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A One-Health Approach to Control the Incidence of Rabies in the Slums of Nairobi

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ABSTRACT

Rabies is a zoonotic disease causing 55,000 human deaths every year and the domestic dog is a main reservoir in Africa. Vaccination of the dog population effectively reduces the incidence of rabies in dog and human population. A rabies control program was carried out in slums of Nairobi. A pre- and post-program knowledge, attitudes and practices survey was done, dogs vaccinated for three years and a post-program sero-conversion testing of the dog population performed. A total of 390 interviews of persons aged 18-83 years were carried, 5,676 dogs and 1,565 cats were vaccinated, 497 bitches and 345 cats were spayed and finally 857 dogs and 306 cats were castrated. Initially 86% of people had heard of rabies, 76% knew it was contracted through dog bite, 40% of knew rabies could be prevented in dogs through vaccination, 10% knew prevention of human rabies was by vaccination and 23% suggested animal vaccination as a means of preventing human rabies. Bite incidence was high - 7 per 1000 per year and wound washing following dog bite was reported in 26% of the cases. Older respondents were more knowledgeable about rabies transmission and prevention in dogs and people; (n=390, P = 0.02) and (n=390, P = 0.01). Knowledge of human rabies transmission and prevention was associated with level of education (n=390, P = 0.01) and an increase in awareness was associated with the vaccination program (n=390, P = 0.01). The vaccination program was successful with a sero-conversion of 65%±0.49 in the dog population. Vaccinations and public awareness can help in control of rabies in the slums.

Keywords: Rabies, Public awareness, Vaccination, Population control, Slum areas.

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INTRODUCTION

Rabies is an acute and fatal zoonotic disease affecting mainly the central nervous system (Knobel et al., 2005). Once symptoms develop, mortality rate is 100%. Rabies affects all mammals and the spreads to humans mainly through dog bite or scratch from infected dog or cat (Tang et al., 2005; WHO, 2010). The domestic dog is the primary reservoir and carrier of rabies, and responsible for most of the fatal human rabies worldwide (CDC, 2010). Rabies is widely distributed around the globe and causes more than 55,000 human deaths every year (Cleaveland et al., 2003; Knobel et al., 2005). About 95% of human deaths from rabies occur in Asia and Africa (WHO, 2010).

Rabies infection in humans manifests initially in nonspecific symptoms that include fever, headache and general malaise (Bleck, 2006). As the disease progresses the nonspecific signs neurological symptoms like insomnia, anxiety, confusion, excitation, slight or partial paralysis, excitation, hallucinations, agitation, hyper salivation, difficulty in swallowing and hydrophobia are observed. Death usually follows within 10 days of onset of such symptoms (Takayama, 2008).

Rabies can be controlled through vaccination programs, i.e. the use effective and safe vaccines against rabies in both humans and animals. However, the presence of large populations of feral dogs and bats, which serve as natural reservoir of the disease, pose challenges to preventive measures (Knobel et al., 2005). In the urban informal settlements roaming stray dogs and cats resulting from uncontrolled birth control measures serve as a conducive and encouraging habitat for the spread of rabies (Cleaveland et al., 2003).

Over the past three decades, there have been concerted efforts in the control of canine rabies and successes have been demonstrated in many parts of central and South America through large-scale synchronized mass vaccination campaigns (Belotto et el., 2005; Schneider et al., 2007). In Kenya knowledge of incidence of rabies in dogs and human within informal settlements remain scarce. This study designed and evaluated a 3-year model of one-health approach to the control of rabies within such settlements in Nairobi.

MATERIALS AND METHODS

The study was planned within a 3-year program in a one-health approach to rabies control targeting three slum areas of Nairobi through promotion of responsible ownership of pets (dogs and cats) by inhabitants. The program intended to control rabies in these settlements by:

i. Conducting a pre- and post-program rabies knowledge, attitudes and practices survey.
ii. Vaccinating dogs and cats for a period of three years.
iii. Creating rabies awareness to the inhabitants for a period of three years.
iv. Spaying and neutering dogs and cats for a period of three years for the willing owners.
v. Randomly testing for dog population rabies sero-conversion after the three year period.

