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Determinants of the Level of Dog Vaccination against Rabies in Chipata District in Zambia

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Abstract: ***Analytical cross-sectional study was conducted to determine factors affecting dog vaccination and vaccination statuses of dogs in the Chipata, Zambia in August 2017. A total of 787 households were purposively sampled and data collected using a questionnaire. Chi-square and binary logistic regression analysis were used.The number of dogs kept, marital status, residence and heads of households' education level were all significantly associated with having dogs vaccinated, while knowledge of household headswere not. The households in urban area were 0.076 times more likely to take their dogs for vaccination than those in the rural area.Households head who hadreach secondary level and above were 0.636 times more likely to take their dogs for vaccination than those who had not.Households were 1.53 times likely to take their dogs for vaccination as a result of cost related to vaccines (cost was not a barrier).Households with less than two dogs were 0.800 more likely to take their dogs for vaccination than those with more than two dogs.In order to control rabies as public health problem, we recommend that households should minimize the number of dogs owned for easy managing. To intensifysensitization of the prevention of rabies. The veterinary department should open up more vaccination points and conduct monthly mobile dog vaccinations.***

Keywords: Rabies, Vaccination, Determinants

1. Introduction

Rabies is a viral disease that is transmitted through the saliva or tissues from the nervous system from an infected mammal to another mammal and is a zoonotic disease. Zoonotic diseases can pass between species. The rabies virus attacks the central nervous system causing severely distressing neurological symptoms before causing the victim to die. Rabies is the deadliest disease on earth with a 99.9% fatality rate (Schoenstadat, 2013).

Rabies has been present in Zambia since the early years of the 20th century. It is a significant public health problem in Zambia. Domestic dogs account for 69.7% (1,348/1,935) of the rabies diagnosis for the period 1985-2004. Of the 1,069 positive cases confirmed by the fluorescent antibody test, 747 (69.9%) were from domestic dogs, 139 (13.0%) from cattle and 98 (9.2%) from humans. Wildlife samples accounted for 4.5% (87/1935) of the samples tested with the jackal (Canisadustus) being the predominant species. Cases of rabies were highest in Lusaka Province followed by the Copperbelt, Southern and Central Provinces respectively. The monthly distribution of canine rabies showed an average of 2.93 (95% CI 2.59-3.29) dog positive cases per month, (Jackman, 2007). The disease is endemic in Zambia and that the domestic dog is the principal maintenance host. Despite being endemic advocacy for strengthening the delivery of public health services and steps taken to reduce the incidence of rabies in Chipata district seem not to be yielding any results. Most human cases (90%) are caused by exposure from an infected dog. However, bats, raccoons, skunks, foxes, and coyotes are also known to be important reservoirs of the disease. Other, rare forms of transmission are when saliva comes into contact with mucus membranes (eyes, nose, mouth), through inhalation of aerosolized saliva, and through corneal and internal organ transplantation. Eating raw meat or other tissues from rabid animals (while not advisable) does not transmit the infection. But this does not give any protection against rabies either. There have been cases where butchering raw meat from rabid animals has transmitted the infection, presumably through infectious nervous tissue coming into contact with wounds in the skin(Leney., and Remfry. 2000).

Those most at risk of the disease today are children living in the poorest parts of the world, particularly rural Africa and Asia. The second most at risk group are young men in these areas. They are often the breadwinners and their death often have dire financial consequences for their families (Reece, 2005).

Rabies is found on every continent except Antarctica. It is well controlled in most developed countries through ongoing public health measures. Today, over 90% of rabies deaths are in Africa, Asia and the Middle East where canine rabies is wide-spread. Estimates suggest 3.3 billion people live with the daily risk of rabies. Best estimates are that 55,000 people die from the disease every year. Over half of the people who die are children(Peacock, 2005).

Some of the world's poorest people are those most at risk of the disease. Families living in rural areas of Africa and Asia often face the desperate choice of selling livestock (on which they depend for food) to pay for the cost of rabies treatment or dying (or allowing a family member to die) of the disease.What is also not clearis the vaccination status of the dogs hence this study which was conducted to determine the proportion of dogs protected against Rabies through vaccination andinvestigate the control and preventive measures available for rabies in Chipata district.

2. Method and Materials

Study design

Analytical cross-sectional study design. For the purpose of this study all study element were households which had dogs.

Study site

The study was conducted in Chipata district, Eastern Province of Zambia. The province was chosen because in 1980s – 2000s literature indicates that there were very few cases of dog bites and rabies in the province. However, literature now indicates a steady increase in the number of rabies and dog bite. Further, Chipata district had shown a steady increase in the number of dog bites from 129, 134 and 170 in 2015, 2016 and 2017 respectively (Chipata District A/Plan: 2017).

Inclusion and exclusion criteria

All households with dog s or reported to have owned dogs in the previous year prior to data collection. Exclusion: Household without dogs or those who reported owning dogs 2 years prior to data collection

Sampling Procedure

787 households were sampled using purposive and snowball sampling methods because there was no register for dog ownship to use as sampling frame.

