Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 8, Issue, 10, pp.40589-40593, October, 2016

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

ASSESSING THE BURDEN OF HUMAN DOG BITE CASES IN PUDUCHERRY, INDIA

***Vijayan, C., Ajay Kumar, V. J., Bhattacharya, A. and Leonal Rabins**

Department of Veterinary Public Health and Epidemology, Rajiv Gandhi Institute Veterinary Education and Research, Kurumbapet, Puducherry - 605009

ARTICLE INFO

Article History:
Received 20th July, 2016
Received in revised form
05th August, 2016
Accepted 08th September, 2016
Published online 30th October, 2016

Key words:

Economic impact,
Dog bite cases,
Vaccination,
Rabies.

ABSTRACT

Background and Objectives: The epidemiological study was conducted to determine the distribution, determinance and economic impact of human dog bite cases in Union Territory Puducherry, India. The total population of puducherry is estimated around 1,244,264 in 2015.

Materials and Methods: There are 39 Primary Health centers in the UT Puducherry (15 Urban & 24 Rural). This retrospective study was based on data from 12 Urban PHCs of Puducherry region, during the year 2015 and it collected data were analyzed considering age, sex, animal species, part of body bitten, vaccination regimen etc. In these study man-days exposure and also man-days lost were also calculated.

Results: In the year of study, a total of 3635 human dog bite cases were recorded. Out of 3635 bite cases 61.62 per cent were males and 38.38 per cent were females. Among different age groups 35.50 per cent, 28.61 per cent, 24.00 per cent and 11.89 per cent of cases belonged to middle age, old age, children and teenagers, respectively. Most of the human bites were due to dogs (96.20 per cent). Among dog bites 84.00 per cent were due to stray dogs and 16.00 per cent was pet dogs. This was followed by cats (3. 25 per cent) and monkeys (0.55). In most of the people were bitten on legs (86.5 per cent), followed by hands (13.00 per cent) and other body parts (0.50). All the victims were treated by inactivated diploid cell anti rabies vaccine and no anti rabies serum was used. Based on the observation nearly 30.12 per cent of the victims did not complete their full course of vaccination regimen. Maximum numbers of cases were reported during the month of October to December (27.37 per cent). While estimating the man-days of exposure to the animal bites in Puducherry is projected to 2921 per one million of population in one year (29 per 10,000 populations). In cost analysis, estimated cost of ARV alone can be projected as Rs.26, 89,900 for the reported cases alone, approximately treatment expenditure was Rs.3, 63,500, miscellaneous cost was assessed as Rs. 9,08,750 and Man-days lost based on 5 days on each cases is causing a loss of Rs. 1,52,67,000. The total estimated lose for UT taking in to consider only cases reported in Puducherry government PHCs is Rs. 4,34,37,050. The study clearly shows amount of money lost on human dog bite cases is around 2.0% of the total money spent on the public health welfare in Puducherry.

Conclusion: By effective stray dog control and by licensing of pet dogs in an area were loss can be reduced and that money can be used effectively by other development activities.

Citation: Vijayan, C., Ajay Kumar, V. J., Bhattacharya, A. and Leonal Rabins, 2016. "Assessing the burden of human dog bite cases in Puducherry, India", *International Journal of Current Research*, 8, (10), 40589-40593.

