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1 Adopt a village, rural rabies prevention project: A 'one health' experiment in India

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17 ABSTRACT

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20 **Aim:** To assess the feasibility of implementing "one health" to prevent human rabies and control
21 animal rabies in a rural community in India.

22
23 **Study design:** Health services research in a rural setting.

24
25 **Place and duration of study:** A medical college and a veterinary college along with an animal
26 welfare organization delivered a wide array of "integrated services" in three villages' viz.
27 Kumbalagodu, Thagachikuppe and Gerupalya near Bangalore, India comprising of 10,220
28 population for a period of two years from December, 2009 to November, 2011. The nearby three
29 villages of Ramohally, Vinayakanagara and Bhimanakuppe with a population of 6,023 formed
30 the control group, with no intervention.

31
32 **Methodology:** This consisted of baseline and end line surveys; rabies awareness campaigns;
33 clinical and laboratory surveillance; rabies post-exposure prophylaxis (PEP) in humans; pre-
34 exposure rabies prophylaxis (PrEP) by intradermal route in school children and others; mass
35 dog vaccination and deworming; and sero-surveillance.

36
37 **Results:** The veterinary : medical manpower was 1: 11; dog : man ratio was 1: 23. The
38 information, education and communication materials developed and used were outdoor wall

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to me

39 paintings (11), indoor annual wall calendar (2000), school book labels (1000); game charts(16);
40 wall posters(65); training aid (15) ; rabies educational DVD(1). Twenty four volunteers and 370
41 school children were educated about rabies and its prevention. There were 102 local cable
42 television transmissions on rabies prevention. The incidence of animal bite was 19 per 1000
43 persons per year and 69 people received rabies PEP. PrEP was given to 368 school children
44 and others. Sixty one human serum samples were analyzed by rapid fluorescent focus inhibition
45 test. Sixteen veterinarians and others were trained to use direct rapid immunohistochemical test
46 for rabies diagnosis and the same was used to confirm 6 animal deaths in the field. There was ~~more~~
47 no case of human rabies during the project period. The total economic cost of the project was
48 2.7 times more than financial cost.

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50 **Conclusion:** A blend of integrated medical and veterinary services including animal welfare
51 could be delivered through a "one health" approach. Based on this success a "system model" is ~~has~~
52 evolved to propagate its replication in other rural communities across the country.

53
54 **Key words:** rabies, prophylaxis, dog vaccination, surveillance, one health, health services
55 research, system model
56
57
58

59 1. INTRODUCTION

60 Rabies is a zoonotic disease caused by a RNA virus and usually transmitted to man following
61 the bite of a rabid animal. The disease is almost always fatal both in man and animals as there
62 is no cure once the signs and symptoms appear. The ~~animals~~ ^{species} involved in the transmission of
63 rabies include dogs, cats, mongoose, foxes, ferrets, raccoons, skunks, wolves, bats and other
64 mammals. In India, the most common vectors are the dogs (96%), cats (2%) and others (2%)
65 like mongoose, foxes, etc(1). India has the highest burden of human rabies deaths ^{at} of 20,000
66 (36%) annually of the global incidence of about 55,000 (2) and about 17 million animal bites
67 each year (3). In Asia, Thailand, Philippines and Sri Lanka have successfully reduced the
68 burden of human rabies and controlled dog rabies by effectively integrating medical and
69 veterinary services popularly known as "one health approach" (4). But in India there is very little
70 "cooperation and coordination" between medical and veterinary services. ~~Besides~~ ^{In addition,} there is no
71 system or mechanism for integrating the two sectors for prevention and control of ~~this disease~~ ^{rabies}.
72 There are two separate ministries, one for preventing rabies in humans viz public health and
73 the other for controlling rabies in animals viz agriculture and animal husbandry. Also rabies is a
74 neglected disease, i.e. a disease of low priority both in public health and veterinary sectors. The ^{formist}

No effectiveness of a "one health model"

~~The effect was of a one health model~~

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 ZillaParishats (ZP). Besides mythology, historically and socio- culturally ^{the} dog is a much loved animal and also revered in some communities. Hence, attempts to control the ever growing dog population have not been successful. However, recently, 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 the ^{rabies} disease in humans(5). In this background, ~~it was considered necessary to do a "health services research" (6) and demonstrate "a model" 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.~~ Hence, ^{This research} ~~this "one health" experiment~~ was conducted in three villages, near Bangalore, Karnataka, a southern state of India.

