine consumption from 328 vials per lakh population in 2002 to 1,367 vials in 2007. Between 2004 and 2008 in the rural areas, the number of reported dog bite cases increased (from 202 to 498 per lakh) and the number of rabies deaths decreased (from 0.75 to 0.43 per lakh).

The incidence rates of dog bites and rabies remained stable in both the reported years (2008 & 2009). However, relative to the reported incidence of dog bites, incidence of rabies was less in urban areas compared to rural areas. During this period there was a decline in reported rabies cases both in rural and urban areas.

The dog population density per lakh human population for entire Tamil Nadu was estimated (in 2004 by DAH as 2,135 per lakh humans) to be twice the urban density of dogs (4,238 per lakh humans as surveyed by MAD in 2006) implying higher density of dogs in the rural areas. It was found from the rural data that top tercile districts having high dog bite incidence account for 52% of all reported dog bites in rural areas. More than 60% of the dog population was found to reside in one-third of the districts.

Conclusions

The state-wide rabies control initiative includes interventions such as ABC-AR programme in all urban local bodies, multisectoral Coordination Committees to review and guide rabies control efforts, legislation and policies on vaccinating dogs and controlling their population, infrastructure for facilitating availability of vaccine at all government facilities and innovations like engaging in Public Private Partnerships for waste disposal systems in municipalities and for carrying out ABC-AR procedures. This holistic perspective has led to the creation of an enabling environment for successful control of rabies.

However, these efforts need to be combined with focused interventions for controlling the dog population in rural and periurban areas, improved surveillance of both human and animal rabies as per WHO guidelines, build upon existing intersectoral coordination mechanisms and come up with a strategic plan to bring about a decline in both rabies cases as well as dog bites in the state. Documentation of these strategies and interventions can provide a blueprint for further replication and scaling-up in other states and disease conditions.

1 Background

Rabies, a viral zoonotic disease, continues to pose a public health challenge in various countries across the globe. It accounts for more than 55,000 deaths each year, about 95% of which occur in Asia and Africa. Majority of these deaths occur in rural areas. About 30 - 60% of reported rabies cases and deaths occur in children under the age of 15 years.¹ Rabies deaths result in a loss of about 1.74 million DALYs each year. Also, the economic burden of the disease in the affected countries is enormous. The annual estimated cost of rabies in Asia and Africa is approximately US \$ 583.5 million.²

Rabies accounts for nearly 20,000 human deaths a year in India which is nearly 50% of the annual global mortality³ The main vector is domestic dog and 94 % of human cases are due to dog bites. In India, 60% of the dogs are considered to be 'neighbourhood dogs'. These neighbourhood dogs account for about 60% of reported dog-bite injuries.⁴ Majority of human rabies victims are adult men and those from the poorer sections of the community. As over two-third population lives in rural areas, nearly 76% of rabies cases are reported from the rural population. Recent community surveys reveal that majority of dog bite victims do not receive any rabies vaccine which reflects gross negligence on the part of both the bite victim as well as the health care system. Also, only 50% of the patients are actually hospitalised with remainder of the rabies cases dying at home or during transit.⁵ Among those who reach the health care facilities, nearly half of the financial burden attributed to rabies is borne by the patient.²

The high burden of rabies in the country and the associated impact on the poorer and rural sections of society has largely remained unaddressed. Till date, there is no organised rabies control programme in India. Several cities like Jaipur, Chennai, Kalimpong and Bangalore have taken up sustained ABC-AR (Animal Birth Control – Anti Rabies Immunisation) programmes. Jaipur ABC programme, implemented between November 1994 and December 2002, resulted in decline of stray dog population by 28% (annual decline of 3.5%) and reduction of human cases due to rabies to 'zero' in programme areas. The number of cases increased in non-programme areas during the same time period.⁶ These successes have remained few and far between, and there is need for a comprehensive strategy to tackle this public health problem.

¹ WHO. Rabies Fact Sheet N099 December 2008. <http://www.who.int/mediacentre/factsheets/fs099/en/>. Accessed 22.12.2009

² WHO Expert Consultation on Rabies, First Report. WHO Technical Report Series, No. 931. World Health Organisation. Geneva (2005).

³ Anon (2004a). Assessing the burden of rabies in India. WHO sponsored national multicentric rabies survey 2003. Bangalore, Association for Prevention and Control of Rabies in India.

⁴ Sudarshan, M. K., Mahendra, B. J. & Narayan, D. H. A. (2001). A community survey of dog bites, anti-rabies treatment, rabies and dog population management in Bangalore city. Journal of Communicable Disease 33,245-251

⁵ Sudarshan MK et al. Assessing the burden of human rabies in India: results of a national multi center epidemiological survey. International Journal of Infectious Diseases (2007) 11, 29-35

⁶ Reece J.F., Chawla S.K. Control of rabies in Jaipur, India, by the sterilisation and vaccination of neighbourhood dogs. Veterinary Record (2006) 159, 379-383

As per the World Health Organisation, the most cost effective strategy for prevention of human rabies is the elimination of rabies in dogs through animal vaccinations. A combined effort by the public health delivery system and the animal welfare/ veterinary departments can lead to the control of rabies in dogs and thereby impact the transmission of the virus to the human population. Countries such as Japan and Malaysia have successfully used this strategy to eliminate transmission of rabies to humans and other animals.⁷

Recent reports from Tamil Nadu suggest that Tamil Nadu has become the first state in India to have asked all local bodies to set up ABC-AR programmes⁸. All government hospitals in the state now administer the anti-rabies vaccine by the intradermal route, saving over 80% in vaccine costs -- a facility that will be extended to all primary health centres in the next few months. Reports also mention that the rabies control programme has resulted in a steady and steep decline in rabies cases over the last few years in Tamil Nadu.

These reports prompted the World Health Organisation to commission a study to appraise the rabies control initiative in Tamil Nadu, outline and review the strategy and document its effect on the status of the dog-bite and rabies cases in the state. The Public Health Foundation of India (PHFI) was chosen to carry out this study. PHFI is a public private partnership collaboratively evolved to redress the limited institutional capacity in India for strengthening training, research and policy development in Public Health. The organisation is committed to key public health issues and it adopts a broad, integrative approach to public health that includes promotion of research activities tailored to Indian conditions. In-depth research, critical analysis, drawing from global experiences and academic collaborations enable PHFI to provide much-needed technical assistance to initiatives and policies that protect, promote and improve health and health systems.

This report outlines the salient features of the assessment and presents the findings regarding dog bite and rabies cases in rural and urban Tamil Nadu. It provides an insight into ground realities and documents the roles of different stakeholders in this initiative. The presented details will provide a basis for formulating a workable strategy that may be used by the states to reduce the number of human rabies cases and deaths in the country.

Tamil Nadu

"Tamil Nadu is situated on the southeastern side of the Indian peninsula. It is bounded on the east by Bay of Bengal, in the south by the Indian Ocean, in the west by the states of Kerala and Karnataka and in the North by the Karnataka and Andhra Pradesh. The land mass of the state can be divided into two natural divisions; viz. the Eastern coastal plain and the hilly region along the North and the West".⁹

⁷ WHO. Rabies Fact Sheet N099 December 2008. <http://www.who.int/mediacentre/factsheets/fs099/en/>. Accessed 22.12.2009

⁸ ProMED-mail. PRO/AH/EDR> Rabies, human, control - India (TN). ProMED-mail 2009; 22 Apr: 20090422.1511. <http://www.promedmail.org>. Accessed 24.10.09

⁹ NRHM. State Profile. http://www.mohfw.nic.in/NRHM/State_Profile.htm#tn Accessed 30.12.2009

Tamil Nadu compares favourably with rest of India in terms of Infant Mortality, Maternal Mortality and Gender Ratio.¹⁰ Its 2009 population is estimated to be 66 million of which 52% is urban¹¹.

2 Objectives

The assessment had the following overall objectives:

- Appraise the rabies control programme in Tamil Nadu
- Review intervention strategies of the programme and their effectiveness

2.1 Major Objectives

- 1- Gain Insight
 - a. Document major policy initiatives and strategies relating to rabies control efforts in Tamil Nadu
 - b. Document activities, institutions, stakeholders, policy processes and regulations responsible for implementation of interventions over a five-year period
 - c. Describe structure of rabies control initiative in Tamil Nadu
- 2- Assess effects
 - a. Assess effects of rabies control efforts in Tamil Nadu
 - b. Document level of accomplishments in rabies control efforts in Tamil Nadu

2.2 Minor objectives

- 3- Affect Participants
 - a. Raise awareness regarding best practices in rabies control strategies
- 4- Change Practice
 - a. Set priorities for rabies control efforts in Tamil Nadu
 - b. Determine if rabies control efforts might be scaled-up

¹⁰ NRHM. State Health Profile http://www.mohfw.nic.in/NRHM/Health_Profile.htm#tn Accessed 30.12.2009

¹¹ Office of the Registrar General & Census Commissioner, Govt of India. (2006) Population projection for India and States 2001-2026: Report of the Technical Group on Population projections constituted by the National Commission on Population, New Delhi

3 Initial Steps

3.1 Programme vs Initiative

It is important to note here, that rabies control activities have been organised by different agencies of the state government of Tamil Nadu (notably, the Department of Municipal Administration, different directorates under the Department of Health & Family Welfare, Tamil Nadu Medical Services Corporation, Department of Animal Husbandry, and Animal Welfare Board of India) and civil society actors. There is no organised programme structure for the implementation of activities and it is only recently that a state level coordination committee was formed.

Most of the activities implemented for rabies control in Tamil Nadu can best be described as a set of direct service interventions employed by different agencies to work towards control of rabies in the state. Given the absence of an organised programmatic structure and the recent nature of rabies control efforts, it was not possible to describe the extent of impact of programme activities on rabies control in Tamil Nadu. Resultantly, the study team chose to describe this study as an ‘assessment’ of rabies control efforts in Tamil Nadu, rather than an ‘evaluation’, since a control comparison was not possible.

Rabies control efforts in Tamil Nadu can be understood in two contexts – urban initiatives and rural initiatives. The following aspects of the rabies control efforts were looked into:

- Policy overview
- Surveillance and disease trends
- Vaccine availability and administration/utilisation at different health facilities
- Vaccine procurement and supply chain management
- Awareness among community regarding prevention of rabies
- ABC-AR programme units in local bodies (in municipalities)
- Cost of programme inputs
- State/District Health Delivery System – Organisation, Reporting, Monitoring/Evaluation

3.2 Framework for Evaluation

The CDC Framework for Programme Evaluation in Public Health¹² was used to design and conduct the assessment exercise.

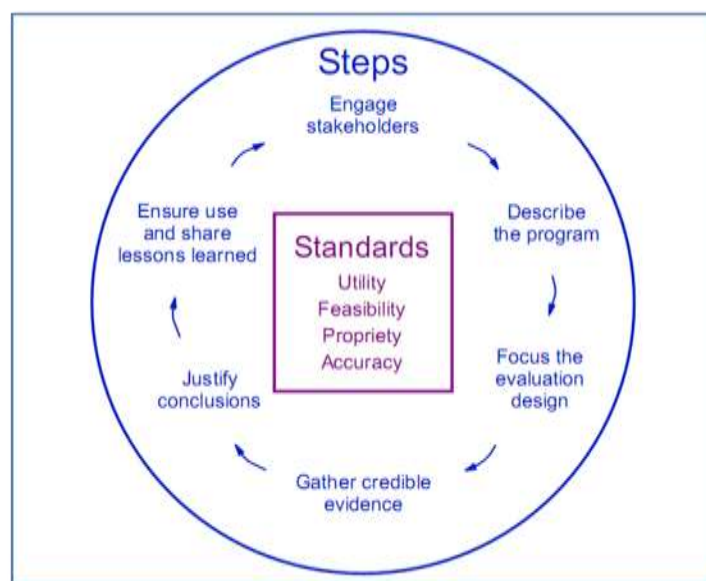


Figure 1: Framework for Programme Evaluation in Public Health. CDC. MMWR 1999;48(No. RR-11)

The framework, as depicted above, entailed the following eight steps:

- Step 1: Engage stakeholders
- Step 2: Describe the program
- Step 3: Focus the evaluation design
- Step 4: Gather credible evidence
- Step 5: Justify conclusions
- Step 6: Ensure use and share lessons learned

3.3 Stakeholder Engagement

Different stakeholders are involved in different aspects of developing and implementing rabies control interventions in the state. In order to refine the study parameters and develop a broader understanding of the operationalisation of rabies control activities, information was collected from the following groups of stakeholders:

¹² Centers for Disease Control and Prevention. Framework for program evaluation in public health. MMWR 1999;48(No. RR-11):1-40.

Those involved in program operations

- Ministry of Health & Family Welfare
 - Directorate of Public Health & Preventive Medicine
 - Directorate of Medical Education
 - Directorate of Rural Health & Medical Services
 - State Surveillance Office
 - Tamil Nadu Medical Services Corporation
- Department of Municipal Administration
- Department of Animal Husbandry
- Blue Cross

Those affected by program operations

- Rabies clinic visitors
- Community members

Primary Users of the information

- Funding agency: WHO
- National & state experts: NCDC/ State Epidemiologists
- National & State Ministries: MOHFW, Animal Husbandry Dept.