INTRODUCTION

Rabies or hydrophobia is a contagious viral disease of dogs and other warm blooded animals which is almost invariably fatal. The disease causes serious public health problem because of its zoonotic nature. It ranks 10th among the causes of human death due to infectious diseases worldwide. The disease is still a challenge in developing world as 99 per cent of total human deaths are occurring in tropical developing countries (Haupt, 1999). India alone contributes approximately 36 per cent of these total rabies related deaths (Chatterjee, 2009). Over 55,000 people die from rabies worldwide annually, 95 per cent of them in Asia and Africa (WHO, 2010). Out of the total human death between 30 per cent to 60 per cent are children aged less than 15 years. In India, 95-97 per cent of human deaths due to rabies are because of dog bite and annual incidence of bite is 1.7per cent (Sudarshan *et al*., 2006). In majority of cases, these bites go unreported and are unrecognized by their parents and health officials, resulting in a much higher risk of complications and deaths among children compared to adults. It is likely that the total number of deaths in many parts of the world is much higher than official estimates. Experts from animal as well as human health sectors agree on the controllable nature of the disease and on the importance of joint population level interventions for restricting disease transmission among animals and humans (WHO, 2005 and Briggs, 2010). Evidence from India and elsewhere demonstrates the efficacy of principle rabies intervention strategies. Indian researchers have studied the application of different post-exposure prophylaxis (PEP) regimens among humans (Madhusudana, 2003). Indian researchers have also used the experience of dog population

****Corresponding author: Vijayan, C.***
Department of Veterinary Public Health and Epidemology, Rajiv Gandhi Institute Veterinary Education and Research, Kurumbapet, Puducherry - 605009

control in specific urban settings to demonstrate the impacts of animal birth control strategies (Totton *et al*., 2010; Reece and Chawla, 2006). Of late there is mounting evidence produced by international researchers related to the efficacy of anti-rabies immunization among animals in reducing rabies transmission (Hampson *et al*., 2009). Economic assessments have also been conducted in different parts of the world which study the economic impact of rabies (Knobel *et al*., 2005), economics of rabies control (Zinsstag *et al*., 2009) and cost effectiveness of different post-exposure prophylaxis regimens (Hampson *et al*., 2011). However, as previously documented, rabies researchers have not been able to satisfy the information needs of policymakers (Kakkar *et al*., 2012) and the economics of rabies control remains a ''significant constraint'' in rolling out rabies control programmes in low income countries (Lembo *et al*., 2010; Bogel and Meslin 1990). A possible explanation could be that to date; only a handful of studies have looked at combined costs of rabies across human and animal sectors (Knobel *et al*., 2005; Zinsstag *et al*., 2009). Accordingly, we undertook a burden assessment based upon an earlier study (Abbas *et al*., 2011) of rabies control initiative in the Southern Indian Union territory of Puducherry.

Puducherry rabies control initiative

Puducherry is one of the Union territory in India having a population of 12 million (Office of the Registrar General Ministry of Home Affairs Government of India, 2015) and is considered one of the better performing states in public health (Gupta *et al*., 2010). In response to calls for controlling dog bites and rabies, the state government of Puducherry formed a state level rabies coordination committee in 2008 to develop and manage a multi sectoral response to dog bites and rabies in the state. As described in Table 1, the human interventions consisted of ensuring availability of anti-rabies vaccine at all government-run health facilities in the state as well as promoting awareness about rabies control across the state. Rabies antibody was not provided universally due to perceived high costs. The animal interventions involved outsourcing of ABC-AR operations to private veterinarians; dog catching operations were handled by local animal welfare organizations in selected urban areas of the state. ABC-AR was conducted throughout the year as specified in the guidelines of Animal Welfare Board of India; vaccination-only strategies, whether parenteral or oral, were not considered. The interventions were supposed to be implemented in a continuous fashion throughout the year and not conducted in a campaign mode. The animal and human sector interventions were implemented by different departments and coordinated at the state and district levels through formal multi-stakeholder coordination mechanisms (Abbas *et al*., 2011).

Table 1. Interventions employed for rabies control in Puducherry

S.No	Implementing Sector	Interventions for rabies control
1	Human Interventions	1. Inclusion of dog bite cases 2. Easy availability of anti-rabies vaccination 3. Training for intra-dermal vaccination 4. Antibody provision 5. Community Awareness

Human sector interventions

Based upon the existing interventions in Puducherry, it was assumed that the entire population in urban (rural not included) would be covered by the expanded intervention. Costs were estimated for two combinations of interventions. Based upon the existing intervention model, the first set of interventions consisted of increased surveillance and awareness, in addition to provision of anti-rabies vaccine (ARV) to all patients reporting dog bites at public health facilities. The second combination of interventions involved an additional component of antibody administration to patients with severe dog bites in addition to the ARV. Based upon the feedback received from local program managers (Abbas and kakkar, 2013), it was assumed that dog bite cases that report at peripherally located and low-throughput health centres would be provided with rabies vaccine through the easier intramuscular route. While the national guidelines (National Institute of Communicable Diseases, 2007) recommend vaccination only for category 2 and category 3 dog bites, in practice, the vaccine was being administered to all reported dog bite cases, which was factored into our analysis.