2. MATERIAL AND METHODS

~~A medical college, a veterinary college including an animal welfare organization came together for this purpose.~~ ^{comb} The Department of Community Medicine, Kempegowda Institute of Medical Sciences and Department of Pathology of Veterinary College, Bangalore along with "Karuna" an animal welfare organization (AWO) ^{combined expertise of} integrated for this project work. The project was implemented in three villages viz Kumbalagodu, Thagachikuppe and Gerupalya comprising of 10,220 ^{people} population for the duration of two years from December, 2009 to November, 2011. The ^{with a} nearby three villages viz. Ramohally, Vinayakanagara and Bhimanakuppe having a population of 6,023 formed the control group, with no intervention.

The activities were conducted over a two years period from December, 2009 to November, 2011. The core project team comprised of two faculty members from medical college, a medical officer and field staff; from veterinary college, a faculty member and a veterinarian and from the AWO, a veterinarian and field staff.

The various community level activities conducted include live stock census, base line & 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, training aid for village level volunteers, chart on snake and ladder game, indoor annual wall calendar, school book label, outdoor wall painting, rabies video and its transmission

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maybe can reference Table 1

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108 through cable television net work, use of folk dance, public rallies, drawing competitions in
109 schools; providing rabies pre-exposure prophylaxis (PrEP) by intradermal route and its sero-
110 surveillance ; PEP through both intradermal(ID) and intramuscular(IM) routes as feasible;
111 clinical and laboratory surveillance for rabies in animals and humans, training of veterinarians in
112 rabies diagnosis using direct rapid immunohistochemical test(dRIT) ; animal welfare work
113 consisting of mass dog vaccination, collaring, deworming and sero-surveillance. The project
114 was periodically monitored by both national and international observers.

115 3. RESULTS AND DISCUSSION

at 116 An overview of activities ^{conducted} done under the project is shown in table-1. It was found that the
1:11 117 veterinary manpower ^{as compared to medical manpower} in the ratio of 1:11 was grossly
118 inadequate. The live stock of ^{GOV} buffalo, sheep and goat in the community are known hosts of
119 rabies in the region and dogs & cats the common vectors of the disease. The dog: man ratio of
120 1:23 ^{was more as compared to national figures of 1: 36 (3)}. This made the people more prone
121 to dog bites and ^{consequently} an higher incidence of animal bite in the project villages.

122 The rabies IEC materials were developed based on the results of baseline survey and socio-
123 cultural acceptance. The outdoor wall paintings depicting the message of rabies and its
124 prevention were done with the consent of the head of the household, ^{on the walls of these}
125 houses that are strategically located giving a clear view to the community for easy readability.
126 The indoor domestic annual wall calendars having ^{12 pages} one for each month are popular in
127 the villages. These calendars generally display the day, ^{date} list of important local festivals
128 events, etc for every month. Such calendars were specially printed ^{having twelve rabies}
129 education messages ^{one for each month}. One calendar was provided to each household. The
130 Rabies prevention messages were effectively communicated through these calendars to
131 household members.

132 The school children have a set of books to use for one year and ^{each book} on the front cover
133 has a self adhesive label, which provides ^{space for} writing the name, class and other details of the
134 pupil. Such labels were printed with an additional message of rabies prophylaxis and given to
135 school children through their teachers ^{in the class rooms}. Similarly, the snake and ladder chart
136 is a popular indoor game which is played with dice; the snakes represent the "bad practices in
137 rabies prevention" and the ladder "good practices in rabies prevention". The school children
138 learnt about rabies prevention while playing snake & ladder game.

