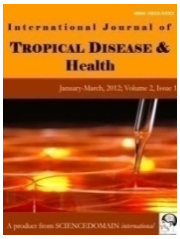

International Journal of TROPICAL DISEASE & Health
3(2): 104-113, 2013

SCIENCEDOMAIN *international*
www.sciencedomain.org

Rural Rabies Prevention Project - A 'One Health' Experiment in India: An Overview

M. K. Sudarshan[1*], D. H. Ashwath Narayana[1], N. R. Ramesh Masthi[1], M. L. Satyanarayana[2], Praveen Kulkarni[1], S. N. Madhusudana[3], B. C. Ramakrishna[4] and Gangaboraiah[1]

[1]Department of Community Medicine, Kempegowda Institute of Medical Sciences, Bangalore, 560 070, India.
[2]Department of Pathology, Veterinary College, Hebbal, Bangalore, 560 024, India.
[3]Department of Neurovirology, National Institute of Mental Health and Neurosciences, Bangalore, 560029, India.
[4]Karuna animal welfare organization, Veterinary College Campus, Hebbal, Bangalore, 560 024, India.

Authors' contributions

This project was a collaborative work of all the authors. Author MKS put forth the idea, mentored, monitored the project work and prepared the manuscript. Author DHAN did the coordination and liaison work and prepared the project report. Author NRRM planned and supervised the field work. Author MLS was responsible for the veterinary component of the study. Author PK was the medical officer and postgraduate trainee who organized the field work. Author SNM conducted the laboratory training and responsible for sero-surveillance. Author BCR was responsible for mass dog vaccination, deworming and animal welfare work. GB performed data and statistical analysis. All authors have read and approved the final manuscript.

Research Article

Received 31st October 2012
Accepted 2nd March 2013
Published 18th March 2013

ABSTRACT

Aim: To assess the feasibility of implementing "one health approach" to prevent human rabies and control animal rabies in a rural community.
Study Design: Health services research in a rural setting.
Place and Duration of Study: A medical college and a veterinary college along with an animal welfare organization delivered a wide array of "integrated services" in three

**Corresponding author: Email: mksudarshan@gmail.com;*

villages' i.e. Kumbalagodu, Thagachikuppe and Gerupalya near Bangalore, India comprising a population of 10,220 persons for a period of two years from December, 2009 to November, 2011. The nearby three villages of Ramohally, Vinayakanagara and Bhimanakuppe with a population of 6,023 persons formed the control group, with no project inputs.

Methodology: This consisted of household surveys at the beginning and end of two years ; rabies awareness campaigns; clinical and laboratory surveillance of rabies in dogs; rabies post-exposure prophylaxis (PEP) in humans; pre-exposure rabies prophylaxis (PrEP) by intradermal route in school children, pet dog owners and veterinarians ; mass dog vaccination and deworming; and sero-surveillance in both dogs and humans.

Results: The ratio of veterinary and medical manpower in study villages was 1: 11 and dog to human ratio was 1: 23.The information, education and communication materials developed and used were domestic outdoor wall writings (11), domestic indoor annual wall calendar (2000), school book labels (1000); game charts (16); wall posters (65); flip chart (15); rabies educational DVD (1). There were 102 local cable television transmissions on rabies prevention. 69 persons received rabies PEP. PrEP was given to 368 school children, pet dog owners and veterinarians. Sixty one human serum samples were analyzed by rapid fluorescent focus inhibition test for rabies antibody detection. Sixteen veterinarians were trained to use direct rapid immunohistochemical test (dRIT) for rabies diagnosis. Six ruminants were confirmed rabid by dRIT. There were no cases of human rabies. The cost of entire project was US $ 85,958.

Conclusion: A blend of medical, veterinary and animal welfare services were successfully delivered through a "one health" approach. Based on this success a "conceptual model" was evolved to propagate its replication in other rural communities across India.

Keywords: Rabies; prophylaxis; dog vaccination; surveillance; one health; health services research; conceptual model.