MATERIALS AND METHODS

There are 39 Primary Health centers in the UT puducherry (15 Urban & 24 Rural). This retrospective study was based on data from 12 Urban PHCs of Puducherry region. The patients presented to primary health centers in Puducherry region during the year 2015 (January to December) with clinical history of animal bite wounds (dogs, cats and monkeys) were also included in the study. Observations were made regarding the following:

1. Age of the patients (children, teenagers, middle and old age),
2. Sex of the patients,
3. Part of body bitten (Hands, legs and other parts of the body),
4. Animal species (Canine, feline and monkeys),
5. Vaccination regimen.

The estimation of the burden of human bite case in Puducherry and cost of implementing the interventions for human populations, miscellaneous cost and man-days lost were calculated separately and the costs for different components within this intervention were disaggregated. Costs were calculated from the perspective of government, which was the provider for bulk of the services. Costs were estimated for five different combinations of interventions described in Table 1. All costs were inflated to 2012 Indian Rupees using national financial data. Costs of implementing human and animal rabies control interventions per individual were given in the Table no. 2 (Abbas *et al*., 2015).

Table 2. Costs of implementing human rabies control interventions per individual

S.No.	Interventions	Cost per dog bite patient/ Cost per vaccinated dog
1	Human Interventions	
	a. Anti-rabies vaccine+Antibodies and	a. Rs. 607
	b. Anti-rabies vaccine only	b. Rs. 185

Limitations

The study is based upon one-time costs data collected from state programme managers. Therefore the analysis only considers those human cases that were reported to the Primary

Health Centers in the Puducherry region. This is likely to be an underestimate. Moreover, there is limited data on the completion of treatment; and it is possible that a small portion of patients might not complete their treatment, leading to a further underestimate of dog bite incidence rate. The current analysis estimates the cost of an year-long continuous routine vaccination strategy which is likely to provide a conservative estimate of likely costs. More long-term efficacy studies for different interventions are required to better comment upon their cost effectiveness.

RESULTS

In the year 2015, a total of 3635 human dog bite cases were recorded in 12 primary Health Centers in the Puducherry region. From observation, it was identified as almost all the age groups of people were bitten by animals. In that, highest per cent of animal bite was recorded in the middle age group of peoples (35.50 per cent) followed by old age group (28.61 per cent), children (24.00 per cent) and teenagers (11.89 per cent). Data about the age groups of patient are shown in the Table no. 3 and figure no. 1.

Table 3. Age groups of the patients

S.No.	Age groups	No. of cases	Per cent
1	Children (0 to 12 years)	871	24.00
2	Teenagers (13 to 19 years)	432	11.89
3	Middle age (20 to 49 years)	1290	35.50
4	Old age (above 50 years)	1042	28.61
5	Total	3635	100.00

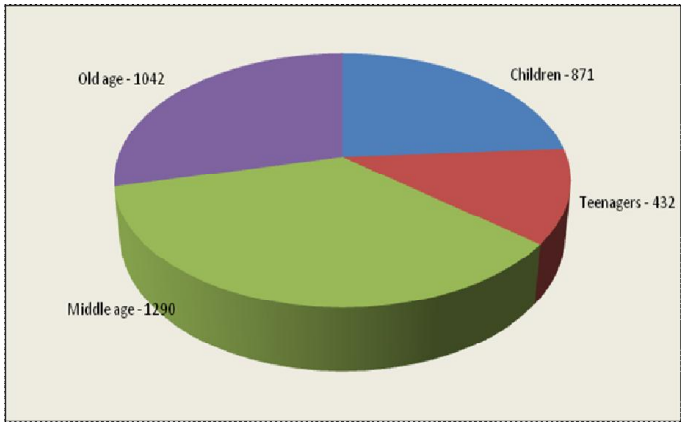

Fig.1. Age wise classification of human bite cases

On sex wise classification of the human bite cases, more males had animal bite (61.62 per cent) compared to the females (38.38 per cent) which included male and female children. Details about the sex wise classification of human bite cases are given in the Table no. 4.