Box 1: Stakeholders involved in Rabies control efforts in Tamil Nadu

4 Programme Description

4.1 Rabies Control in Urban Tamil Nadu:

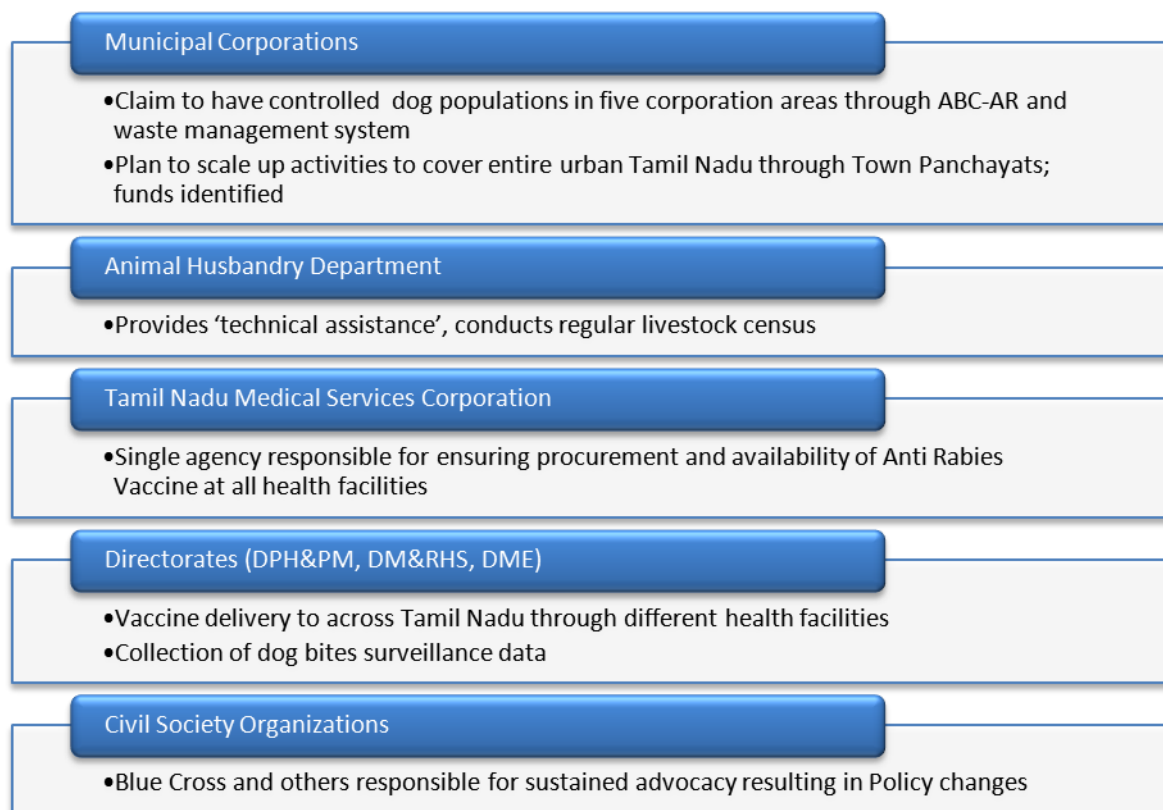


Figure 2: Principle institutions involved in Rabies Control Initiative in Tamil Nadu

4.1.1 Historical Perspective

Rabies control efforts were limited to elimination of stray dogs till 2004. This was abandoned after the ban on killing of dogs as per court orders in 2005. This was followed by a perceptible increase in number of stray dogs and corresponding increase in dog bites and rabies cases in humans. This was followed by strong public opinion and pressure from civil society organisations. Based on the evidence of successes in Chennai Municipal Corporation area following efforts of NGOs like Blue Cross and in other cities like Jaipur, Kalimpong and Bangalore, Municipal administration department of Government of Tamil Nadu re- launched its rabies control efforts. At the same time, the decision was supported by evidence accumulating in other parts of the world on successful rabies control using a combination of interventions, with ABC-AR as the central strategy.

4.1.2 Policy Environment

Rabies control initiative in Tamil Nadu owes its strength to several policy changes that have taken place over the last decade. Notable policies that facilitated the development of a strong rabies control agenda in the state and have been outlined below:

4.1.2.1 TNMSC ensures availability of vaccines at all health facilities

Tamil Nadu Medical Services Corporation (TNMSC) is responsible for procurement, storage and distribution of essential drugs and other supplies to health and related institutions in Tamil Nadu. It was incorporated in 1994 to ensure *ready availability of all essential drugs and medicines in the Govt Medical Institutions throughout the State by adopting a streamlined procedure for their procurement, storage and distribution*¹³. Its efficient supply chain management systems have ensured availability of vaccines at all health facilities in the state.

4.1.2.2 Licensing of dog rules

Domestic dogs outnumber stray dogs in the state 2.7 to 1¹⁴. The Village Panchayats have enacted regulation for compulsory licensing of domestic dogs to reduce the rabies virus circulation.

4.1.2.3 Ban on neural tissue vaccine

Neural tissue vaccine was banned in 2004 because of adverse reactions and production difficulties associated with it. Cell culture vaccine was introduced in the same year clearing way for increased availability of the vaccine.

4.1.2.4 Ban on killing of dogs, Launch of ABC-AR

As a result of the initiative of the Society of Prevention to Cruelty Animals (SPCA) and animal welfare organisations, the state government took a decision to enforce the ban on killing of dogs under the provisions of the Prevention of Cruelty to Animals Act. Subsequent public pressure on the government due to increased dog bites got it to formulate an Animal Birth Control Programme on a pilot basis in 50 urban municipalities in early 2007.

4.1.2.5 District level monitoring committees

Along with the Pilot programme on ABC-AR, the Municipal Administration Department established District Level Monitoring Committees that consist of officials from local administration, public health, veterinary science and animal welfare representatives. The multidisciplinary nature of the team at the district level aims to provide a useful platform for exchange of information from different sectors for making informed policy decisions.

4.1.2.6 Intradermal vaccine

Following clearance by the Drugs Controller General of India in 2006, Government of Tamil Nadu started training medical officers and health workers in intradermal administration of the vaccine and began procurement of intradermal vaccine formulation.

4.1.2.7 Constitution of state level committee

A State level coordination committee was formed to oversee implementation of rabies control activities in the state including both animal as well as human side interventions. For more details on the committee, please see page 20.

¹³ <http://www.tnmsc.com/tnmsc/new/html/aboutus.htm>

¹⁴ DAH Livestock Census, 2004

4.1.3 Change in strategy of rabies control efforts

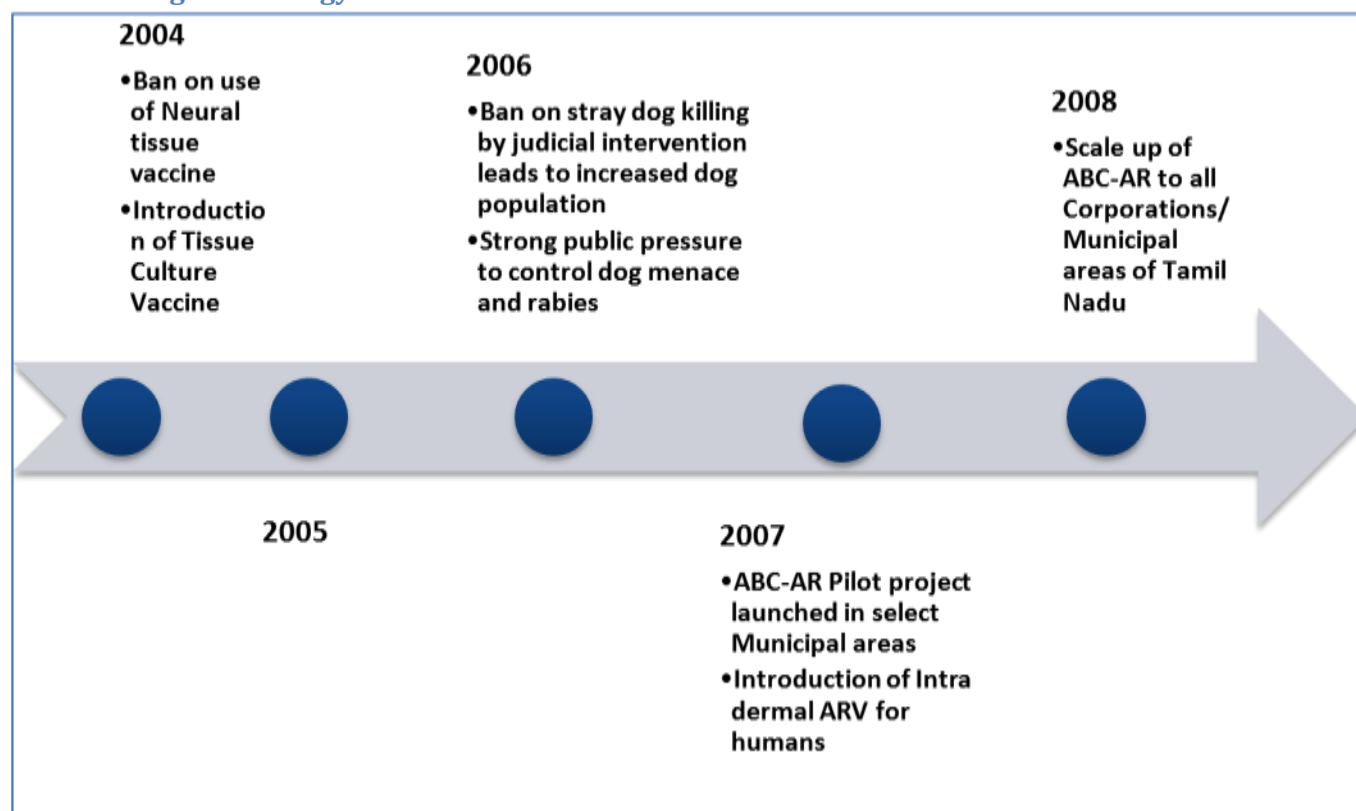


Figure 3: Evolution of Rabies Control Initiative in Tamil Nadu: Major Milestones (2004-08)

Urban Tamil Nadu has 147 corporation areas administered by city corporations/ municipalities. Following public outcry, rabies control efforts were relaunched in urban areas of Tamil Nadu in a systematic manner. The initiatives were initially piloted in five corporation and 50 municipalities at the beginning of 2007.

The major intervention strategies in the pilot municipalities were as follows:

- Animal birth control- anti rabies vaccination (ABC-AR) in stray dogs
- Intersectoral coordination with other stakeholders at state and corporation/municipality level and provision for flexible collaborative mechanisms
- Effective municipal waste management through innovative partnership models
- Increasing community awareness and involvement



Figure 4: ABC-AR Center, Madurai Municipal Corporation

4.1.3.1 Animal birth control – anti rabies vaccination (ABC-AR)

ABC-AR is a standard humane strategy for control of animal population followed world over, especially in urban areas. The strategy is based on ecological principles of reducing and eventually eliminating stray dog populations by systematically controlling reproduction of these animals. It has been shown that rapid killing of stray dogs can never achieve complete elimination, for the dog population tends to bounce back and in greater number due to fitter surviving dogs being able to reproduce with lesser competition. In addition, in the absence of effective waste management, competition for food is diminished. Spillover from surrounding non-intervention areas also leads to blunting of effect.

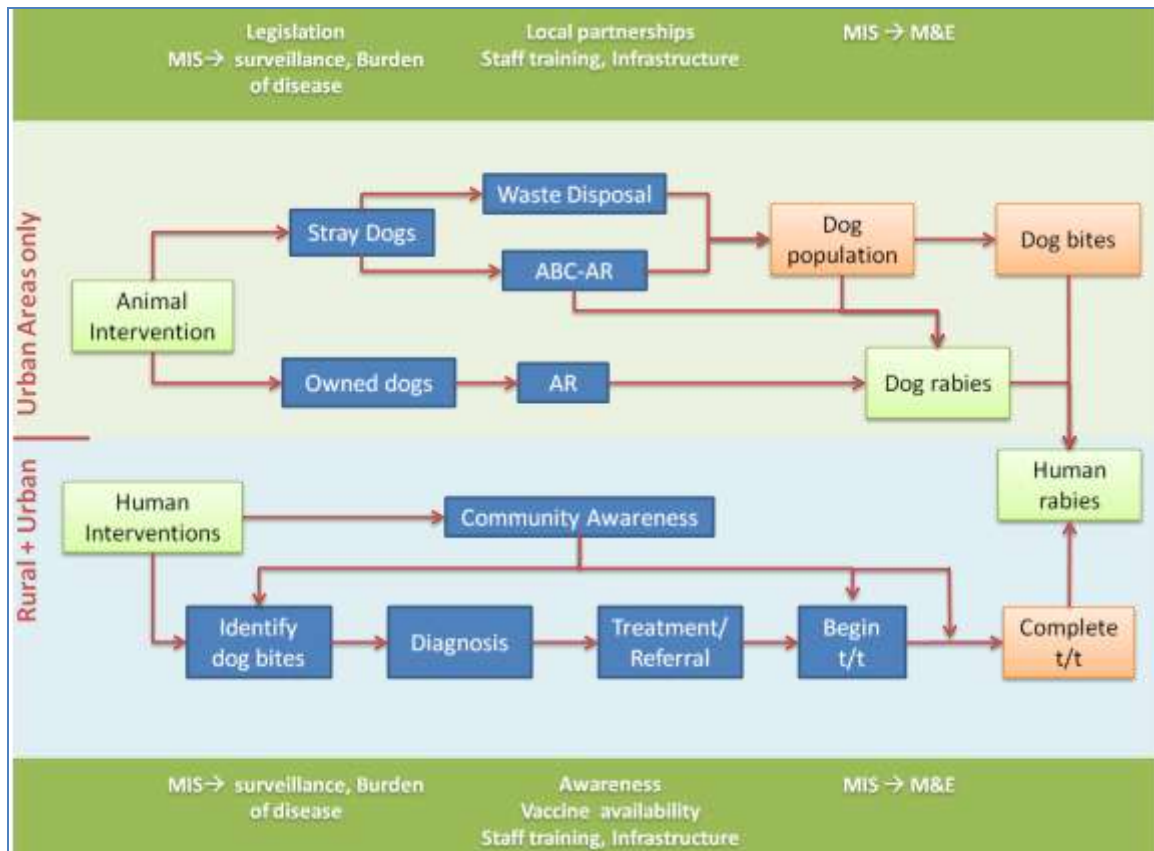


Figure 5: Logic Model for Rabies Control Initiative in Tamil Nadu

On the contrary, systematic catching of stray dogs, their sterilisation and vaccination and reintroduction into the original habitat, not only reduces their ability to transmit rabies to dogs and humans but also leads to a gradual reduction in overall stray dog population and eventual elimination.¹⁵

ABC-AR was introduced in five corporations and 50 municipalities of Tamil Nadu in beginning 2007. These efforts of Tamil Nadu are supported by Animal Welfare Board of India through a 50:50 cost sharing with the Municipal Administration Department. Based on the successes of the pilot, the

¹⁵ Section 7.4. WHO Expert Consultation on Rabies, First Report. WHO Technical Report Series, No. 931. World Health Organisation. Geneva (2005).

initiative is being expanded to all corporations and municipal areas with complete and dedicated funding provisioned by the government of Tamil Nadu.