1. INTRODUCTION

Rabies is a zoonotic disease caused by a RNA virus and transmitted to humans following the bite of a rabid animal. The disease is almost always fatal both in humans and animals as there is no cure once the signs and symptoms appear. Though all mammals are susceptible to rabies some serve as hosts and vectors which include dogs, cats, mongoose, foxes, ferrets, raccoons, skunks, wolves and bats. In India, the most common vectors are the dogs (96%) and cats (2%), besides other mammals like mongoose, foxes, etc [1]. India has the highest incidence of human rabies deaths at 20,000 annually which corresponds to 36% of the estimated global burden of about 55,000 [2] and about 17 million animal bites each year [3].

In Asia, Thailand, Philippines and Sri Lanka have successfully reduced the burden of human rabies and controlled dog rabies by effectively integrating medical and veterinary services by a "one health approach" [4,5]. The “one health approach” is a concept that promotes partnership among multiple disciplines including human and veterinary medicine. The development of strategies for implementing "one health" involves important steps toward our understanding of how to control and ultimately, prevent zoonotic disease transmission, which would improve the health and lives of both animals and humans. Schools of medicine, veterinary medicine, and public health should embrace the “One Health” approach. But in

India there is very little "collaboration" between medical and veterinary services. There are two separate ministries, one for preventing rabies in humans' i.e. public health and the other for controlling rabies in animals' i.e. agriculture and animal husbandry. Also, rabies is a neglected disease both in public health and veterinary sectors. The other impeding factors include vastness of the country and the three tier system of governance i.e. Central or Federal Government; State or Provincial Government; and local self government i.e. in urban areas Municipalities or Civic Corporations, and in rural areas known as Zilla Parishats (ZP). India being a multi-political party democracy, when different political parties are in place at the central, state and local self governments it often leads to poor collaboration among themselves.

The dog is mythologically, historically and socio- culturally a much loved animal and also revered in some communities. Hence, attempts to control the ever growing dog population have not been successful. However, from 2007 to 2011 a "National Pilot Project on Human Rabies Prevention" was implemented by Government of India in five cities, which attempted to bring together both medical and veterinary sectors for preventing rabies in humans [6]. It was considered necessary to demonstrate "a model project" in a rural area of India to prevent rabies in humans and control it in dogs through integration of medical and veterinary services including animal welfare services. Consequently this "health services research" [7] was conducted in three villages, near Bangalore, Karnataka, a southern state of India.

2. MATERIALS AND METHODS

The Department of Community Medicine, Kempegowda Institute of Medical Sciences, Bangalore [www.kimscommunitymedicine.org] and Department of Pathology of Veterinary College, Bangalore [www.kvafsu.kar.nic.in] along with "Karuna" an animal welfare organization (AWO), Bangalore [www.karunaanimalwelfare.org] had combined expertise for this project work. The project was implemented in three study villages i.e. Kumbalagodu, Thagachikuppe and Gerupalya with a 10,220 population of humans. The nearby three villages i.e. Ramohally, Vinayakanagara and Bhimanakuppe having a population of 6,023 humans formed the control group, with no inputs from the project.

The activities were conducted over a two years period from December, 2009 to November, 2011. The core project team comprised of two faculty members - a professor and an associate professor of community medicine, medical officer (tutor) from a medical college; professor of pathology from veterinary college, a veterinarian from state government veterinary services and a veterinarian from the animal welfare organization.

Various community level activities conducted included the household surveys using structured questionnaire at the beginning of the project to assess the baseline knowledge, attitude and practice of people regarding prevention and control of human and animal rabies. The survey was again conducted in the same households using same questionnaire at the end of the project to know the difference between baseline & endline observations. Besides livestock census; base line and end line door to door household surveys; training and orientation of formal and informal village leaders, women self help groups, medical and veterinary personnel, school teachers and others; development of socio-culturally acceptable rabies information, education and communication (IEC) materials like posters on rabies post-exposure prophylaxis (PEP), responsible pet ownership, flip chart for village volunteers including volunteers from department of women & social welfare, chart on snake and ladder game, indoor annual wall calendar, school book label, outdoor wall writings, rabies DVD and its transmission through cable television net work, use of folk dance, public