Table 4. Sex wise classification of human bite cases

S.No.	Sex of the human bite cases	No. of cases	Per cent
1	Male	2240	61.62
2	Female	1395	38.38
3	Total	3635	100.00

Regarding the part of body bitten by the animals, nearly 86.50 per cent were bitten on legs, 13.00 per cent on hands and 0.50 per cent were on the other parts of the body. Details about the body parts bitten are given in the Table no.5.

Table 5. Parts of body bitten by animals

S.No.	Parts of body bitten	No. of cases	Per cent
1	Hands	472	13.00
2	Legs	3144	86.50
3	Other parts of body	30	0.50
4	Total	3635	100.00

Almost three animal species were involved in the human bite cases, like dogs, cats and mokeys. Most of bites were from the dogs (96.20 per cent). In that dog bites 84.0 per cent were by stray dogs and 16.0 per cent were by pet dogs. Followed by the dogs, cats (3.25 per cent) and monkeys (0.55 per cent). Results of animal species involved in human bite cases is shown in the Figure no. 2

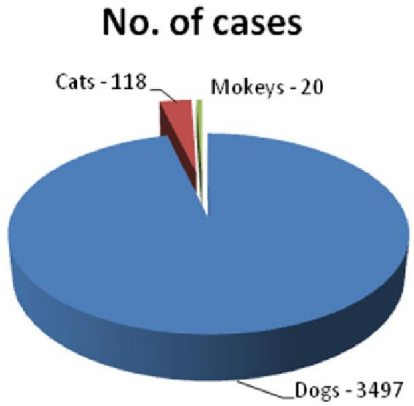

Fig.2. Animal species involved in human bite cases

All the victims who reported in the Primary Health Centers in the Puducherry region were treated by using the inactivated diploid cell anti rabies vaccines but no one was treated with antirabies immune serum. Based on the observation of the vaccination registers of the PHCs, nearly 30.12 per cent of victims did not complete their full course of vaccination regimen which indicates probably 69.88 per cent of the victims only complete their full course of post bite ARV regimen. Highest occurrence of the animal bites mainly dog bites were noticed in the period of October to December (27.37 per cent), followed by January to March (26.69 per cent), April to May (23.77 per cent) and least number of cases were in the period of July to September 22.17 per cent. The data about the human bite cases based on the months is shown in the figure no. 2.

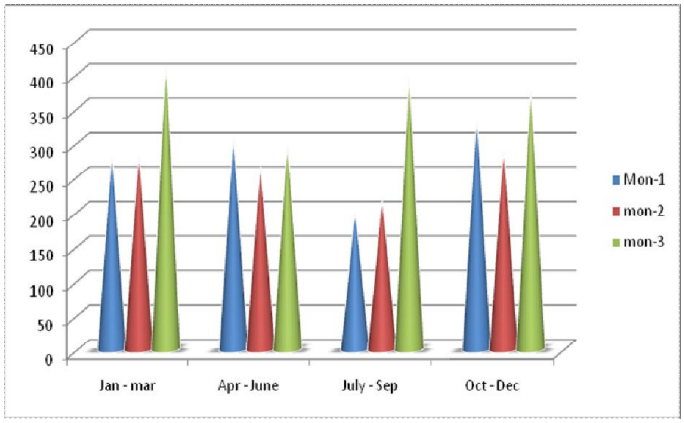

Fig.2. Distribution of dog bite cases in human during 2015

Estimating the burden of human bite cases in Puducherry

All the 3635 cases were used for the estimation based on the population. Subsequently, the actual annual animal bite case in human incidence was calculated on the basis of man-days exposure. The resultant estimate figure was 29 per 10,000 populations.