The study was carried out in Mathare, Kawangware and Kangemi slum areas. Mathare is the second largest slum area in Kenya with a population of 500,000 people. Kawangware is a rural and peri urban area with a population of 200,000 people in its slums. Kangemi has residents of low to middle class status and enjoys more space within settlements but also has a population of 250,000 people in its slums. In all the three settlement areas, there are many stray dogs and cats that pose a threat to rabies disease outbreaks.

Pre and post-program knowledge, attitudes and practices (KAP) surveys were conducted through interviews of 390 individuals aged between 18 and 83 years. A transect line methodology targeting every firth household from the central location of each of the settlement areas was deployed to randomly interview one household inhabitant using pre-tested data capturing questionnaires. Attributes of public awareness of rabies disease, the causes and measures of control were captured.

A 3-year program targeting to control rabies in the three slum areas was instituted. Dogs and cats aged six months and above were vaccinated in three sites for three days in each of the slums for three consecutive years. The sites were located equidistant within each of the settlement areas. Vaccinations were done after prior public awareness campaign using tour of the area public announcements and announcement in local churches. The Rabisin vaccine (Me´rial, South Africa) was used, which is produced with the Pasteur PV 11 strain on hamster embryonic cell line and inactivated with b-propiolactone with aluminum hydroxide as the adjuvant. All vaccinated animals were identified using permanent marker ink to avoid repeat vaccinations during the three days period. Dogs and cats from willing owners who presented them during the vaccinations campaign were spayed and neutered using the described methods of oviarohysterctomy and castration. Awareness on rabies was created to the animal owners through site training education during the vaccination campaigns. Tallies of all vaccinated, spayed and neutered animals was done for each of the areas covered.

A post-program testing of rabies sero-conversion antibody titers was carried out in 900 dogs by randomly capturing 300 dogs from each of the slums and taking 5ml blood samples the jugular vein using vacutainers. Dogs were lured using pieces of meat and captured using dog catchers. Once sampled, the dogs were released with a collar to ensure they were not recaptured for sampling. The samples were then left to settle for 15 minutes in a rack and then spanned in a centrifuge for 10 min. to obtain the serum to titers. The samples were tested for antibodies titers using ELISA technique.

RESULTS

In the three-year period, 5,676 dogs and 1,565 cats were vaccinated, 497 bitches and 345 cats spayed, and 857 dogs and 306 cats castrated (Table 1).

Table 2 shows results comparing respondent's knowledge, attitudes and practices (KAP) on rabies during the pre and post-program periods.

The results showing post-vaccination perception of respondents are presented in Table 3.

Table 4 shows the other data obtained on rabies within the three slum areas of Nairobi.

DISCUSSION

This study was carried out to show case a one-health approach to rabies control in slum areas. The natural

Table 1: A 3year summary of vaccinations spays and neuters in dogs and cats.

	Dog vaccinations	Cat vaccinations	Dog spays	Dog neuters	Cat spays	Cat neuters
Mathare	2,882	661	115	226	76	68
Kawangware	1,473	673	125	253	90	97
Kangemi	1,321	231	257	378	179	141
Total	5,676	1,565	497	857	345	306

Table 2: Respondent's knowledge, attitudes and practices on rabies (n=390).

	Pre-vaccinations	Post-vaccinations
Awareness about existence of rabies	86% ±2.05	87% ±1.03
Awareness is caused by dog bites	40% ±1.74	89% ±3.06
Awareness of human rabies control by vaccinations	10% ±1.89	92% ±1.97
Awareness of human rabies control by dog vaccinations	23% ±3.02	84% ±2.76

Table 3: Respondents perception analysis post-vaccination period (n=390).