rallies, drawing competitions in schools; providing rabies pre-exposure prophylaxis (PrEP) by intradermal route and measuring its effectiveness through sero-surveillance of vaccinees ; PEP by both intradermal (ID) and intramuscular (IM) routes as feasible; clinical and laboratory surveillance for rabies in animals and humans, training of veterinarians in rabies diagnosis using direct rapid immunohistochemical test (dRIT) ; animal welfare activities consisting of mass dog vaccination, collaring, deworming and sero-surveillance were done. The project was periodically monitored by both national and international observers. The project activities and progress made were monitored on quarterly basis by the project advisors. Besides two international observers from Global Alliance for Rabies Control (GARC) visited the project villages in November, 2010 and December, 2011 for an on-site appraisal. An observer from National Centre for Disease Control (NCDC), Delhi visited the project implementing institutions in April, 2011 and reviewed the progress made. For more details refer to the " adopt a village project ' report [8].

3. RESULTS AND DISCUSSION

An overview of activities conducted under the project is shown in Table-1. The regular service providing veterinary manpower as compared to medical manpower (excluding the project team) at 1:11 in the study villages was grossly inadequate. There were 446 dogs in three study villages having a human population of 10,220 resulting in a dog : human ratio of 1: 23 which was higher than the national figures of 1:36 [3]. This made the people more prone to dog bites and consequently there was a higher incidence of animal bite in the project villages.

The rabies IEC materials were developed based on the results of baseline household survey on knowledge, attitude and practice of people on rabies prevention and their socio-cultural acceptance. The outdoor wall writings depicting the message of rabies and its prevention were done with the consent of the head of the household. Wall writings were on houses that are strategically located in clear view to the community. The indoor domestic annual wall calendars having 12 pages one page for each month are popular in the villages. These calendars generally display the day and date of important local festivals, events for every month. Such calendars were specially printed with different rabies education messages for each month. One calendar was provided to all households in the three study villages and some community organizations/institutions like schools, mother and child care centers, health centers, grocery shops, etc. Rabies prevention messages were effectively communicated through these calendars to household members and others.

The school children have a set of books to use for one year and the front cover of each book has a self adhesive label, which provides for writing the name, class and other details of the pupil. Such labels were printed with an additional message of rabies prophylaxis and given to school children through their teachers. The snake and ladder chart is a popular indoor game which is played with dice; the snakes represent the "bad practices in rabies prevention" and the ladder "good practices in rabies prevention".

Table 1. Rural rabies prevention project: an overview of activities conducted in study villages

Socio-demography	
Villages	3
Total human population	10,220
Medical manpower (medical-4; paramedics-5; traditional - 2)	11
Veterinary manpower (live stock inspector)	1
Live stock census (dogs-446, cats-56, cows-348, buffalo-45, sheep-165 & goat-275)	1335
Dog: human ratio	1:23
Rabies awareness and education materials developed and used/ displayed/distributed (In local dialect, Kannada)	
Outdoor wall writings (on the prominently located houses)	11
Annual wall calendars (in local dialect) distributed to households	2000
Book labels distributed through school teachers amongst school children	1000
Snake and ladder game thick charts given to schools (for children to play in schools)	16
Thick Posters displayed/fixed on the walls (in schools and community centres)	65
Rabies training aid (for village level volunteers)	15
Rabies DVD (in local dialect, Kannada; 15 minutes duration)	1
Rabies awareness and education activities	
Veterinarians and other health staff trained in rabies prophylaxis	40
Village level volunteers attended training programme on rabies and its prophylaxis	24
Rabies education sessions conducted in the village per month	14
Rabies education sessions conducted in the schools per month	5
School children attended rabies education sessions	370
Drawing competitions (start & end of the project) for school children	6
Rabies DVD shown (in local dialect, Kannada) (number of times shown in schools-6; local cable television network -96)	102
Use of folk dance	1
Use of public rally	2
Rabies prophylaxis in humans	
Number of rabies PEP given	69
Number of rabies PrEP given (school children-323, vets& pet owners-45)	368
Number of rapid fluorescent focus inhibition test (RFFIT) for antirabies antibody done	61
Number of vaccinees protected (RFFIT titers ≥0.5 IU/mL)	61
Rabies prophylaxis in animals	
Total number of vaccine doses administered (primary - 262; one month booster - 183; annual booster-243)	688
Number of RFFIT (antirabies antibody test) done	148
Rabies surveillance	
Number of veterinarians (15) and others (1) trained in dRIT (sessions held-2)	16
Number of dRIT done	6
Number of animals(ruminants) positive for rabies	6
Human rabies cases	Nil
Costing of the project (2 years duration)	
Total cost	USD 85,958
Cost of actual money spent	USD 31,604 (37%)
Cost estimate of donated goods and free services provided	USD 54,354 (63%)