Man-days of exposure

Urban population in 2015 = 860519 X 365 = 314089435 man-days
Rural population in 2015 = 383745 X 365 = 140066925 man-days
Total man-days of exposure = 1244264 X 365 = 454156360 man-days
Total animal bite cases reported = 3635

$$\text{Number of bite cases per one lak. Man} - \text{days of exposure} = \frac{3635}{454156360} X100000 = 0.8003851361$$

Number of bites/one lakh. Man-years of exposure = 0.8003851361 X 365= 292.140574669

Number of bites/one million populations in one year = 292.140574669 X 10 = 2921 (29 per 10,000 population)

Cost analysis in human intervention

The important two different interventions for controlling rabies among the human population are ARV alone and other one combination with immunoglobins. In India cost of providing ARV alone is around Rs.185/patient and combination with immunoglobins is estimated about Rs.607/patient. All the victims in the study were treated by ARV only. The estimated cost of ARV alone can be projected as Rs.26, 89,900 (incase of 4 doses per patient) for the reported cases. Approximately treatment expenditure including antiseptics, syringes etc. were comes to Rs.3, 63,500. Tentative miscellaneous cost like travel etc. were Rs. 9,08,750 and Man-days lost based on 5 days on each cases is causing a loss of Rs. 1,52,67,000. The total estimated lose for UT taking in to consider only cases reported in Puducherry government PHCs is Rs. 4,34,37,050.

DISCUSSION

In this study, highest animal bites were noticed in the middle age group of people (35.5 per cent) followed by old age (28.61 per cent), children (24.00 per cent) and teenagers (11.89). But the studies conducted by Domple *et al*., 2015 in Maharastra reported that majority of bite cases were from children below 10 years (30.8 per cent) compared middle age and teenage peoples (21.2 per cent). This may be due to the fact that middle age group of peoples are more active in work and they tend to move out more often at anytime. In the study by Bedi *et al*., 2006, they found that more than half of the animal bite cases were in children lesser than 10 years of age. Male had higher incidence of bites (61.62 per cent) than females (38.38 per cent). This finding corroborates with other study by Hanspal *et al*., 2007. Similarly, more bite cases among males (65.1 per cent) in the study by Shankaraiah *et al*., 2015. Males are mostly the victims of animal bites because as they were more mobile than female. Nearly 86.5 per cent were bitten on legs, followed on hands (13.00 per cent) and other body parts (0.5 per cent). Which is Similar to the findings by Shankaraiah *et al* (2015) and Domple *et al*. (2015). The most common site of the bite was legs, as it is the most easily approachable part of the body for animals. Mostly the animal bite cases were from the dogs (96.20 per cent), is that stray dogs (84.0 per cent) and pet dogs (16.0 per cent) followed by cats (3.25 per cent) and monkeys (0.55 per cent). Sudarsan *et al*., 2007 reported 96.2 per cent of bites from the dogs. The majority of these were stray dogs (75.2 per cent), followed by pets (11.1 per cent), cats (1.7 per cent) and wild animals (3.5 per cent). Dog bites were mainly responsible for the rabies and the majority of these were by stray dogs. Similarly, other studies have identified dogs as being the main animal responsible for human rabies death in India. Consequently, the key to human rabies prevention and control in India lies in the successful control of canine rabies and the stray dog population. The study reveals that 30.12 per cent of victims did not complete their full vaccination regimen which indicating probably 69.88 per cent of the victims only completed their full course of post bite ARV regimen. Bhalla *et al*., 2005 also revealed 56.0 per cent of victims only complete their full vaccination regimen in Jammu, India. Gogtay *et al*. (2014) reported 22.0 per cent did not complete the full vaccination regime in Mumbai. This indicates still peoples are not aware about the rabies and also about the importance of completing the course of vaccination against therabies. Highest occurrence of dog bite cases were noticed during the period of October to December (27. 37 per cent). This finding is in par with the study by Hanspal *et al*. (2007) who reported higher incidence during winter (December to February) and the study by Agarwal *et al*. (2004) who found higher incidence in summer (May-July). This may be due to the fact that during winter the female dogs are lactating and fear of hurting their puppies makes them more aggressive. The abnormal behaviour of biting dogs for which they are even killed is most commonly seen in December to May. The new estimate of about 2921 or 29 per 10,000 population annual human dog bite cases based on the survey indicates needs for improving the present rabies control measurement and increase usage of modern rabies vaccine, particularly in urban peoples. A similar study was conducted by sudarshan *et al*., 2015 in India and they reported nearly 20,000 or 2 per 100000 population were suffered by rabies annually. The cost analysis based on the number of cases in present study due to animal bite cases at population level rabies control programme in Puducherry revealed total estimated loss for UT taking into consider only cases reported in Puducherry government PHCs is Rs. 4,34,37,050(4.3C). Puducherry budget 2015 for Health and Family Welfare was an outlay of 330 crore has been proposed in the Annual Plan 2015-16. This allocation is` 103 crore more than the last year's outlay. The study clearly shows amount of money lost on human dog bite cases is around 2.0% of the total money spent on the public health welfare in Puducherry.