4.1.3.2 Intersectoral coordination at state and municipality level

ABC-AR is carried out as a systematic effort at the state and corporation/ municipality level. At the state level, a Coordination Committee has been formed. The committee meets every six months to review and guide the efforts of the corporation/ municipality level bodies/ functionaries. Members of the committee include the following:

- Director of Municipal Administration (Chairman)
- Director of Town Panchayat (Co-Chairman)
- Director of Public Health & Preventive Medicine (Vice Chairman)
- Additional Director of Public Health & Preventive Medicine- M&F (Member Secretary)
- Director of Rural Development & Local Administration
- Director of Medical Education
- Director of Medical and Rural Health Services
- Director of Animal Husbandry
- Representatives of Animal Welfare Board

Terms of Reference of State Level Coordination Committee

- 1- To review the situation of Rabies, its prevention and control
- 2- To review the vaccination of dogs and the sterilisation
- 3- Management of human rabies cases
- 4- Licensing of stray dogs
- 5- Ensure intra dermal inoculation of Anti Rabies Vaccine

At the corporation and municipality level, it involves formation of a local animal welfare trust to supervise the ABC-AR activities. Under the pilot project of Municipal Administration, a Monitoring Committee has been constituted at all Urban Local Bodies consisting of the following:

Box 2: Terms of Reference of State Level Committee

- Commissioner/chief of the local authority, who shall be the ex-officio chairman of the Committee
- A representative of the Public Health Department of the local authority
- A representative of the Animal Welfare Department if any of the local authority
- A veterinary doctor
- A representative of the district SPCA
- At least two representatives from the Animal Welfare organisations operating within the said authority

An ABC-AR team is created at the municipality level to actually conduct the dog catching and ABC-AR procedures. It consists of the following members:

- Two private veterinarians to perform the procedures
- One driver for each dog van
- Two dog catchers for each dog van

Vehicle, driver and fuel are provided by the local to the dog catching teams. In addition, facility for conducting the procedure etc is provided. These include establishment of sufficient number of dog

pounds and animal shelters to be managed by animal welfare organisations and an ambulance-cum clinical van to be provided as mobile centre for sterilisation and immunisation.

The number of stray dogs in a municipality was estimated by the Municipal Administration Department through a survey conducted in 2006. Apart from the general support provided by the Municipality, the budget for ABC-AR activities was estimated @ Rs 445/- per dog for completed ABC-AR procedure. The Municipality engages the services of an animal welfare organisation, or in case it has its own facilities, engages private veterinarians for catching and sterilising the dogs.

Technical support to these teams is provided by local animal husbandry functionaries. There are two breeding seasons a year for dogs which is responsible for replenishment of dog population, if control operations are not sustained over time. This also corresponds to increase in dog bite cases. Accordingly, in a typical municipality, based on dog population census, 50 dogs per day are caught under ABC-AR operations. The activity is carried out round the year with a target to cover 70% dog population on a sustained basis.

Functions of the Local Body Monitoring ABC-AR Committee

- Issue instructions for catching, transportation, sheltering, sterilisation, vaccination, treatment and release of sterilized vaccinated or treated dogs.
- Authorize veterinary doctor to decide on case to case basis the need to put to sleep critically ill or fatally injured or rabid dogs in a painless method by using sodium pentothal. Any other method is strictly prohibited.
- Create public awareness, solicit co-operation and funding.
- Provide guidelines to pet dog owners and commercial breeders from time to time
- Get a survey done of the number of street dogs by an independent agency
- Take such steps for monitoring the dog bite cases to ascertain the reasons of dog bite, the area where it took place and whether it was from a stray or a pet dog
- Keep a watch on the national and international development in the field of research pertaining to street dogs' control and management, development of vaccines and cost effective methods of sterilisation, vaccination, etc.

Box 3: Functions of the Local Body Monitoring ABC-AR Committee

Budget Head	Budgeted amount
Dog catchers	25
Surgeon fees	60
Para-veterinarian fees	50
Anti rabies vaccine and medicines	170
Food for admitted dogs	70
Ambulance and driver charges	50
Miscellaneous	20
Total amount per dog	445

Table 1: Budgeted cost of ABC-AR per dog (Source: Municipal Corporation of Madurai)

Animal husbandry department is also responsible for regular animal census in the state, including municipal areas. These datasets are used in planning ABC-AR activities at state and local levels.

For corporations/ municipalities lacking the expertise of veterinarians, including in the private sectors, ABC-AR teams from nearby districts are mobilised to conduct activities in those areas. The teams are appropriately provided support facilities and funds for the activities completed.

4.1.3.3 Effective municipal waste management through innovative partnership models

Availability of food through domestic waste piles has been identified as one of the factors contributing to the survival and multiplication of stray dogs and in turn continuing incidence of rabies. Both the WHO and the World Organisation for Animal Health (OIE) recommend environment management¹⁶ as an important means for stray dog population control including steps to *exclude dogs from sources of food (e.g. rubbish dumps and abattoirs and installing animal-proof rubbish containers)*¹⁷.

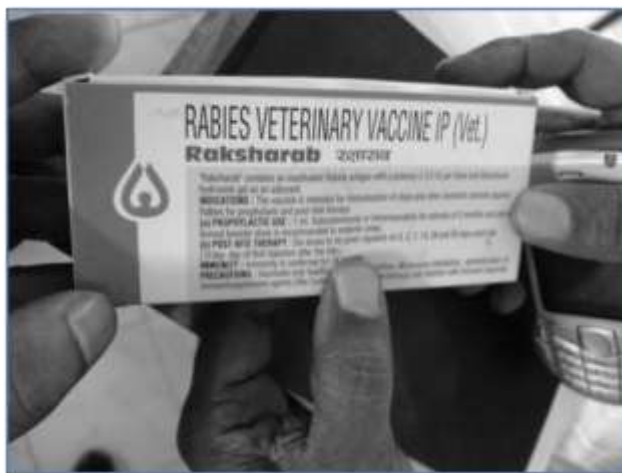


Figure 6: Anti Rabies Vaccine being used by Municipal Administration in Tamil Nadu

As part of their comprehensive rabies control strategy, the Municipal Administration department of Tamil Nadu has provisioned for an innovative and flexible mechanism for Public Private Partnerships in domestic waste management in urban areas. These offer 50:50 arrangement in terms of coverage of municipal limits and involve door-to-door collection, segregation, transport and safe disposal/ recycling of domestic waste.

4.1.3.4 Community awareness and involvement

Perception and awareness of community and community based organisations is an important determinant in the success or failure of rabies control efforts. Increase public pressure led to banning of inhuman killing of dogs (electrocution, poisoning, shooting etc.) and introduction of the ABC-AR strategy. Similarly, the rapid increase in the number of stray dogs leading recalibration of rabies control efforts in Tamil Nadu in favour of ABC-AR has also been a result of public pressure. Accordingly, an essential component of the comprehensive rabies control strategy in Tamil Nadu is to ensure sustained IEC/BCC/IPC to educate communities on their role in these efforts – waste management, reporting of dog bites, dog populations explosions etc.

Dedicated funds from the regular budget of individual corporations/ municipalities were identified for these efforts. Activities include putting up posters, distribution of pamphlets, street plays, health camps and involvement of schools and opinion makers/ community leaders. These are carried out in close collaboration with other health functionaries such as DPH, DME and DM & RHS.

¹⁶ WHO Expert Consultation on Rabies, First Report. WHO Technical Report Series, No. 931. World Health Organisation. Geneva (2005).

¹⁷ OIE Terrestrial Animal Health Code, 2005. Chapter 7.7- Guidelines on stray dog population control. World Organisation for Animal Health. Paris (2009)

4.2 Rabies Control in Rural Tamil Nadu

The primary health care delivery in rural areas up to the level of community health centres (Health sub-centres, Primary Health Centres, Block PHCs) in Tamil Nadu is administered by the Department of Public Health and Preventive Medicine. District level rural health care delivery is administered through Department of Medicine and Rural Health Services through District Hospitals.

Animal health care in rural areas is provided by the Animal Husbandry department through veterinary sub-centres, veterinary clinics and district hospitals. The facilities are, however, limited to preventive and curative care of large animals and ruminants, including vaccination programme for diseases like foot and mouth disease, hemorrhagic septicemia, brucella abortus, sheep pox, ranikhet disease, duck plague, etc. No ABC-AR initiatives have been implemented in rural areas. Animal husbandry department network does not provide vaccination to stray or pet dogs. Vaccine, however, is done at the request of pet owners and Panchayats (in case of stray dogs) upon payment of the cost of the vaccine.

Main agency responsible for intervention for rabies prevention and control in rural areas is therefore by DPH & PM. The strategy includes:

- Regular anti-rabies vaccine availability for human dog bite cases
- Increasing community awareness and involvement

4.2.1 Regular anti-rabies vaccine availability for human dog bite cases



Figure 7: Rabies awareness poster in Tamil at the Madurai Medical College, Madurai

The estimated number of dog bite cases in India is a staggering 17million¹⁸. Most of these cases are not reported to the health system, either because they seek informal care due to lack of awareness or due

¹⁸ Rabies: General aspects and laboratory techniques. Zoonosis Division, National Institute of Communicable Diseases, Government of India. New Delhi. (2007) available at http://www.whoindia.org/LinkFiles/Communicable_Diseases_Rabies_-_General_Aspects_&_Laboratory_Diagnostic_Techniques.pdf

to non-availability of vaccine at the nearest health facilities. The availability of anti-rabies serum for category III dog bites is even more limited¹⁹.

Neural tissue vaccine has been available in Tamil Nadu regularly till 2004, when it was banned due to its adverse effects on humans and implications on animal rights. This was followed by introduction of the tissue culture vaccines (TCV) in 2004/2005. TCV has been made available in all health facilities (primary health centres, block PHCs, district hospitals and medical colleges) across the state and up to the Primary Health centres through an efficient supply chain management system of the Tamil Nadu Medical Services Corporation (TNMSC). The vaccines are procured on the basis of annual estimates for the entire state by TNMSC on payment from the respective government department (DPH, DRH&MS and DME). Every health facility can access the district warehouse for issue of vaccines as soon as they find their stocks depleting. Requested vaccine vials are issued to them and the transaction recorded in the institution pass book. In case of a sudden reduction in its stocks, district warehouses can request for additional vaccines from the central depot or, in case of an emergency, from a nearby district.

The availability of vaccine has been backed by training of health care staff (across all health facilities) in Tamil Nadu. In addition, intra-dermal administration of ARV was introduced in Tamil Nadu in 2006/2007 which was again backed by training of the entire health care delivery staff. This has led to further savings and wide availability of vaccine across the state with no significant stock-outs.

ARS is made available at district hospitals and medical colleges. Category III dog bite cases requiring anti-rabies serum are referred from primary health care facilities and rural areas to these institutions after initial patient management.

4.2.2 Increasing community awareness and involvement

Recent years have seen a sharp increase in the number of dog bite cases reported by health facilities. This is a reflection of the increased awareness amongst the community regarding management of dog bites as well the availability of vaccines at health care facilities. Random exit interviews were conducted amongst patients and their attendants in the OPDs of medical colleges and district hospitals (both general OPDs and anti-rabies clinics) during field visits. The level of awareness on issues like *“What do you do if bitten by a dog?; Where do you go if bitten by a dog?; Do you consult a traditional healer, if yes then why, if not then why?; Do you have stray dogs in your area?; What is the level of stray dog menace - has it improved or worsened over the last few years?; DO dogs bite people?; Has there been any death due to dog bite in your area?; What measures are taken by the authorities to tackle stray dog problem?”* was found to be very high.

The communication channels used to educate the community on rabies prevention and control and dog bite management include putting up posters, distribution of pamphlets, street plays, health camps and involvement of schools and opinion makers/ community leaders, and mass media like TV channels and radio.

¹⁹ Sudarshan, M. K., Mahendra, B. J. & Narayan, D. H. A. (2001). A community survey of dog bites, anti-rabies treatment, rabies and dog population management in Bangalore city. *Journal of Communicable Disease* 33,245-251

4.3 Role of other Departments/ Stakeholders and other Initiatives

The following state and central level stakeholders play a role in supporting rabies control efforts in the state of Tamil Nadu.

4.3.1 State level

4.3.1.1 Directorate of Medical & Rural Health Services (DM&RHS)

DM&RHS administers district level health care delivery through the network of district hospital in the state of Tamil Nadu. District Hospitals are referral institution for PHCs and Block PHCs for dog bite cases falling in the category III as well provide anti rabies treatment for other category of cases.

4.3.1.2 Directorate of Medical Education (DME)

DME administers medical teaching and tertiary level health care through medical colleges in Tamil Nadu. The state of TN has 15 government medical colleges in 13 districts (Chennai, Coimbatore, Dharmapuri, Kancheepuram, Kanniyakumari, Madurai, Salem, Thanjavur, The Nilgiris, Theni, Thiruchirapalli, Thirunelveli & Vellore)²⁰. Medical colleges are referral institution for PHCs and Block PHCs for dog bite cases falling in the category III as well provide anti rabies treatment for other category of cases. Data from the medical colleges is collected separately from other health institutions and is transmitted through the DME.

Madurai Medical College has been identified as rabies referral treatment and laboratory diagnosis center in Tamil Nadu through a project supported by National Center for Disease Control.

4.3.1.3 Department of Animal Husbandry (DAH):

DAH has a network of veterinary sub centres, veterinary dispensaries and district veterinary hospitals. The focus of these facilities, however, is on large animals and ruminants and activities include preventive, promotive and curative services such as artificial insemination, vaccination, surgical intervention, pregnancy related services, spaying/ castration etc.

DAH also conducts regular animal census in the state, including municipal areas. These datasets are used in planning ABC-AR activities at state and local levels. Animal husbandry department network does not provide vaccination to stray or pet dogs. Vaccine, however, is done at the request of pet owners and Panchayats (in case of stray dogs). However, DAH provides technical assistance to various rabies control efforts at all levels, including state and district level coordination committees, corporations/ municipalities, and ABC-AR teams.

²⁰ MoHFW, Govt of India. Status of medical colleges for admission for the academic session 2009-10, available at <http://www.mohfw.nic.in/Amedical.html>

4.3.1.4 Civil Society groups

Tamil Nadu has many active NGOs and community based organisations. These civil society actors have played a prominent role in influencing the rabies policies in the state.

Blue Cross of India (BCI), People for Animals (PFA), Humane Animal Services (HAS), People for Ethical Treatment of Animals (PETA) and Society for Prevention of Cruelty to Animals (SPCA) are some institutions at state level that advocate promotion of animal rights. The Supreme Court order banning killing of stray dogs was brought about by a petition filed from the animal right groups. Interestingly, the resultant increase in dog population caused other public groups to push for a more proactive animal birth control policy.

4.3.2 Central Level

4.3.2.1 Animal Welfare Board of India

AWBI has been a long-term partner of Municipal Administration Department and Government of TN in their rabies control efforts. The pilot project of Municipal Administration Department was supported technically and financially by the AWBI. Following the successes of the pilot, AWBI agreed to support 50% of the cost of scaling-up of ABC-AR to all corporations/ municipalities of Tamil Nadu.