The thick paper board wall posters depicting rabies prophylaxis messages were fixed at strategic places in the community halls, schools, health centers, grocery shops and other places served as a source of rabies information to the community. After training volunteers from the villages on rabies prophylaxis a well designed and tested rabies education flip chart was provided to them for educating the community. Educational sessions on rabies conducted in the schools benefitted both students and teachers. The drawing competition held in the schools at the start and end of the project on the theme of “Rabies prevention” had improved the rabies awareness. A documentary DVD on rabies in local dialect (Kannada) prepared by Rabies in Asia Foundation (www.rabiesinasia.org) was shown in the schools and also through local cable television network for community education. The folk dance was another popular medium used for improving community awareness about rabies and its prevention. World rabies days (WRDs), 28th September 2010 and 2011 were used to hold public rallies to create rabies awareness in the villages.

The training of veterinarians, medical doctors, health workers and village volunteers on rabies prophylaxis ensured timely and appropriate provision of rabies PEP for the animal bite victims. The PrEP was provided to 323 school children whose parents gave consent. 0.1mL of Injection Rabipur (purified chick embryo cell vaccine) was given in the deltoid area by intradermal route in these children on days 0, 7 and 28. Five mL of venous blood was drawn from 52 vaccinated children whose parents had given consent and the rabies virus neutralizing antibody titre (RVNA) was estimated by rapid fluorescent focus inhibition test (RFFIT) at National Institute of Mental Health and Neurosciences, a WHO collaborating centre for research on rabies, at Bangalore. The vaccine was found to be safe and immunogenic by serology [8].

The animal welfare campaign emphasized responsible pet ownership, dog collaring, mass dog vaccination and deworming was well received. Mass vaccination of dogs in the community was accomplished using Injection *Nobivac R* (Inactivated *rabies vaccine*) three times i.e, at the start of the project, one month later and again after one year. Mass deworming was done by using Tablet Plozin (Praziquintel 50mg, Pyrantel pamoate 144mg & Fenbendazole 500mg) orally for owned dogs and injection Ivermectin (0.5ml for puppies and 1 ml for adults) subcutaneously for stray dogs. To assess the immunogenicity of Inj. Nobivac-R, sera samples from dogs were tested for rabies virus neutralizing antibody using RFFIT on day 0 i.e, before first dose of vaccination, day 365 and day 379 i.e, 14 days after one year booster dose. The geometric mean concentration of rabies virus neutralizing antibody was 0.60 (Range: 0.2 to 3.5) on day 0; 0.62 (Range: 0.5-2.0) on day 365 and 2.32 (Range: 0.5-4.0) on day 379. The vaccine was found to be immunogenic on day 379. However, no RVNA estimation was done before day 365 due to logistical problems in the field.

Presently, many veterinary institutions in India that conduct laboratory diagnosis for rabies routinely use "seller's stain" to demonstrate "Negri bodies" in the brain of the suspect animal. Through this project local veterinarians were trained to use, a simple field diagnostic test developed by CDC, Atlanta, USA [9]. The dRIT was successfully evaluated in the field conditions in Chad, Africa [10]. Surveillance for rabies was conducted using both medical and veterinary manpower in project villages. Six ruminant’s i.e, three cows, one calf and two goats were diagnosed of rabies by dRIT in the study villages. The laboratory diagnosis of rabies in dogs was not possible as dog deaths were not reported by the community despite educating them about the importance of rabies surveillance in the dogs. This was because dogs are not of economic value to the community.

There were no cases of human rabies reported in both study and control villages during the project period.

Following implementation of public health and veterinary activities there was a significant improvement in the knowledge, attitude and practices (KAP) on rabies prevention in the study villages as compared to the control villages [8].