Age was associated with knowledge on rabies control	$X^2 = 15.50$, P= 0.02
Age was associated with knowledge on rabies prevention	$X^2 = 15.95$, P= 0.01
Knowledge on rabies control and prevention was associated with level of education	$X^2 = 10.73$, P= 0.01
Increased public awareness on rabies control and prevention was associated with the vaccination program	$X^2 = 10.14$, P= 0.01

Table 4: Data on other attributes related to rabies in the three areas.

	Government reported bite incidences	Reported wound washing after bite injuries	Rabies sero-conversion in dogs sampled (n=300/area)
Mathare	6 per 1000	25.91% ±0.42	64.8% ±0.03
Kawangware	8 per 1000	26.25% ±1.31	64.9% ±0.04
Kangemi	7 per 1000	26.30% ±2.22	65.7% ±1.23
Average±SEM	7 per 1000	26.15% ±0.21	65.13% ±0.49

epidemiological spread of canine rabies has been shown to depend on the tradition of human-dog relations as well as on structure and density of the existing dog population (Beran et al., 1972; OIE, 2011). Stray dogs are known to play a crucial role in the spread of rabies and such dogs find ideal living conditions in urban slum areas (Beck, 1980; Coleman and Dye, 1996; Cleaveland et al., 2003). The increased mobility of human and dog and cat populations to urban informal settlement areas warrants a study on knowledge of the rabies serology of these animals, especially for non-supervised populations (WHO, 1992).

The WHO (1992 and 2010) describes vaccinations, confinement, reproductive control and removal of animals as the four methods of dog and cats population control that may be used as adjunct procedures to control rabies. The Department of Veterinary Services in Kenya has been trying to control the stray dog population through strychnine baiting (a poisonous chemical criticized on the basis of inhumane animal killing). Reports indicate this method does not work because once the killing occurs; the vacuum created is easily filled up by other roaming dogs (Knobel et al., 2005). Thus a more effective method population control is spay and neuter program of the dominant dogs, which if timed appropriately, reduces animal numbers due to reduced breeding (Cleaveland et al., 2003). The spayed and neutered dogs retain their dominance and prevent any other dog from occupying their position in marked territories. This is a major advantage in contrast to baiting technique to invasion of vacant position by other intruding stray dog. Gradually, with time mating is reduced and the population of stray dog reduces (WHO, 1992).

The number of stray dogs and owner cats in urban areas is directly associated with the human population within the settlement area (Beck, 1981; Cleaveland, 1996). This agrees with the distribution of stray animals presented for vaccinations in the three slum areas of Nairobi. Also this was also directly associated with the standard of living; Mathare has the least standard of living with the least educated owners who also had the highest tendency not to consent to spay and neuter of their animals.

Majority of domestic dog populations across sub-Saharan Africa are only accessible to vaccination only through community sensitization (Awahndukum et al., 2002). Thus, it was not surprising that many owners brought their animals for rabies vaccinations and were willing to be educated on attributes of rabies disease.

Dog bites were very high in these areas and this agrees with the statistics of rabies in Africa (Cleaveland et al., 2003; Knobel et al., 2005; WHO , 1987 and 2010). The trend on awareness on rabies over the three year period agrees with other authors who showed that concerted efforts in control of canine rabies through vaccinations and public education could effectively control the disease (Belotto et al., 2005; Schneider et al., 2007). The sero-conversion rate reported in this program is higher than those reported elsewhere in Africa (Coleman and Dye, 1996; Cleaveland et al., 2003). The results demonstrate that one-health approach to control of rabies within slum settlements can be an effective method to control rabies. Models of similar programs can be recommended in similar setups to help in control of rabies.

CONCLUSION

The tested 3-year model of one-health approach for rabies control in the slums achieved effective sero-conversion demonstrating that such a model can be utilized in similar setups to effectively reduce incidences of both human and dog rabies.

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