Conclusion

Rabies control efforts in Puducherry seem a costly proposition as they are currently structured in the state. This would necessarily require high levels of technical, political and financial commitments before the government chooses to start upon a long-term rabies control strategy. Given recent recognition of the need for a national rabies control programme in India by the National Centre for Disease Control and the FAO/WHO/OIE tripartite statement on inclusion of rabies as an 'entry point' for demonstrating zoonoses control

efforts at the global level, it is important that these discussions adopt a long term perspective and take local complexities into account before developing a national or a global rabies elimination strategy. The study also points the need of stray dog population control directly and proper waste disposal indirectly as the stray dogs and other animals depends upon the waste for survival. The need for health education and proper counseling when they appear for treatment is very essential to ensure completion of vaccination regimen.

REFERENCES

Abbas SS and Kakkar M 2013. Systems thinking needed for rabies control. *Lancet,* 381: 200.

Abbas SS, Venkataramanan V, Pathak G and Kakkar M .2011. Rabies control initiative in Tamil Nadu, India: a test case for the ''One Health'' approach. *Int Health,* 3: 231–239.

Agarwal N and Reddajah VP 2004. Epidemiology of dog bites: A community based study in India. *Trap Dod*., 34 (2): 76 - 8.

Bedi R, Bedi DK, Tankha A, Choudhry V and Matoria RS 2006. Profile of animal bite cases attending Anti Rabies Clinic of JLN Medical College & Hospital, Ajmer; *APCRI Journal*, 8(1): 28-30.

Bhalla and MehetaSingh JP 2005. Knowledge and Practices among General Practitioners of Jamnagar city regarding Animal Bite. *IJCM*, 30(3): 94 - 96.

Bogel K and Meslin FX 1990. Economics of human and canine rabies elimination: guidelines for programme orientation. *Bull World Health Organ.,* 68: 281–291.

Briggs DJ 2010. Reducing the global burden of rabies. *Int Health,* 2: 161–2.

Chatterjee P 2009. India's ongoing war against rabies. Bull World Health Organ 87:890-89.

Domple VK, Doibale MK, Sonkar VK, Aswar NR, Khadilkar HA and Jain SR. 2015. Treatment compliance of self-reported dog bite cases attending outpatient department of Tertiary Care Hospital, Maharashtra. *Int J Med Public Health*, 5:297-300.

Global Alliance for Rabies Control 2011. Blueprint for rabies prevention and control.

Gogtay NJ, Nagpal A, Mallad A, Patel K, Stimpson SJ Belur A and Thatte UM 2014. Demographics of animal bite victims & management practices in a tertiary care institute in Mumbai, Maharashtra, India. *Indian J Med*., 139: 459-462.