The cost of entire project was US $ 85,958. This included actual money spent of US $ 31,604 plus the estimated cost of donated goods & free services provided which was US $ 54,354.

The distribution of the cost was: awareness and education (25%), veterinary component (22%), training and capacity building (19%), monitoring and evaluation (19%) and medical component (15%).

While the human population and area of coverage for this project was small, it was suitable to test the implementation of an array of public health and veterinary activities. The activities could be blended well and made acceptable to the community. This supports and strengthens the conclusion of another recent study from India that it is possible to implement a "one health" approach for rabies prevention and control [11].

4. LESSONS LEARNED

1. The intersectoral collaboration among the departments of public health, veterinary health, school education, local self government, women and social welfare was key to success.
2. The rabies education materials must be based on local traditions, conditions and interesting especially to school children.

5. CONCLUSION AND RECOMMENDATION

Based on the activities, results and experience from this study a "conceptual model" [12] is provided for medical personnel and veterinarians in the country to implement “one health approach “for rabies prevention and control work in rural community (Fig. 1).

It is hoped that the results of this project will be useful in formulating rabies prevention and control strategies under the "National Rabies Control Programme" of Government of India during the twelfth five year plan (2012-17).

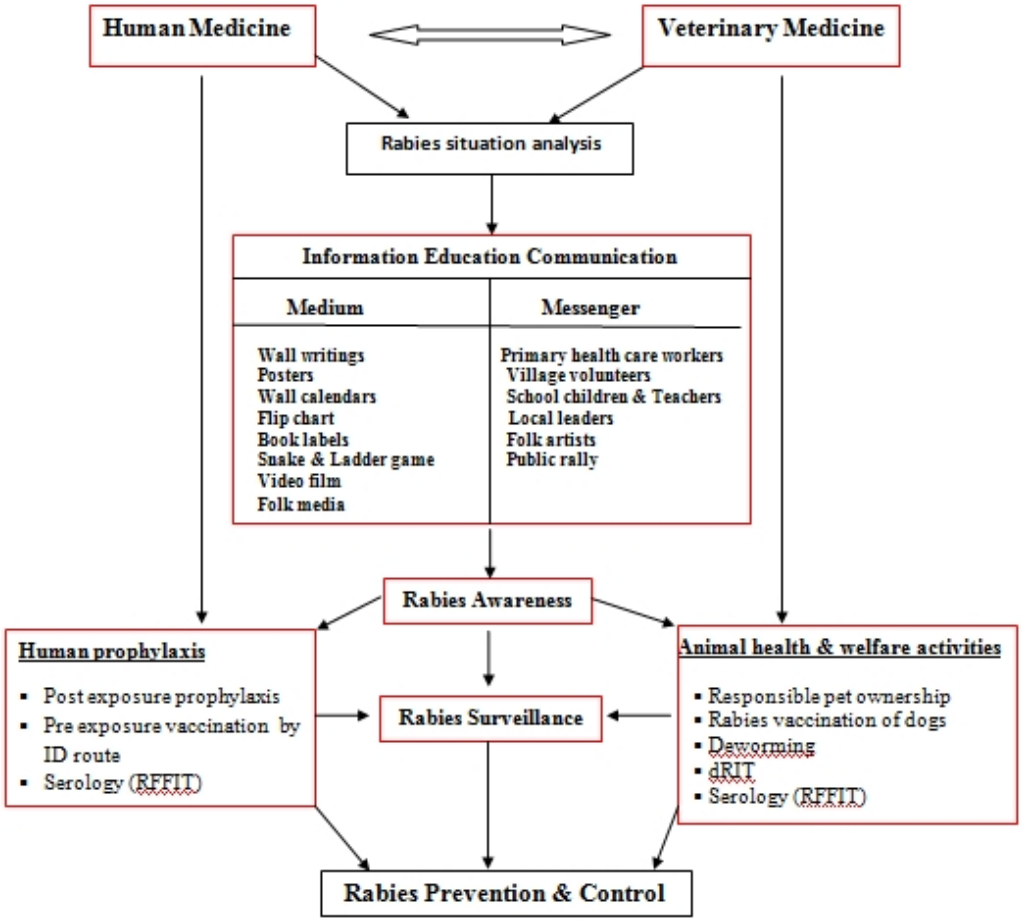

Fig. 1. Rural rabies prevention project, "one health" experiment-a conceptual model

6. DEFINITION

6.1 Health Services Research

A systematic study of the means by which biomedical and other relevant knowledge is brought to bear on the health of individuals and communities under a given set of conditions.