Apart from strategic support, AWBI is also involved in the day-to-day functioning of the ABC-AR programme. The quality and implementation of ABC-AR drives in all corporations/ municipalities are monitored and evaluated by experts from AWBI on a regular basis. AWBI representatives are also members of the district level coordination committees.

Madurai Medical College – Site for Rabies Pilot project of NCDC

- Started in April, 2008 (2008 beginning)
- One among the five cities in India selected as pilot sites
- Components – Lab strengthening, IEC, human rabies vaccination (I/D), health workforce training and inter-sectoral coordination
- Centrally driven
- Targets need better definition
- Focus only on human aspect of rabies control
- Misses out on rural aspects of burden of rabies in India
- Functional in areas which already have sound rabies control initiatives
- Only additional areas of inputs are lab strengthening and availability of ARS (equine)
- Lack of communication and clear understanding of the project amongst various stakeholders
- Project is coordinated by DPH, staff trained is from DME and IEC performed is in rural areas
- Role of other agencies active in rabies control, including municipal-corporation and animal husbandry department, not well defined.

Box 4: Madurai Medical College – Site for Rabies Pilot project of NCDC

4.3.2.2 National Centre for Disease Control (NCDC), Delhi:

NCDC is the apex technical organisation for teaching, training, operational research and technical support for communicable disease surveillance and control in India and south Asia. As part of its mandate for operational research, the Zoonoses Division of NCDC has launched pilot project on human rabies prevention and control in five cities in the country with Madurai being one of them. The lessons from the pilot will feed into a potential national rabies control programme. Salient features of this pilot in Madurai are listed in Box 4.

5 Surveillance and Programme Data Analysis

Following rabies related data are reported by different departments in TN:

Department	Data reported	Catchment area
Department of Public Health & Preventive Medicine (DPH)	Dog bites by district by year Rabies cases/ deaths by district by year District census data	Rural TN (PHC and Block PHC)
Department of Medical Education (DME)	Dog bites by district by year Rabies cases/ deaths by district by year	Urban TN
Department of Medical and Rural Health Services (DM&RHS)	Dog bites by district by year Rabies cases/ deaths by district by year	Rural and urban TN (Taluka & District Hospitals)
Municipal Administration Department (MAD)	Stray dog population by Corporation/ Municipality (four year census) Number of ABC-AR procedure conducted every year by Corporation/ Municipality Municipality census data	Urban TN (Corporation/ Municipal limits)
Department of Animal Husbandry (DAH)	Dog population census by stray/ pet (four year census)	Rural and urban TN (by District)
Tamil Nadu Medical Services Corporation (TNMSC)	Vaccine consumption by district by year	Rural and urban TN (by health facility at all levels)

Table 2: Sources of Reported Data

5.1 Data Collection Methods

Given the widespread nature of intervention, multiple data collection methods were used. Some data regarding disease burden was shared with the study team by the Department of Health during the planning phase of the study. Most of the information was collected during the Key Informant Interviews held during the field visit. Official websites maintained by the Municipal Administration Department were helpful for sourcing census figures and boundary demarcations.

5.2 Data Quality

Surveillance data on various aspects of rabies and intervention measures had several limitations. Some of these limitations are mentioned below.

Data related to rabies is reported by all the three directorates. However, information reported is not standardised across departments e.g. in addition to dog bites reported by all departments, DPH reports rabies cases, DME reports new and old rabies cases and DM&RHS reports rabies case and rabies deaths separately. Corporations/ municipalities do not report human dog bites/ rabies data.

Sub-type of human dog bites by category (I, II and III) and number of completed vaccination courses are not available; correlation with vaccine consumption could not be established conclusively. Details of dog ecology data are either unavailable or incomplete e.g. male versus female dogs; age-wise breakup, stray versus pet; urban versus proportion dogs that were subjected to ABC-AR. The duplication in reporting of same patient in three different datasets could not be eliminated. Under reporting of dog bites, rabies, vaccine consumption, dog population estimates reported could not be ruled out; underreporting could be more pronounced before 2006 compared to post-2006

Databases of different departments and sectors have not kept pace with each other and therefore might not be comparable e.g. dog population survey figures for survey done by DAH in 2004 are available; 2008 survey are not available; impact of ABC-AR launched in corporation/ municipal areas in 2007-2008 cannot be corroborated directly

5.3 Data Analysis Strategy

Observational evaluation was conducted using the following methods:

- 1- Epidemiologic analysis of surveillance data to establish rabies trends and identify 'hot-spots' in the state
- 2- Analysis of procurement and supply chain management system to identify vaccine consumption, stock-out details.
- 3- Exit interviews at health centres to assess awareness among community regarding prevention of rabies
- 4- Cost analysis of programme inputs
- 5- Policy analysis of rabies control strategies over the last three years
- 6- Interviews with key officials and review of official reports, documents to assess operational functioning of rabies control

In view of the above limitations of available datasets and the objective of the exercise viz. to establish the trend of rabies incidence in Tamil Nadu following various rabies control initiatives; the following data analysis strategy was followed.

- Analyse state level surveillance data for overall trends – incidence of dog bites, incidence of rabies cases/ deaths (as they are reported), per capita vaccine consumption in the last five years
- Grouping of districts based on tercile ranking of dog bite incidence (proxy for disease burden; the study team did not use rabies cases/ deaths as a marker of disease burden due to greater potential for under reporting, loss to follow up and errors in case classification) followed by identification of 'hotspots' districts. In addition, tercile ranking was also done for other parameters to identify priority districts.
- Analysis of 'micro trends' in districts identified as 'hotspots' along with districts reporting medium and low burden of disease using data on incidence of dog bites, incidence of rabies cases/ deaths (as they are reported), vaccine consumption in the last five years per district warehouse

- Use DPH data to assess trends in rural Tamil Nadu and DME data trends to assess trends in urban Tamil Nadu; in districts which lack government medical college, use DM & RHS data to assess trends of urban areas
- Triangulation of evidence from above multiple databases to make final interpretation on trend of rabies and impact of programme intervention in Tamil Nadu

6 Results

6.1 Overall in Tamil Nadu

As demonstrated in Figure 8, people have had increased access to the Anti Rabies Vaccine that is provided free by government of Tamil Nadu. According to TNMSC figures, there has been a steady increase in vaccine consumption from two lakh vials in 2002 to 9.4 lakh vials in 2007 or from 328 vials in 2002 to 1,367 vials per lakh population in 2007.

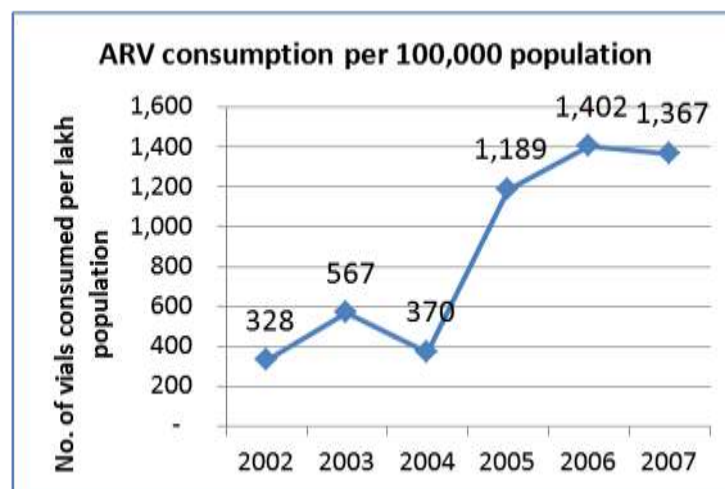


Figure 8: Vaccine consumption in Tamil Nadu, 2002-2007 (Source: TNMSC)

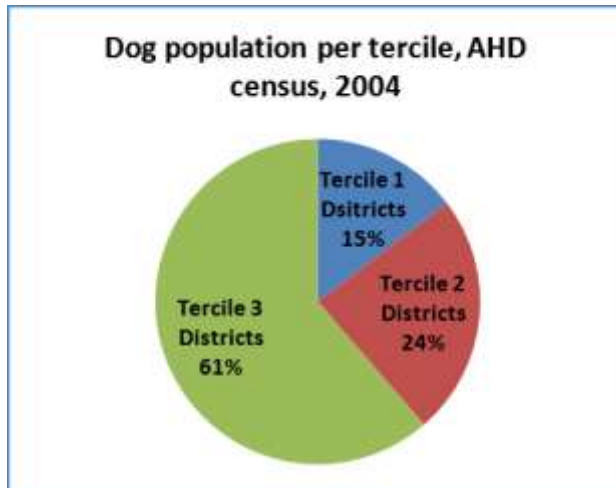


Figure 9: Dog Population distribution in Tamil Nadu (Source: DAH Livestock Survey, 2004)

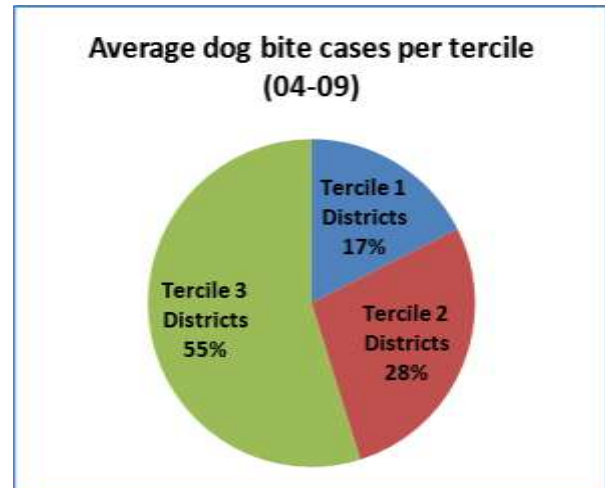


Figure 10: Dog bites among different tercile districts, Rural Tamil Nadu (2004-09) (Source: DPH&PM)

According to the Livestock Census conducted in 2004 (we weren't able to access 2008 results as they were still being analysed) by the Animal Husbandry Department, more than three fifths of the dog population resides in one-third of the districts. These high burden districts roughly correspond to the high dog bite districts as well.

6.2 In Rural Tamil Nadu

Overall between 2004 and 2008, the number of reported dog bite cases has increased (202 per 100,000 to 498 per 100,000 population) and the number of rabies deaths has decreased from 0.75 per 100,000 to 0.43 per 100,000 population).

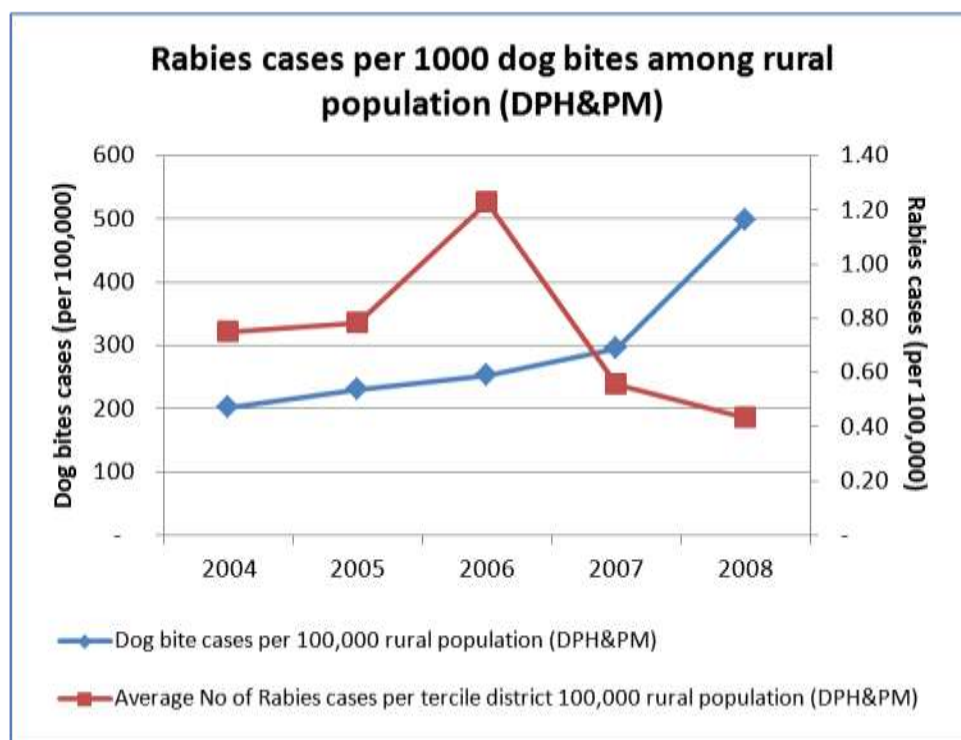


Figure 11: Rabies cases per 1000 dog bites among rural population (Source: DPH&PM)

Average reported dog bite cases in rural areas increased between 2004 and 2006 from 202 to 253 dog bite cases per one lakh population. This was followed by a sharp rise in reported cases to become 498 per lakh population in 2008.

As reported by the Department of Public Health & Preventive Medicine, the decline in reported rabies cases/ deaths was uniformly under one per lakh population from 2004 to 2008, falling below 0.5 per one lakh rural population after 2007. The single exceptional year was 2006 which witnessed a sharp increase in reported rabies cases to 1.2 per lakh population.

It was found from the rural data that top one-third of districts having high dog bite incidence account for 52% of all reported dog bites in rural areas. The number of districts in upper tercile based on reported dog bite incidence in rural areas remained constant between 2004 and 2009 though the exact grouping of districts into tercile classes frequently changed. As evidenced in Figure 12, the distribution of dog bite cases among different terciles has remained almost constant throughout the six years of observation.