What was it?
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→ 139 The thick paper board wall posters having rabies prophylaxis messages were fixed at strategic
→ 140 places in the community halls, schools, health centres, grocery shops, etc and were a good
→ 141 source of rabies information to the community. After training village level volunteers in rabies
→ 142 prophylaxis a well designed and tested rabies education aid was provided to them for educating
→ 143 the community. The educational sessions on rabies conducted in the schools not only benefitted
→ 144 the students but also the teachers. The drawing competition held in the schools at the start, and
→ 145 end of the project on the theme of "Rabies prevention" was successful in improving the
→ 146 awareness. A documentary video film (DVD) on rabies in local dialect (Kannada) prepared by
→ 147 Rabies in Asia Foundation was shown in the schools and also through local cable television
→ 148 network for community education. The folk dance was another popular medium used for
→ 149 improving community awareness about rabies and its prevention. The two World rabies days
→ 150 (WRDs) 28th September of 2010 and 2011 were successfully used to hold public rallies and
→ 151 other rabies awareness activities in the villages.

→ 152 The training of veterinarians, village level volunteers and others on rabies prophylaxis held in
→ 153 separate batches was quite successful. This subsequently ensured timely and appropriate
→ 154 rabies PEP in the community, which was confidence building and reassuring. The PrEP was
→ 155 provided to school children using Injection Rabipur (purified chick embryo cell vaccine) by ID
→ 156 route. This was found to be safe and immunogenic. (7).

→ 157 The animal welfare campaign for responsible pet ownership, dog collaring, mass dog
→ 158 vaccination and deworming were well received. Mass vaccination of dogs in the community was
→ 159 accomplished done using Injection Nobivac R (Inactivated rabies vaccine). Mass deworming was done by
→ 160 using Tablet Plozin (Praziquintel 50mg, Pyrantelpamoate 144mg & Fenbendazole 500mg) orally
→ 161 for owned dogs and injection Ivermectin (0.5ml for puppies and 1 ml for adults) subcutaneously
→ 162 for stray dogs. To assess the immunogenicity of this vaccination the sera samples of the dogs
→ 163 were tested for antirabies antibody using RFFIT. This was found to be immunogenic following
→ 164 an annual booster dose.

→ 165 The animal welfare campaign for responsible pet ownership, dog collaring, mass dog
→ 166 vaccination and deworming were well received. Presently, many veterinary institutions in India
→ 167 that conduct for laboratory diagnosis of rabies still routinely use "seller's stain" and demonstrate "Negri
→ 168 bodies" in the brain of the suspect animal. In this project, for the first time the local veterinarians
→ 169 were trained to use dRIT, a simple field based test developed by CDC, Atlanta, USA, for
→ 170 diagnosis of rabies in animals. (8). Later the test was successfully used for diagnosing rabies in

for the first time

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171 six large animals in the field. Incidentally, there were no case of human rabies during the project
172 period.

173 Following implementation of various public health and veterinary activities there was a
174 significant improvement in the knowledge, attitude and practices (KAP) of people on rabies
175 prevention in the study villages as compared to the control villages (P=0.001)(7).
176

177 The financial cost of the project was US \$ 31,604 and the economic cost was US \$ 85,958. The
178 economic cost was 2.7 times more than the financial cost. This was due to resource
179 mobilization in terms of personnel, supplies and expertise at the local and community level. The
180 distribution of the cost of the activities was awareness and education (25%); veterinary (22%),
181 training and capacity building, (19%), monitoring and evaluation (19%) and medical component
182 (15%).

183 ~~Lastly, though~~ ^{while the human} population and area of coverage of the project was small, ~~it~~ ^{for is} was
184 suitable ~~for this experiment~~ to test the implementation of an array of public health and veterinary
185 activities. The activities could be blended well and made acceptable to the community.
186

187 4. LESSONS LEARNED

188 The intersectoral coordination ~~between~~ ^{among} the departments of public health, veterinary health,
189 school education, local self government, women and social welfare was key to success.