Gupta M, Das S, Desikachari BR, Shukla R, Somanathan TV and Padmanaban P, 2010. How Might India's Public Health Systems Be Strengthened? Lessons from Tamil Nadu. *Econ Polit Wkly XLV*: 46–60.

Hampson K, Cleaveland S and Briggs D 2011. Evaluation of cost-effective strategies for rabies post-exposure vaccination in low-income countries. *PLoS Negl Trop Dis.,* 5: e982.

Hampson K, Dushoff J, Cleavel and S, Haydon DT and Kaare M. 2009. Transmission dynamics and prospects for the elimination of canine rabies. *PLoS Biol.,* 7: e53.

Hanspal, J.S. 2007. A review of attendance trend of animal bite cases in the Anti-Rabies Clinic of GGS Hospital, Jamnagar (Gujarat); *APCRI Journal*, 3(2): 16-18.

Haupt W 1999. Rabies- risk of exposure and current trends in prevention of human cases. *Vaccine*, 17:1742-1749.

Kakkar M, Abbas SS, Raghuvanshi B and Venkataramanan V 2011. Report on National Expert Consultation on Rabies Control in Tamil Nadu: 9–10 August, 2011, Chennai. New Delhi.

Kakkar M, Venkataramanan V, Krishnan S, Chauhan RS and Abbas SS 2012. Moving from Rabies Research to Rabies Control: Lessons from India. *PLoS Negl Trop Dis.,* 6: e1748.

Lembo T, Hampson K, Kaare MT, Ernest E and Knobel DL. 2010. The feasibility of canine rabies elimination in Africa: dispelling doubts with data. *PLoS Negl Trop Dis.,* 4: e626.

Madhusudana S 2003. Intradermal Immunization for rabies Prophylaxis: Issues to be considered in India and other developing countries. *Vaccine,* 21: 3095– 3096.

National Institute of Communicable Diseases 2007. National Guidelines for Rabies Prophylaxis and Intra-dermal Administration of Cell Culture Rabies Vaccines.

Office of the Registrar General Ministry of Home Affairs Government of India 2015. Provisional Population Totals. Census: 1–63.

Reece JF and Chawla SK 2006. Control of rabies in Jaipur, India, by the sterilisation and vaccination of neighbourhood dogs. *Vet Rec.,* 159: 379–383.

Shankaraiah RH, Rajashekar RA, Veena V and Hanumanthaiah AN 2015. Compliance to anti-rabies vaccination in post-exposure prophylaxis. *Indian J Public Health*, 59:58-60.

Sudarshan MK, Madhusudana SN, Mahendra BJ, Rao NSN, Ashwath Narayana DH, Abdul Rahman S, MeslinFX, Lobo D, Ravikumar K and Gangaboraiah 2007. Assessing the burden of human rabies in India: results of a national multi-center epidemiological survey. *Int. J. Inf. Dis*., 11: 29-35.

Sudarshan MK, Mahendra BJ, Madhusudana SN, Narayana DA, Rahman A, Rao NSN, X-Meslin F, Lobo D, Ravikumar K 2006. An epidemiological study of animal bites in India: results of a WHO sponsored national multi-centric rabies survey. J Comm Dis 38(1):32-39.

Totton SC, Wandeler AI, Zinsstag J, Bauch CT and Ribble CS 2010. Stray dog population demographics in Jodhpur, India following a population control/ rabies vaccination program. *Prev. Vet. Med.,* 97: 51–57.

World Health Organisation 2010. WHO guide for Rabies pre and post-exposure prophylaxis in humans.

World Health Organization 2004. WHO Expert Consultation on Rabies - First Report: 1–123.

Zinsstag J, Durr S, Penny M a, Mindekem R and Roth F. 2009. Transmission dynamics and economics of rabies control in dogs and humans in an African city. Proc *Natl Acad Sci USA,* 106: 14996–15001.

****