ETHICAL APPROVALS AND CONSENT

The project was approved by the institutional ethics committee of Kempegowda Institute of Medical Sciences. The approval of State Government of Karnataka was obtained for the different activities done in the community. The consent of the formal leaders of the village, school teachers, heads of the households, parents / guardians of the school children was taken.

ACKNOWLEDGEMENTS

This project was implemented following a financial grant from Global Alliance for Rabies Control, Kansas, United States of America. The formal permission given by the Departments of Public Health and School Education, Government of Karnataka, Bangalore, India for the conduct of this study is gratefully acknowledged. The authors thank Drs. Deborah Briggs, Executive Director, Global Alliance for Rabies Control and S. Abdul Rahman, President, Commonwealth Veterinary Association, for their constant support and guidance. The technical and logistical support extended by Dr. S Yathiraj, Dean, Veterinary College, Bangalore is duly placed on record. The help & support of Dr. D. Nagabushana, Veterinary officer is gratefully acknowledged. The technical expertise and help of Dr. Sudha Chandrasekhar, Associate Professor of St.John's Research Institute, Bangalore for conducting the cost analysis of the project is duly acknowledged. The overall coordination and help of the trustees of Rabies in Asia Foundation is sincerely acknowledged. Lastly, field work of this project was possible due to the cooperation and participation of the community, school teachers, government veterinary staff and public health staff and from the field staff of the Department of Community Medicine of Kempegowda Institute of Medical Sciences, Bangalore.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Sudarshan MK, Madhusudana SN, Mahendra BJ, Rao NSN, Ashwath Narayana DH, Abdul Rahman S, 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.
2. World Health Organization. Rabies vaccines. WHO position paper. Weekly Epidemiological Record. 2010;32(85):309-20.
3. Sudarshan MK, Mahendra BJ, Madhusudana SN, Rao NSN, Ashwath Narayana DH, Abdul Rahman S, et al. An epidemiological survey of animal bites in India: Results of a WHO sponsored national multicentric rabies survey. Journal of Communicable Diseases. 2006;38(1):32-39.
4. Kahn LH, Kaplan B, Monath TP, Steele JH. Teaching "One medicine, One health". The American Journal of Medicine. 2008;121(3):169-70.
5. Zinsstag J, Schelling E, Waltner-Toews D, Tanner M. From “one medicine” to “one health” and systemic approaches to health and well-being. Preventive Veterinary Medicine. 2011;101:148–156.
6. National Centre for Disease Control. Human rabies in India: moving towards elimination. Newsletter. 2012;1(1). New Delhi.
7. Park K. Park's textbook of Preventive and Social Medicine. 21st edition. M/S Banarasidas Bhanot, Jabalpur, India; 2011.
8. Adopt a village Project, Report. Available: http://www.rabiesinasia.org/AVVP.pdf [accessed on 29th October, 2012].
9. Tiziana Lembo, Michael Niezgoda, Andrés Velasco-Villa, Sarah Cleaveland, Eblate Ernest, Charles E. Rupprecht. Evaluation of a direct, rapid immunohistochemical test for rabies diagnosis. Emerging Infectious Diseases. 2006;12(2):310-313. Available: www.cdc.gov/eid.

10. Du¨rr S, Naı¨ssengar S, Mindekem R, Diguimbye C, Niezgoda M, et al. Rabies Diagnosis for Developing Countries. PLoS Negl Trop Dis. 2008;2(3):e206.
11. Syed Shahid Abbas, Vidya Venkatarmanan, Garima Pathak, Manish Kakkar. Rabies control initiative in Tamil Nadu, India: a test case for the ' one health ' approach, International Health. 2011;3:231-239.
12. Conceptual model. Available: http://en.wikipedia.org/wiki/Conceptual_model [accessed on 15th December, 2012].

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sciencedomain.org/review-history.php?iid=208&id=19&aid=1120