190 2. The laboratory diagnosis of rabies in dogs was not possible as dog deaths were not reported
191 by the community despite educating them about the importance of rabies surveillance in the
192 dogs. This is because ^{100% on the dog} dogs are not of economic value to the community ^{and therefore} ~~and therefore~~
^{dog surveillance is rarely conducted.}

193 3. The rabies education materials must be cost-effective, long lasting based on local traditions,
194 conditions and interesting especially to school children. 4. The laboratory diagnosis of rabies in
195 dogs was difficult

196 5. Lastly, it is sincerely hoped that the lessons ^{ed} learnt from this project ^{will} be of some help in ^{applied in}
197 formulating rabies prevention and control strategies in India as now a "National Rabies Control
198 Programme" is under way by Government of India during the twelfth five year plan (2012-17).
199

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5. CONCLUSION AND RECOMMENDATION

Based on the activities ^{implemented} done, results shown and experience gained a "system model" (9) ^{was provided} was evolved. (Figure -1). This in conclusion is the message of the project for other medical and veterinarians in the country and for the attention of all those involved in prevention and control of rabies. (Figure -1) ^{to enhance rabies}

DEFINITIONS.

Health services research. The 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.

One health. Is a concept that promotes partnership ^{among multiple disciplines including} between 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" concept and prepare their students to meet the challenges of the future.

Financial cost. Money spent on goods and services.

Economic cost. Financial cost plus estimated monetary value of donated goods and services.

COMPETING INTERESTS. Authors have declared that no competing interests exist.

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.

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AUTHORS CONTRIBUTIONS

This project was a collaborative work of all the authors. MKS put forth the idea, mentored, monitored the project work and prepared the manuscript. DHAN did the coordination and liaison work and prepared the project report. NRRM planned and supervised the field work. MLS was responsible for the veterinary component of the study. PK was the medical officer and postgraduate trainee who organized the field work. SNM conducted the laboratory training and responsible for sero-surveillance. BCRK 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.

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Table 1: Adopt a village, rural rabies prevention project: An overview and activities done

~~ITEM~~ ACTIVITY	COST \$US
Socio-demography	
Number of Villages	3
Number of households	2043
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: man ratio	1:23
Rabies awareness and education materials developed and used/ displayed/distributed (In local dialect, Kannada)	
Number of outdoor wall paintings (on the prominently located houses)	11
Number of annual wall calendars (in local dialect) distributed to households	2000
Number of book labels distributed through school teachers amongst school children	1000
Number of snake and ladder game thick charts given to schools (for children to play in schools)	16
Number of 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	
Number of veterinarians and other health staff trained in rabies prophylaxis	40
Number of village level (rabies) volunteers attended training programme on rabies & its prophylaxis	24
Number of rabies education sessions conducted in the village per month	14

324	Number of rabies education sessions conducted in the schools per month	5
325	Number of school children attended rabies education sessions	370
326	Number of Drawing competitions (start& end of the project) for school children	6
327	Rabies DVD shown (in local dialect, Kannada) (number of times shown in schools-6;	102
328	local cable television network -96)	
329	Use of folk dance	1
330	Use of public rally	2
331		
332	Rabies prophylaxis in humans	
333	Incidence of animal bite/exposure per 1000 persons per year	19
334	Number of rabies PEP given	69
335	Number of rabies PrEP given (school children-323, vets& pet owners-45)	368
336	Number of rapid fluorescent focus inhibition test (RFFIT, antirabies antibody test) done	61
337	Rabies prophylaxis in animals	
338	Mass vaccination of dogs (primary - 262; one month booster - 183; annual booster-243)	688
339	Number of RFFIT (antirabies antibody test) done	148
340	Rabies surveillance	
341	Number of veterinarians (15) and others (1) trained in dRIT (sessions held - 2)	16
342	Number of dRIT done	06
343	Incidence of animal rabies	06
344	Incidence of human rabies	Nil
345	Costing of the project (2 years duration)	
346	Total financial cost	USD 31,604
347	Total economic cost	USD 85,958
348		
349		

Fig.1: Adopt a village project: “One Health” Experiment

A model for rabies prevention and control in a rural community in India