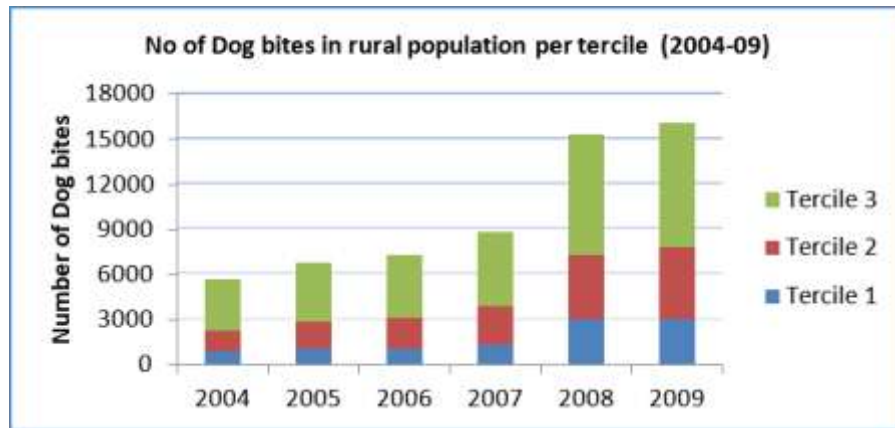


Figure 12: No of Dog bites in rural population per tercile (2004-09) (Source: DPH&PM)

6.3 In Urban Tamil Nadu

In the absence of rural and urban disaggregation of available data, we used data from Directorate of Public Health & Preventive Medicine (DPH&PM) as a proxy for rural burden. Similarly, because of their urban locations, data from the medical colleges reported through the Directorate of Medical Education (DME) was assumed to be representative of urban cases in districts having medical colleges.

As depicted in Figure 13 & Figure 14 we found that the incidence rates of reported dog bites remained relatively stable in both the reported years (2008 & 2009). However, relative to the reported incidence of dog bites, incidence of rabies was less in urban areas as compared to rural areas. During this period there was a decline in reported rabies cases both in rural and urban areas.

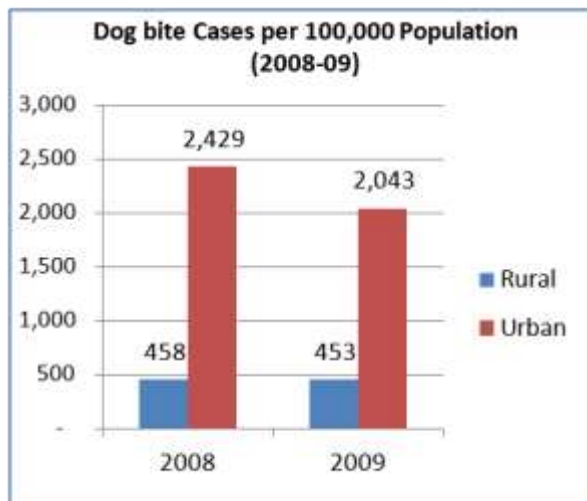


Figure 13: Dog bite cases per 100,000 population (Source: DPH, DME)

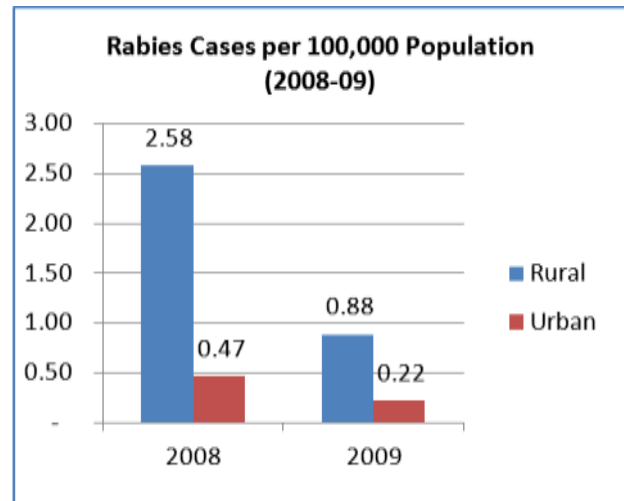


Figure 14: Rabies cases per 100,000 population (Source: DPH, DME)

6.4 Rural versus Urban Trends

We found that reported dog bite cases incidence in rural Tamil Nadu was consistently less than dog bite incidence in urban Tamil Nadu. Directorate of Medical & Rural Health Services data was expected to capture predominantly urban and referred rural population. It consistently showed higher reporting of dog bite cases and lesser incidence of rabies cases/ deaths during the period January 2008 to August 2009.

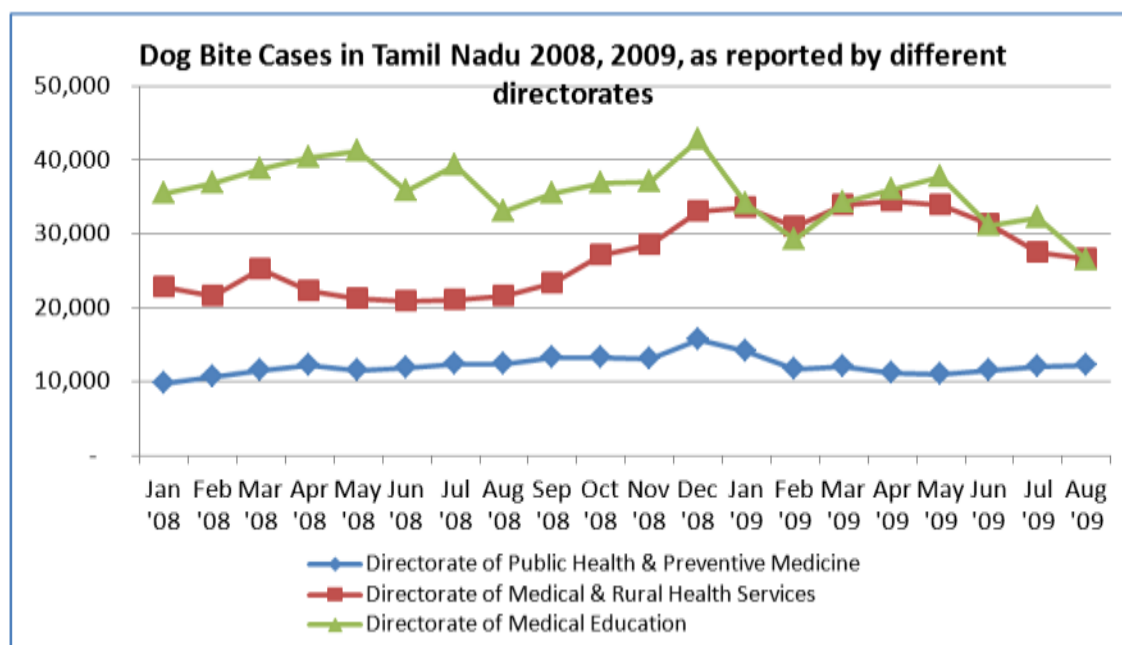


Figure 15: Dog bite cases in Tamil Nadu as reported by different directorates (2008-2009)

Similarly, reported rabies cases/ deaths due to rabies were lesser in urban areas as compared to rural areas during the same period.

The above figure also depicts low coverage of the Directorate of Public Health institutions relative to the Directorate of Medical & Rural Health Services. Unfortunately, because of the limited coverage of 'rural' and 'urban' data sources, it will be difficult to assume their respective representativeness.

Two different information sources were made available to the study team for estimating dog population details (Figure 16). The dog population density per lakh human population for entire Tamil Nadu was estimated (by Animal Husbandry Department Livestock Census, 2004) to be twice the urban density of dogs (as estimated by the Pilot Survey of dog population in urban municipalities conducted by the Municipal Administration department). Assuming similar assessment techniques and no difference in dog populations between 2004-06 (from informal reports, it actually increased during the period) it would appear that the non-pilot areas of rural and semi-rural Tamil Nadu have higher density of dogs, and closer animal-human contact than the selected pilot districts. The figure highlights the importance of regular collection of dog ecology data in helping guide the policy process.

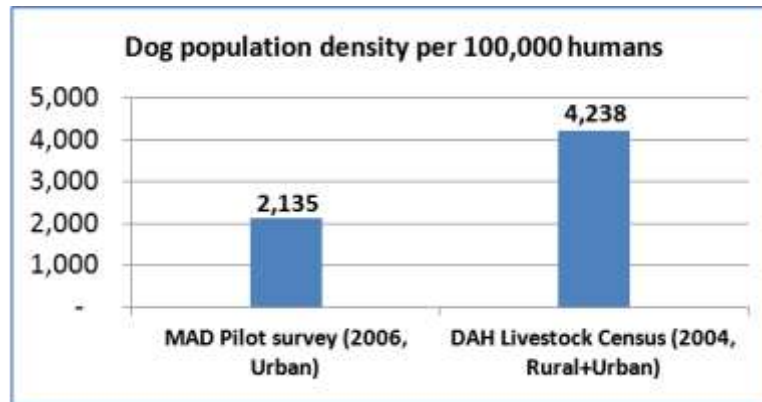


Figure 16: Estimated dog population density through different data sources

These relative discrepancies in HMIS coverage, pilot nature of the animal side interventions, and the absence of repeated dog survey data make it difficult for the team to draw conclusions on possible impact of the ABC-AR programme in reducing dog population, dog bites or rabies.

6.5 Micro Trends

We grouped districts into terciles for four parameters depicted below in Figure 17, such that Tercile 1 represents districts with low values of the specific parameter and Tercile 3 refers to the high value group. With the singular exception of rabies cases, we found that all other parameters were similarly distributed in Tamil Nadu. High burden districts contributed to 50% - 55% of dog bites and vaccine consumption and had 61% of total dog population. Similarly the low value Tercile 1 districts account for 15% - 19% of all distributions. We propose to follow-up on this study and make visits to select districts to examine the impact of ABC-AR districts in their area of implementation.

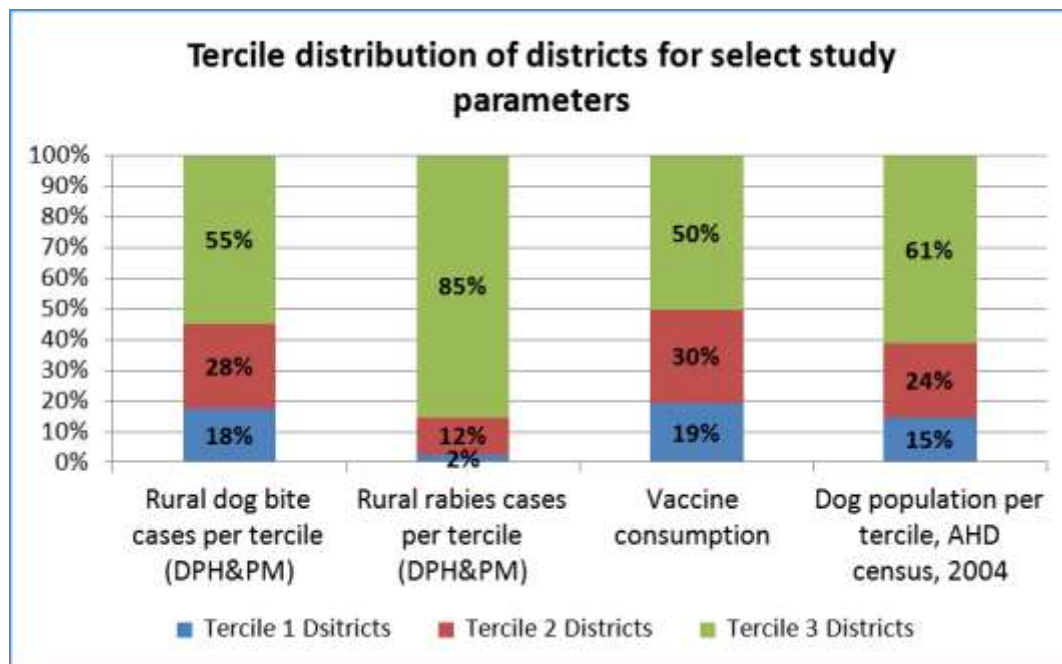


Figure 17: Tercile distribution of study parameters



Figure 18: District dog density (rural) Per 100,000 humans Department of Animal Husbandry Livestock Census (2004)

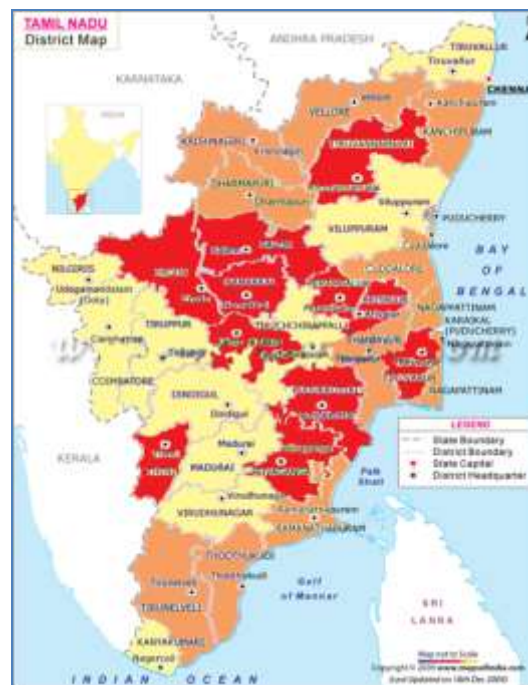


Figure 19: Dog bite incidence per 100,000 humans Average dog bites per 100,000 rural population (2004-09)



Figure 20: Rabies incidence (rural) per 100,000 population Average rabies cases per 100,000 rural population (2004-08)



Figure 21: Number of vaccine vials supplied to district warehouses (TNMSC, 2007)

Maps from: www.mapsofindia.com

Tercile groupings

Tercile 1 Districts (Lowest values)
 Tercile 2 Districts
 Tercile 3 Districts (Highest values)

As depicted in Figure 18 & Figure 19, high number of dog bites as well as high dog density has been reported from the central and some northern districts. Districts bordering Kerala from The Nilgiris to Dindigul are reporting high dog density with low incidence of dog bites. Increased surveillance and an in-depth spatio-temporal analysis is required to tease out the epidemiological and programmatic information.

There is a lot of commonality between the tercile groupings across different parameters, possibly denoting similar pattern of data. However, there are several discordant districts in the tercile groupings as well. The exact composition of terciles varies across parameters. We received data from different government departments for varying time periods. The variation could be because of the differences in the way districts are administratively grouped in different departments (eg. 27 vaccine depots supply 31 districts) or the newer demarcations of districts over the course of last one decade.

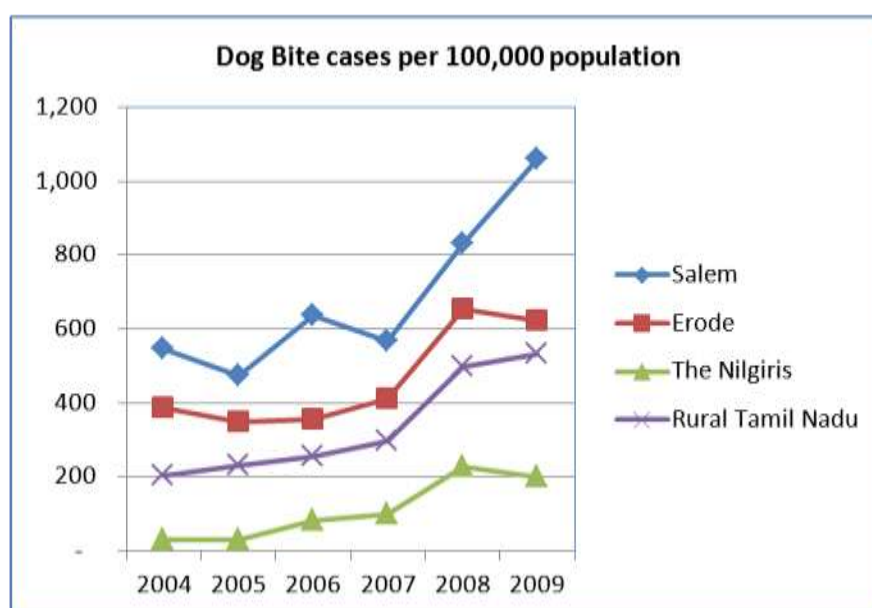


Figure 22: Rural Dog bites incidence in select districts (Source: DPH)

From the epidemiologic perspective interesting variation was noted in the disease burden of adjacent states. (Figure 22) One-third districts in Tamil Nadu have 40% dog bite cases in rural areas; three districts (Salem, Vellore and Erode) account for 23% of all reported dog bites in rural areas. Salem reported maximum number of dog bites between 2004 and 2008 whereas Nilgiris, near Salem, reported least number of cases during the same period.

Continuing in the same vein, Thiruvannamalai reported maximum rabies cases/ deaths between 2004 and 2008 whereas three districts (Coimbatore, Karur and Nagpattinam) reported 'zero' rabies cases/ deaths during the same period.

Number of districts reporting 'zero' incidence of rabies increased from 17 in 2004 to 22 in 2008.

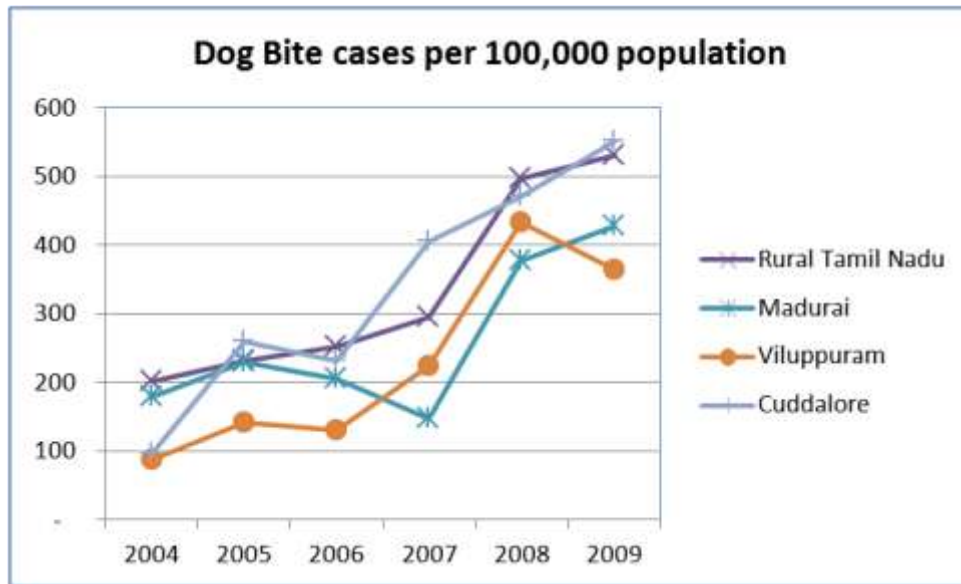


Figure 23: Rural Dog bites incidence in select districts (Source: DPH)

Frequent variations in the temporal distribution of reported dog bites and rabies cases were also noted for several districts. (Figure 23) Whereas rural Tamil Nadu, as a whole, had a steady increase in reported dog bite incidence, there were several districts that displayed stark annual variations. Within a span of three years, Villupuram moved from being a low burden district to a moderately high burden district in 2008, again falling in the following year. Madurai showed similar spurts in dog bite incidence in 2008 preceded by several years of decline in dog bites.

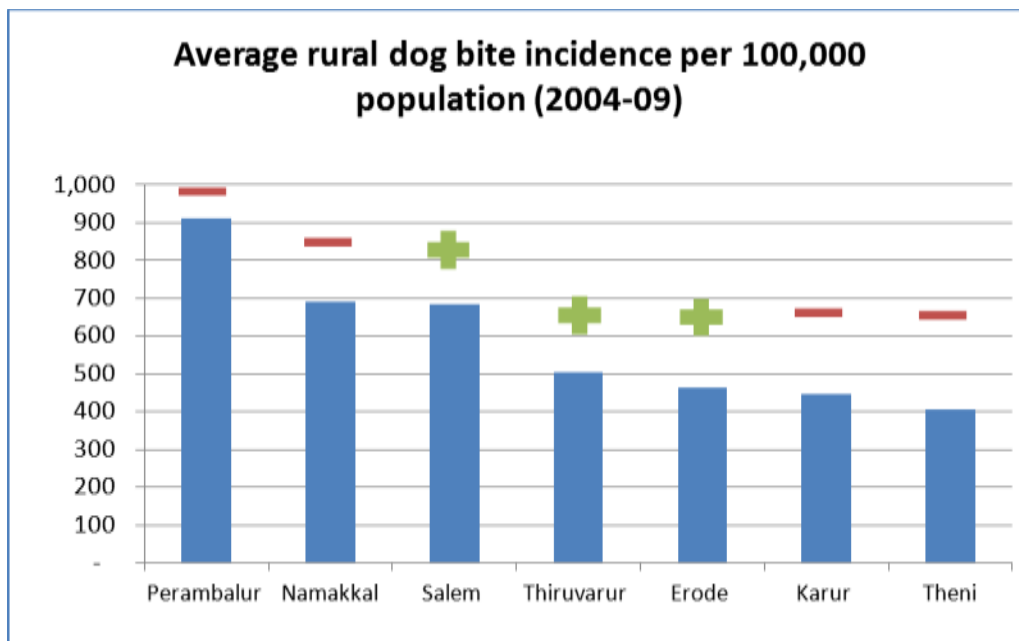


Figure 24: Rural dog bite incidence in top 7 districts (presence of a plus or minus sign denotes presence or absence of a dedicated district depot, respectively)

An interesting finding that emerged was that all districts that did not have a district depot of their own, but sourced the vaccines from the warehouse of a nearby district, showed high incidence of dog bites. Of the seven districts having the highest incidence of dog bites, four did not have district warehouses. (Figure 20, Figure 21 & Figure 24)

The abovementioned variations make for interesting case studies. Both epidemiologic as well as operational reasons could be responsible. In spite of relatively least coverage among all directorates (Figure 15), DPH was responsible for providing the most detailed source of information on dog bites in Tamil Nadu disaggregated in district-wise and month-wise fashions. Waste management practices, ABC-AR initiatives or community awareness campaigns in the above districts might have contributed to the annual variation in dog bites and rabies cases. Detailed surveillance might have explained some of the observed variations.

Reliability of clinical diagnosis of rabies is another point that merits further probe.

7 Costing of Rabies Control Initiative in Tamil Nadu

7.1 Objective

Determine costs to the Government of Tamil Nadu for scaling up current rabies control efforts in the entire state.

7.2 Costing Framework

Several different interventions are being implemented in Tamil Nadu that can be associated with rabies control like improved solid waste management in the municipalities, innovative procurement and supply chain management system, etc. However, for the purpose of costing, we have considered the following interventions that are currently being implemented in different areas of Tamil Nadu.

- 1- Animal side interventions
 - a. ABC-AR in urban populations
 - b. Awareness regarding immunisation of dogs
- 2- Human side interventions
 - a. Availability and administration of Post Exposure Prophylaxis (also includes training of personnel)
 - b. Generating awareness in the community on prevention of rabies among humans and dogs

We have tried to estimate from the Tamil Nadu Government's perspective as to how much it will cost them to scale-up the ABC-AR programme to all municipalities and strengthen other interventions across the state. We have tried to use figures from the current programme wherever available. Where figures were not available or we felt it was underestimating, an amount has been quoted with the assumptions clearly spelt out.

7.3 Animal Side Interventions

7.3.1 Implementation of ABC-AR in all municipalities

Average TN urban dog density	2135 dogs (per lakh urban population)
If 2135 dogs need to be sterilised annually, number of dogs that should be sterilised/immunised per week	$2135 \div (12 \times 4) \approx 45$ (per lakh human population)
Therefore, holding capacity of one shed per lakh human population	45 per lakh urban population
Dogs that can be operated per day to allow 45 dogs to be housed for one week	7.5 per lakh urban population
Total no. of dogs to be sterilised per month	195 per lakh urban population
Dog Male-Female Ratio in Tamil Nadu	2.62
Male dogs to be sterilised per month	141 per lakh urban population
Male dogs to be sterilised per month	54 per lakh urban population

Table 3: Estimating programme targets for ABC-AR Programs

We have estimated the amount required to run an ABC-AR programme per lakh human population. This was then extrapolated to estimate the costs required for this programme to be scaled up to all urban areas. The calculations and assumptions are mentioned as above.

7.3.2 Capital Costs

Some municipalities received funds to the tune of Rs 1.5 lakhs for establishing animal sheds with a capacity for 30 dogs. We have used the same figure to extrapolate costs for a 45-capacity dog shed per lakh urban population.

Cost Heads	Rs
Dog shed plus Operation Theatre for 45 dogs	2,25,000
One dog catching vehicle	3,00,000 ²¹
Dog catching equipment (per vehicle)	2,000 ²¹
Total Capital Costs	5,27,000

Table 4: Capital Costs for establishing ABC-AR facility for 1 lakh population

7.3.3 Recurrent Costs

Since female dogs will need seven days of post-operative care, the holding capacity of the dog shed – cum – OT per lakh population of humans will be around 45. This will mean that on an average 195 dogs will be sterilised and immunised in the shed per month. Assuming DAH census gender distribution among dog population (2.62 males for female dogs), around 195 male and 141 female dogs will need to be operated upon every month.

Cost Heads	Rs	Explanations
Annual Training for Dog catchers	20,000	Assumption for pooled training for 3-4 municipalities.
Fuel	54,600	Calculated as Rs 3.5 / km x 50 km x 26 days/month x 12 months
Vehicle running costs	24,000	Rs 2,000 per month
Driver	1,20,000	Rs 10,000 per month
Dog catchers (2)	1,96,800	Calculated as 2 Sanitary Workers @ Rs 8,200 per month
Vets	1,66,246	Calculated @ Rs 60 for male dogs and Rs 100 for female dogs
Dog enumeration/survey	50,000	Assumption
medicines + ARV	3,24,808	Calculated @ Rs 125 for male dogs and Rs 175 for female dogs
Miscellaneous	46,800	Calculated @ 20 per dog as in Table 1
Para-veterinarians	1,17,000	Calculated @ 50 per dog as in Table 1
Electricity/water supply	12,000	Calculated @ 1,000 per month
IEC	50,000	Assumption
Food for dogs	1,12,985	Calculated @ 40 for male dogs and 70 for female dogs
Recurrent total	12,95,239	Comes to Rs 554 per dog

Table 5: Annual Recurrent Costs for establishing ABC-AR facility for 1 lakh population

²¹ Assumption. Needs to be verified

As mentioned in Table 1 on page 21 the recurrent expenses for running ABC-AR population were calculated at around Rs 445 per dog immunised/sterilised. While making it easy for the planning of the pilot programme, we were not able to find any uniformity in the expenditure patterns in several municipalities visited by us. In fact, at several locations the veterinary surgeons were selectively sterilising the male dogs and avoiding female dogs because of the additional time and effort required for spraying.

We have used differential rates for calculating the surgeon fees as well as the food and medicines required for operating upon male and female dogs in our calculations.

Thus the costs of implementing ABC-AR population in all urban areas will cost the Government of Tamil Nadu Rs 18.4 crores as capital or infrastructure costs and an annual sum of Rs 45.1 crore as recurrent costs. Based upon the 2004 census, the costs of running the programme per dog will be Rs 554 as compared to Rs 445 budgeted earlier. The additional Rs 109 per dog mainly goes towards a more rational salary expense for prospective employees if the programme is to be implemented in a full-time manner. The infrastructure thus created might also be useful in helping the municipalities in providing veterinary care facilities in the future.

	Population	Capital	Recurrent
Per lakh population	1,00,000	5,27,000	12,95,239
For Entire Urban Tamil Nadu	3,48,49,821	18,36,58,555	45,13,88,335

Table 6: Costs of implementing ABC-AR programme in all urban areas of Tamil Nadu

There is a need to study the impact of sustained ABC-AR programmes in other countries to estimate possible duration of such a programme. There is a strong likelihood that benefits from this programme might not be evident if suitable interventions are not planned and implemented in rural areas and similar efforts are not mounted in neighbouring states.

7.4 Human Side Interventions

7.4.1 Availability and administration of Post Exposure Prophylaxis

One of the principle strengths of rabies control effort in Tamil Nadu has been its efficient procurement and supply chain management system that ensures availability of anti rabies vaccine at all levels of health care.

Assuming no incremental storage and transportation costs are borne by the government because of the additional vaccine, and that the incidence of dog bites is similar to the figures reported by state government in 2009, the costs of an upscaled rabies control programme on the human side can be estimated as follows:

Anti Rabies Vaccine Costs	Rural	Urban
Reported dog bite incidence per lakh population 2009	453 ²²	2049 ²³
Population in 2009²⁴	3,17,15,837	3,48,49,821
Estimated number of dog bites in 2009	1,43,673	7,14,073
ARV volume required per dog bite case: 2 site id regimen (ml)	1	1
Wastage rate	33% ²⁵	33%
Estimated Rabipur requirement (ml)	1,91,085	9,49,717
Cost of intradermal vaccine as procured in 2009 (Rs/ml)	270 ²⁶	270
Cost of procuring intradermal anti rabies vaccines (Rs)	5,15,92,881	25,64,23,552

Table 7: Annual Costs of procuring Anti Rabies Vaccine in Tamil Nadu

Currently Antisera is being procured locally by four medical college hospitals in the state including the Madurai Medical College which is doing it as part of the NCDC pilot project. Almost all the category 3 dog bite cases in Tamil Nadu have to go without completing WHO recommended treatment by means of passive immunisation.

Anti Rabies Immunoglobulin Costs	Rural	Urban
Category 3 dog bites density (as a % of total dog bites)	63% ²⁷	63%
Category 3 dog bites density in TN (per lakh population)	285	1,291
Number of Category 3 dog bites in TN	90,514	4,49,866
Cost of Antisera per dose of 1500 IU	433 ²⁸	433
Cost of required antisera	3,91,92,487	19,47,91,926

Table 8: Annual Costs of procuring Anti Rabies Immunoglobulin in Tamil Nadu

If two-thirds of all the reported dog bite cases are assumed to be Category 3 dog bites, approximately 5.4 lakh cases of category 3 dog bites could be going untreated every year in Tamil Nadu. These can potentially translate into high burden of rabies cases if rabies virus is in circulation.

²² As reported by Directorate of Public Health & Preventive Medicine

²³ As reported by Directorate of Medical Education

²⁴ Office of the Registrar General & Census Commissioner, Govt of India. (2006) Population projection for India and States 2001-2026: Report of the Technical Group on Population projections constituted by the National Commission on Population, New Delhi

²⁵ Assumption.

²⁶ Estimated by taking the rate of the least expensive intradermal vaccine formulation procured by TNMSC in 2009.

²⁷ Ichhpujani RL. Epidemiology of Animal Bites and Rabies Cases in India: A Multicentric Study. *J. Commun. Dis.* 40(1) 2008: 27-36

²⁸ Based upon informal discussions with one manufacturer

Cost Heads	Costs
ARV procurement costs	30,80,16,433
Antisera procurement costs	23,39,84,413
Training costs for district level trainings @ 50,000 per district ²⁹	16,50,000
IEC costs in Madurai district (NICD project) @ 15 lakh per district ³⁰	4,95,00,000
TOTAL	59,31,50,847

Table 9: Annual costs of implementing Rabies control interventions among humans in Tamil Nadu

Therefore, it will cost the Government of Tamil Nadu around Rs 59.3 crore to make intradermal ARV and rabies immunoglobulin available at all health facilities in the state supplemented by the required training of health workers and awareness generation among the community.

This calls for approximately 76% increase in the layout for vaccine expenditure. We realise that this will be a substantial investment on the part of the government. The objective of this exercise is to stimulate a debate regarding the preparation of a comprehensive rabies control policy. The above-mentioned figures can be validated by producing necessary evidence regarding major assumptions used in the analysis, namely:

- Disease burden with projections of dog bites with categories, probable rabies cases
- Projected costs of vaccines and immunoglobulin
- A well defined programme structure

²⁹ From implementation report of national multi centric pilot program on rabies, Madurai

³⁰ From implementation report of national multi centric pilot program on rabies, Madurai

8 Implementation of Rabies Control Interventions

The following section aims to describe the findings from the visits which the study team from PHFI made to six different districts. The investigating team visited the following institutions in each district:

- 1- Deputy Director of Health Services office to
 - a. collect dog bite and rabies incidence data
- 2- District Medical College Hospital or Government hospital to
 - a. Study treatment and referral practices
 - b. Understand burden of category 3 dog bites
 - c. Study data reporting mechanisms to the District Surveillance Unit
- 3- Tamil Nadu Medical Services Corporation Warehouse to
 - a. Understand supply patterns for different health institutions in the district
 - b. Collect vaccine supply data
- 4- Municipal Corporation office to
 - a. Assess ABC-AR activities in the municipality

8.1 Surveillance

Dog bites were included in the IDSP reporting format last year. They were being reported separately in the monthly disease burden reports in Tamil Nadu earlier. However, the data on dog bites as well as rabies suffers from a major limitation, i.e. it represents only those conditions that are reported in the rural PHC network. Dog bite cases presenting in health facilities being run by other institutions such as the DME and DMS as well as the private sector are not captured.

Almost uniformly across the state, there was no reporting on categorisation of dog bites or suspected rabies cases, possibly because information was not solicited in the IDSP reporting format. The study team also noticed lack of guidelines on case definition and management of ‘probable’ or ‘confirmed’ rabies cases. Some of the responses that they received included:

“If rabies case is reported, it will create big problem”

“we cannot diagnose rabies; we only report dog bites”

Most ‘serious’ dog bite cases were referred to urban facilities and from there to an Infectious disease hospital outside the district. Apart from ethical concerns about the treatment of suspect rabies cases, this has also resulted in preventing the district programme managers from owning up and reporting suspect rabies cases from their respective districts.

“Suspected cases of rabies are identified based on clinical features.... they are referred to nearest district hospital with isolation facilities..... but no confirmatory report received from them.... they may have died of rabies, but we don’t know”

- DDHS of a visited district in Tamil Nadu

Another finding that emerged uniformly across the state was lack of inter-departmental communication among different health directorates. It was noticed in several districts that suspect cases of rabies were presented in secondary hospitals in urban areas, but these were not reported in the IDSP data.

8.2 Vaccine Administration

IDRV PATIENT CARD

OPD No. _____ NAME: _____ Date: _____
 ADDRESS: _____ AGE: _____ SEX: M/F
 PATIENT'S WEIGHT: _____ Kg Date of Birth: _____

WHO CATEGORY OF EXPOSURE: Superficial / Deep

SITE OF BITE / EXPOSURE: ☐ Face / Head ☐ Palm / Foot ☐ Upper Trunk
☐ Lower Trunk ☐ Leg ☐ Hand ☐ Genitals

TYPE OF WOUND: ☐ Simple ☐ Multiple

ANIMAL: ☐ Dog ☐ Cat ☐ Others _____ Animal dead / Healthy / Not available

TREATMENT REGIMEN: 1. RIG ☐ 2. HRIG 20 IU/Kg ☐ ERIG 40 IU/Kg ☐

3. ID Schedule 2 sites

DAY	DUE DATE	DATE OF ADMIN	SITE OF INJECTION	ADVERSE REACTION
D0				
D1				
D7				
D28				

Calendar: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

Figure 25: IDRV Patient Card being used at a Taluka Hospital in West Tamil Nadu

We visited health facilities at different levels in the study districts and observed that at most centres invariably no categorisation of dog bites was being done. Instead, all dog bite cases were being treated as suspect rabid dog bites and treated on prophylactic basis and administered ARV. A copy of Intradermal Rabies Vaccine Patient Card was being provided to dog bite patients at a Taluka Hospital in one of the western districts.

CASUALTY
DOG BITE CENSUS CHART FOR THE MONTH OF Jan

DATE	MALE	FEMALE	WOMEN	POW	TOTAL	During Quar	Station
1-1-2020	30	5	8	2	47	47	20
2-1-2020	21	24	20	7	104	151	21
3-1-2020	40	18	18	16	80	231	28
4-1-2020	41	13	01	9	94	325	29
5-1-2020	52	15	10	17	95	420	28
6-1-2020	51	12	11	15	89	507	21
7-1-2020	50	17	28	5	96	603	28
8-1-2020	25	13	16	17	71	676	28
9-1-2020	39	7	15	7	68	744	21
10-1-2020	31	15	11	10	67	811	2
11-1-2020	54	16	16	12	98	909	2
12-1-2020	41	20	14	15	90	999	2
13-1-2020	40	11	10	9	70	1069	2
14-1-2020	48	16	12	8	84	1153	2
15-1-2020	43	16	11	10	80	1233	2
16-1-2020	48	12	13	1	74	1307	2
17-1-2020	42	21	10	12	85	1392	2
18-1-2020	48	21	18	10	107	1505	2
19-1-2020							
20-1-2020							
21-1-2020							
22-1-2020							
23-1-2020							
24-1-2020							
25-1-2020							

Figure 27: Dog bite Census in the Casualty Ward of a Medical College Hospital

CASUALTY
DOG BITE ARS CENSUS CHART FOR MONTH OF Jan

DATE	MALE	FEMALE	WOMEN	POW	TOTAL	GRAND TOTAL	81W
1-1-2020	4	2	1	1	8	8	4
2-1-2020	-	-	-	-	-	-	4
3-1-2020	1	1	-	-	2	9	21
4-1-2020	-	-	-	-	-	-	25
5-1-2020	-	-	-	-	-	-	21
6-1-2020	1	-	1	-	2	11	21
7-1-2020	1	1	-	1	3	14	21
8-1-2020	1	-	-	-	1	15	21
9-1-2020	-	-	-	-	-	-	21
10-1-2020	-	-	-	-	-	-	21
11-1-2020	5	6	2	1	14	29	21
12-1-2020	5	5	-	-	10	39	21
13-1-2020	1	-	1	-	2	41	21
14-1-2020	3	-	1	1	5	46	21
15-1-2020	1	-	-	-	1	47	21
16-1-2020	6	3	3	2	14	61	21
17-1-2020	-	-	-	-	-	-	21
18-1-2020	7	2	2	1	14	75	21
19-1-2020							
20-1-2020							
21-1-2020							
22-1-2020							
23-1-2020							
24-1-2020							
25-1-2020							

Figure 26: No. of patients being administered Immunoglobulin in the same Casualty (through a separate local procurement by the Medical College)

We found a lot of confusion amongst medical officers regarding route of administration of ARV. While most doctors were of the opinion that intradermal is the recommended route and several had been administering the vaccine through intradermal route for some time. However, there appeared to be a gap between official policy and its implementation; the ARV kits being supplied by TNMSC contained 5 ml syringes used for intramuscular injections confusing many doctors. An explanation provided to us was that there still remained doctors who have not been trained in intradermal administration and that the switch in procurement would occur post completion of training.

While anti rabies vaccine was available at all levels of health care, limited availability of immunoglobulin and isolation facilities in the state meant that most suspect rabies cases were referred to institutions located 100 km or more away. It is difficult to estimate the number of such cases because of a lack of data on categorisation of dog bites and probable rabies cases.

While the policy of vaccinating all dog bite cases with anti rabies vaccine may be politically expedient, it will involve substantial wastage of the vaccine. It has even more expensive cost implications if rabies immunoglobulins are introduced. Lack of dog bite category data will also prevent policy planners from accurately estimating quantum of dog bites and burden of probable rabies cases in the state.

8.3 Community Awareness

We were not able to comprehensively assess the community's perception regarding rabies control efforts. However, the programme managers and medical officers interviewed by us were of the opinion that there was increased awareness among the community regarding importance and availability of PEP.

The use of traditional methods like making nicks and applying lime, cow dung, turmeric or acid were still in vogue and people seemed to be more comfortable taking tetanus injections but not ARV. However, after the abandoning of per-umbilical administration of the earlier vaccine, there was increased acceptance of the newer vaccine.

People have increasingly started coming to government health facilities for ARV. IEC campaigns focussing on rabies were not observed in any district other than Madurai. Programme managers were of the opinion that there was increased demand for ARV at government health facilities primarily because of word-of-mouth publicity regarding availability of vaccine and also because private practitioners usually refer dog bite cases to the public health system because of easy availability of the vaccine.

8.4 Animal Birth Control – Anti Rabies Activities

ABC-AR activities are currently confined to urban areas by municipal administration as there is not enough capacity to provide the same services in rural areas. There is now a plan to scale-up the ABC-AR activities to all urban municipalities from the initial pilot phase of 50 municipalities.

“ABC is done for control of dog bites and not for rabies cases... it is done for controlling ‘animal scare’”

While the ABC-AR programme appears to have been well implemented in all the pilot districts, there appears to be a lack of clear cut guidelines regarding its implementation. An amount of Rs 445 per dog has been budgeted and its expenditure is being differently carried out in all the municipalities.

“Two workers catch one dog; sometimes they catch 10 dogs in one hour and on other occasions, they take upto three to four hours”

While some municipalities have created their own animal sheds with operation theatres, and provide additional honoraria to their own sanitary workers, others have outsourced the entire work to animal welfare organisations in the area. Typically, a team of 1-2 dog catchers along with a driver and van visit a locality and catch 4-8 dogs in a few hours. The caught dogs are sterilised and immunised the same day by private veterinary surgeons and given post operative rest of 3-7 days (for male female dogs, respectively). These dogs are released back at the same place they had been caught with small notches on their ear for future identification.

While it is noteworthy that Tamil Nadu has launched an ABC-AR programme on an unprecedented scale in other parts of the country, lack of detailed planning and excessive reliance of external agencies in the implementation of the pilot project has ensured that it becomes difficult to monitor its quality or progress. The mechanism of scaling-up the intervention in peri-urban and town panchayat areas needs further discussion.

Rabies virus circulation cannot be effectively controlled in urban ‘islands of containment’ unless rabies is sufficiently controlled in the rural areas immediately and long-term planning is done regarding rabies circulation among jungle fauna. There is need to study and discuss epidemiology of rabies and the impact of select interventions in more detail to allow preparation of a comprehensive rabies control policy in Tamil Nadu which might then also be used in other parts of the subcontinent.

9 Discussion

In spite of contributing to nearly 50% of preventable global mortality due to rabies, a coordinated National Rabies initiative in India has been lacking, not even as part of a larger disease control program. The multi-centric study of WHO³¹ estimated the burden of rabies in India as well as demonstrated the level of under-reporting. The study also pointed out glaring gaps in the knowledge and perception regarding rabies and its prevention/ treatment amongst the community as well as health care providers. These gaps in knowledge and perception have had a negative bearing on the treatment seeking patterns and treatment availability, thus contributing to high burden of dog bites and deaths due to rabies. The study also confirmed epidemiological patterns of rabies in India such as large stray dog population, these being the principal source of rabies in humans as well as, greater rural distribution of the disease.

Evidence on the effectiveness of interventions such as human vaccine (tissue culture vaccines; their delivery by intra-dermal use for greater cost benefit etc.), dog population control methods (ABC-AR), and environmental control measures (waste management) is well documented (Japan and Malaysia)³². However, policy uptake of this evidence in India has been patchy leading to fragmented and ineffective rabies control efforts in different cities and states. Underreporting of the disease has underestimated the problem, thereby leading to lack of political will to make investments in this preventable but hugely neglected public health issue.

In a first of its kind initiative, Tamil Nadu has rolled out state-wide rabies control efforts. Through the administrative structure of DPH, DME and DM&RHS, interventions have been made both in rural and urban areas. While there are gaps in surveillance, including completeness, coverage, quality and standardisation of data, this does not stop us from recognising the importance of several innovations in rabies control policy introduced by the Government of Tamil Nadu which has led to consistent success. Key state policies from which the initiatives have drawn strength include:

- State-wide ABC-AR programme in all Urban Local Bodies is a national first.
- State and district level multi-sectoral Coordination Committees to review and guide rabies control efforts
- Favourable regulatory environment through its legislation and policies on Licensing of Pet Dogs, guaranteed availability of vaccines and identification of dedicated funds for scale-up of ABC-AR strategy
- Establishment of infrastructure to make vaccines available at all government health facilities
- Encouraging innovations like
 - TNMSC procurement system

³¹ Anon (2004a). Assessing the burden of rabies in India. WHO sponsored national multicentric rabies survey 2003. Bangalore, Association for Prevention and Control of Rabies in India.

³² WHO. Rabies Fact Sheet N099 December 2008. <http://www.who.int/mediacentre/factsheets/fs099/en/>. Accessed 22.12.2009

- Engaging in Public Private Partnerships for waste disposal systems in municipalities
- Engaging private veterinarians for carrying out ABC-AR procedures

The policy frameworks, infrastructural provisions and innovations are definite enabling mechanisms in Tamil Nadu in its pursuit of future rabies elimination. However, certain key deficiencies/ gaps in initiatives would need to be overcome so that impact of the above is not blunted. In the presence of these gaps, the present study faced problems in establishing the impact of the above interventions. Gaps identified included the following:

The distribution of rabies in India is predominantly rural³³. Accordingly, public health efforts should have greater focus in these areas. However, rural and peri-urban areas in Tamil Nadu do not have animal control measures. In addition, the impact of rabies control initiatives in corporation/ municipal areas in urban Tamil Nadu will have a tendency to get neutralised by spill-over of stray dog population from these areas.

In spite of its extensive network of personnel and institutions and its presence in rural areas, with its focus largely directed to large animals and small ruminants, the Animal Husbandry department has played a very limited role in dog population/ vaccination control efforts in rural areas.

Surveillance of both human and animal rabies is essential to detect high-risk areas and outbreaks quickly and to monitor the use of vaccine. An expert consultation on Rabies sponsored by WHO in 2005³⁴ proposed standards in establishing surveillance systems for assessing burden of rabies among humans and animals. It cautioned against focusing on lab-confirmed rabies cases alone for surveillance as that could lead to *severe underestimation of true number of human cases, resulting in low priority being given to rabies control*. Collecting data on suspect cases and clinical assessment of rabies will result in epidemiologic more meaningful information. Reporting of lab confirmed human rabies cases alone may lead to severe underestimation of true number of human cases, resulting in low priority being given to rabies control. Therefore data on suspect cases and clinical categorisations is essential.

WHO thus recommends that rabies surveillance in human populations should include:

- Surveillance of human exposure to rabies i.e. dog bites and bites from other animals known to transmit rabies to humans
- Surveillance of cases of human rabies
- Rapid exchange of information with services in charge of animal rabies surveillance and control epidemiological investigation of outbreaks

The following measures should be taken for establishing rabies surveillance in animal populations:

- Surveillance should be laboratory-based. Brain specimen of the suspected animal for laboratory diagnosis should be tested when human exposure occurs (immediately or if immediate submission is not possible, then after a period of observation for 10 days).

³³ Anon (2004a). Assessing the burden of rabies in India. WHO sponsored national multicentric rabies survey 2003. Bangalore, Association for Prevention and Control of Rabies in India. (Also refer to Figure 16 on page 26)

³⁴ WHO Expert Consultation on Rabies, First Report. WHO Technical Report Series, No. 931. World Health Organisation. Geneva (2005)

- In circumstances where samples cannot be collected from the suspected rabid animal or a laboratory diagnosis cannot be made, cases to be recorded as suspected animal rabies cases on the basis of clinical signs; and these data should also be collected and exchanged with public health authorities.
- Rapid exchange of information between services in charge of human and animal rabies surveillance and control.

Data on dog bites and human rabies cases/ deaths are reported by DPH, DME and DM & RHS. The data reported, however, is not standardised across departments. Reported data also does not provide details on the type of human dog bites by categories and completed vaccinations. This deficiency does not allow correlation of disease burden with vaccine consumption. Laboratory diagnosis has been made available only recently in Madurai Medical College (last 1 year) under the NCDC, Delhi pilot project. The facility has, however, not been utilised at all in the last one year, either by the human or animal health departments.

Corporations/ municipalities do not report human dog bites/ rabies data. Thus data used in the present analysis was not segregated as urban and rural and hence accurate estimates of disease burden in urban areas is not available. Data in these areas was estimated only indirectly by assuming catchment areas of the reporting directorates DPH and DME as representative of rural and urban picture, respectively.

On the animal health side, data on dog rabies (including data based on laboratory diagnosis) is not reported by any department. Data on dog ecology (including outputs of ABC-AR activities) is deficient and dog population surveys are not up-to-date.

Finally, the coordination committee mechanisms are recent developments and traditionally the intersectoral coordination has not been effective in facilitating exchange of surveillance information between sectors so as to allow better and more targeted interventions.

All these gaps in rabies control initiatives of different departments, do not allow ascertaining the impact of various interventions conclusively, both human and animal.

Currently DPH is best placed to do so in rural areas if surveillance criteria are made technically sound. With a good lab set up possible extension of the programme could be typing of the rabies strain in view of the increased inter-state, inter-species and international transfer of animals.³⁵

Evidence from above multiple databases, however, allowed us to triangulate available information and interpret the overall trend of rabies and impact of programme interventions in Tamil Nadu.

As depicted in Figure 11 on page 31, there appears to be a decline in incidence of rabies reported in the rural PHCs from 0.75 in 2004 to 0.43 per 100,000 population in 2008. This has been accompanied with an increase in reported dog bite cases in rural areas from 202 to 498 dog bites per 100,000 population in the same period.

³⁵ WHO Expert Consultation on Rabies, First Report. WHO Technical Report Series, No. 931. World Health Organisation. Geneva (2005)

When we try to compare the rural picture with urban areas (Figure 13 & Figure 14), the difference in proportion is stark. It is possible that the 'urban figures' depicted in the report should be taken as merely indicative of the true picture.

Several explanations could be possible for the above finding. It could be possible that access to vaccines could be much better in urban areas, possibly because of more awareness and/or higher perceived quality of care at the Medical Colleges. We noted during informal conversations with TNMSC staff that urban hospitals account for a greater portion of vaccine consumption. It is also possible that urban centers will have better qualified doctors, and consequently, better, and more strict, diagnostic criteria (in the absence of laboratory diagnosis in most districts of Tamil Nadu, we assume that rabies cases are 'diagnosed' based upon their clinical presentations). Urban areas also have dog population control measures in the form of ABC-AR programme. However, due to non-availability of dog population survey data, we could not ascertain the impact of ABC-AR programme in corporation/ municipal areas.



Figure 28: Major strengths and challenges of rabies control efforts in Tamil Nadu

Over all, there appears to be an increase in the reported dog bite incidence and a corresponding decline in reported rabies incidence in Tamil Nadu between 2004 and 2008. The phenomenon is also supported by a steady increase in vaccine consumption (Figure 8) in the corresponding period.

Procurement and guaranteeing availability of vaccines at all health facilities is a remarkable achievement. Though there is no justification for the assertion in the limited data available to us, it is very likely that the availability of free vaccines will have positively contributed to increase in the reported dog bite cases and successful saving of countless lives. Interestingly, districts having high incidence of dog bites, frequently do not have a TNMSC warehouse available in the district. If this finding is substantiated for other emergency medications as well, it might make case for reconsidering the supply chain management system at the TNMSC.

There is district-wise variation in reported dogbite cases and rabies cases that needs deeper examination. A detailed study of these districts can help us exclude reporting and recording errors and better understand the reasons behind a successful intervention. Illustrative examples have been discussed in Section 6.5 Micro Trends on page 34 and possible factors influencing surveillance have been discussed in Section 8.1 on page 44.

It was found (page 35) that the high burden districts (in central Tamil Nadu) account for most of the disease burden (dog bites), treatment consumption (vaccines) and possibly, have highest levels of causative factor (dog population). If data from other departments is collated and further analysed, it will be possible for the Government of Tamil Nadu to identify high burden districts and strategically focus its interventions.

Several implementation challenges were observed in the course of our district visits. There was variable reporting of dog bites and rabies cases due to their absence from the IDSP reporting format and unclear case definitions. Information was not being received from different directorates leading to decreased sensitivity of the surveillance systems. There was confusion regarding state policy about the route of administration of ARV because of the packaging of the vaccine vials. No categorisations of dog bite cases was being done and all reported cases were being administered ARV. This has substantial cost implications and might influence the decision to introduce rabies anti sera in the public health system. 'Severe dog bite cases' were being referred to distant districts because of inadequate treatment and containment facilities.

10 Conclusions & Recommendations

10.1 Conclusions

The policy frameworks, infrastructural provisions and innovations by Government of Tamil Nadu have provided enabling mechanisms for state-wide rabies prevention and control initiatives. The present study made the following conclusions at the end of this assessment of various initiatives:

- State-wide ABC-AR programme in urban areas, steady supply and judicious use of vaccine for human dog bite cases in both rural and urban areas, innovative mechanisms for involvement of private sector in waste management and dog population control are key initiatives contributing to success in rabies prevention and control
- Gaps in surveillance standardisation across reporting departments and surveillance coordination between sectors along with absence of ABC-AR programme in rural areas and limited role played by Animal Husbandry Department are key impediments to rabies prevention and control in Tamil Nadu.
- Available surveillance data, both human and animal, does not allow definitive comment on the impact of various interventions for prevention and control of rabies. Triangulation of different data sets allows only general interpretation of trends
- Reported incidence of dog bites has increased in rural areas between 2004 and 2008; incidence of rabies has declined during the same period. A similar trend is expected for the urban areas.
- The trend is more pronounced in urban areas compared to rural areas – reported dog bite incidence is higher and human rabies incidence lower in urban areas – indicating greater impact of rabies prevention and control initiatives in urban areas, especially ABC-AR programme which is operational only in urban areas.
- There is considerable heterogeneity by districts in reported dog bite incidence and rabies incidence. This needs deeper examination to exclude reporting and recording errors and better understand the reasons behind a successful intervention.
- High burden districts account for most of the disease burden (dog bites), treatment consumption (vaccines) and possibly, have highest levels of causative factor (dog population). These could be districts for strategic focus of interventions.
- Based on rural and urban trends and state level vaccine consumption data, over all there appears to be increased reporting of dog bite incidence and decline in human rabies incidence in Tamil Nadu
- Following improvements in above mentioned areas and appropriate customisation, Tamil Nadu rabies control initiatives provide an effective template for replication in other states and cities.

- Apart from replication of rabies control efforts in other states, the rabies initiative in Tamil Nadu provides a promising model for establishing zoonotic disease control programs at the state and national levels as well
- Due to lack of operational guidelines, the ABC-AR project is being implemented in different ways across the state possibly with variable quality.
- Reported dog bite data can potentially be used for detecting and controlling local outbreaks of dog bites if not rabies through the district monitoring committee
- There were several knowledge gaps noticed in the course of the study that are important to gaining an understanding of the impact of the interventions and which will be important for monitoring the quality of their implementation. The knowledge gaps include information on disease burden among humans and animals including projections and costing data.

10.2 Recommendations

10.2.1 Establish surveillance on human as well as animal side

Establishing rabies reporting systems, especially to detect and contain outbreaks of rabies is a major challenge which can be addressed.

Suggested Action:

- Collect and compile data on dog bites and their categorisation and rabies cases by other directorates in a manner similar to the one adopted by DPH
- Strengthen routine surveillance systems and data from all sources at one administrative level by analysing it at one place
- Have a good laboratory set-up and extend the programme by typing the rabies strain in view of increased inter-species, inter-state and international transfer of animals

10.2.2 Strengthen State-level coordination committee

The recently constituted State level multisectoral coordination committee is an ideal mechanism for promoting intersectoral coordination.

Suggested Action:

- Engage stakeholders through regular meetings and exchange of ideas
- Develop strategic road map and vision that provisions for effective rabies control programme
- Facilitate multisectoral collaboration for prevention and control of other endemic and emerging zoonoses in general

10.2.3 Identify and fill gaps in current implementation

Rural and peri-urban areas pose a major threat to the success of rabies control efforts in Tamil Nadu. Given the evolved state of administration in Tamil Nadu, it is important to bridge this gap in the rabies control plans.

Suggested Action:

- Involve state level agencies with local reach along with local stakeholders in the implementation of this programme.

10.2.4 Build upon existing intersectoral coordination mechanism at peripheral level

Several innovative institutions exist at the municipal level for implementation of rabies control activities.

Suggested Action:

- Establish similar mechanisms at the levels of other local bodies
- Partner with Department of Animal Husbandry, town panchayats and village panchayats and others to scale-up activities in rural areas

10.2.5 Adopt phased approach to implementation and scaling-up

If the rabies control programme is to be implemented in rural areas, the scale of activities will necessarily require a phased approach to allow for programmatic learning to take place and for institutional capacity to develop.

Suggested Action:

- Identify high burden districts through analyses similar to the ones attempted here and these could be focussed upon in the initial phase.

10.2.6 Document Rabies intervention as a model for replication

Suggested Action:

- Document how rabies surveillance and control efforts were strengthened and scaled-up in a planned and strategic manner and share with other states/national level for possible replication
- Draft a blueprint that can guide the national disease control programme to combat rabies and other zoonoses in the country

Annexure: List of Abbreviations

ABC	Animal Birth Control
ABC-AR	Animal Birth Control & Anti Rabies Immunisation
ARS	Anti Rabies Serum
ARV	Anti Rabies Vaccine
AWBI	Animal Welfare Board of India
BCI	Blue Cross of India
DAH	Department of Animal Husbandry, Govt of Tamil Nadu
DH	District Hospital
DME	Directorate of Medical Education
DPH	Directorate of Public Health & Preventive Medicine
DRH&MS	Directorate of Rural Health & Medical Services
HMIS	Health Management Information Systems
id	Intra dermal
IDRV	Intra Dermal Rabies Vaccine
im	Intra muscular
IEC	Information Education Communication
MAD	Municipal Administration Department
MOHFW	Ministry of Health & Family Welfare
NCDC	National Centre for Disease Control (Formerly, National Institute of Communicable Diseases)
NGO	Non Government Organisation
OPD	Out Patient Department
PEP	Post Exposure Prophylaxis
PETA	Promotion of Ethical Treatment to Animals
PFA	People for Animals
PHC	Primary Health Centre
PHFI	Public Health Foundation of India
SC	Supreme Court of India
SPCA	Society of Prevention to Cruelty Animals (SPCA)
T/t	Treatment
TCV	Tissue Culture Vaccine
TN	Tamil Nadu
TNMSC	Tamil Nadu Medical Services Corporation
WHO	World Health Organisation