The sample size was determined using the following formula **(Eng, 2003)**

N = Total sample size of both groups

$N = \frac{4\alpha^2 (Zcrit + Zpwr)^2}{D^2}$ α = assumed SD (equal in both group)

Zcrit= value given on the table when confidence interval is known (95%).

Zpwr= value corresponding to statistical power on the table (0.95)

D^2 = minimum or maximum expected difference between Zcrit and Zpwr is 4.

$D^2 = 20 – 16 = 4$

$$N = \frac{4(7^2)(1.96 + 0.842)^2}{4} = 882$$

In order to have a strong statistical significance when comparing the two groups, rural and urban, the total sample size for this study will was to be 882.However, when data collected reach 787 it reached the saturation point where no more new information was coming out.

Control of Confounders

In order to control for any confounders, the study had identified beforehand the following suspected confounders; level of education of the guardian, employment status of the guardian, the household environmental health standards.

Data Collection

A structured questionnaire was administered to each household in order to collect data that assisted in answering the research questions. The structured questionnaire was prepared in English and translated in local languages during interviews. The data that was captured include the demographic characteristic of the households, sources of income for sustenance and whether a household keeps dogs or not, number of dogs kept, vaccination status of the dogs and their management, health seeking behaviors.

Data Analysis

The main response variables were the keeping dogs or not at a given household. Initially, descriptive statistics were generated for each of the variables under study. Then associations between categorical variables were determined using Chi-square test, while association between continuous variables were determined. In order to quantify the effect various variables on each other multiply and binary logistic regression was used. All statistics were considered significant at a 5% significance level.

3. Results

A total 787 households were included in the study of which 423 (54%) (95% CI = 1.4 – 1.5)were from rural area and 363 46% (95% CI = 1.4 – 1.5) were from urban area. The total number male headed households in the study were 390 (49.6%) of which 239 were from the rural and 151 urban while the female were 397 (50.4%) of which 212 were rural and 185 in urban areas.

Table 1: Number of dogs per household and in a given area

Area	Number of Dogs owned					Total	P Value
	1	2	3	4	>4		
Rural	209	97	62	38	18	424	0.057
Urban	170	117	47	19	10	363	
Total	379	214	109	57	28	787	

Table 1 shows the number of dogs kept per household and in a given area. The majority 424 (54%) (C.I =49.3 – 58.7) of households in rural area kept dogs compared to urban areas. Furthermore, majority (209) of rural households kept less than 2 dogs at one household. The reasons given for such situation was that animals helped them in terms of hunting. While both households in urban and rural areas said they kept dogs basically for security reasons as a result it never mattered on the total number of dogs kept. However, the study found that there was no significant relationship between area and number of dogs being kept (p = 0.057).

Table 2: Shows the association of variousvariables and vaccination status of the dogs

Variable	*Category*	*Vaccination Status*		*P Value*
		Yes	No	
Number dogs	< 2 dogs	222	371	0.012
	>2 dogs	70	124	
Marital status	Single	110	89	0.000
	Married	158	373	
	Previous Married	24	33	
Residence	Rural	44	380	0.000
	Urban	248	115	
Education	Primary & less	79	350	0.000
	Secondary & above	213	145	
Religion	Christian	248	455	0.001
	Non-Christian	44	38	
Knowledge rabies	Yes	225	371	0.410
	No	64	123	

Table 2 shows the association of various variables with the vaccination status of the dogs. The majority 75.3% (C.I = 71.8 – 78.8%) of households kept two dogs and less. The number of animals kept at a household is significant in having the dogs to be vaccinated or not, (P = 0.012). Then the majority 62.9% (C.I = 58.0 – 67.8%) of dogs were not vaccinated in rural area compared to the urban. The number of dogs kept, marital status, residence, religious belief and education level of the heads of household were all significantly associated with having dogs vaccinated at P value (0.012, 0.000, 0.000 0.000 and 0.001) respectively, while the level of knowledge of household about rabies was not associated with having dogs vaccinated P value = 0.410).

Predictors of vaccination status in the area.

The logistic regression analysis was used to determine predictors of vaccination status of dogs and the reasons why dogs are found straying. The Hosmer lemeshow test was non-significant (p>0.050) and the Omnibus test for Model Coefficients was significant (p<0.050), indicating that the model fitted the data.

Table 3: Maximum Likelihood Estimates of Predictors of Dog Vaccination Status.

Category	Exp(B)	95.0% C.I.		P value
		Lower	Upper	
Residence	0.076	0.049	0.118	0
Education	0.636	0.49	0.826	0.001
Income	0.838	0.642	1.094	0.194
No dogs at household	0.8	0.685	0.935	0.005
Cost	1.502	0.964	2.341	0.072
Distance	1.586	1.035	2.429	0.034
Knowledge	1.129	0.72	1.772	0.597

Table 3 shows the predictors of the vaccination status of the household dogs. The households in urban area were 0.076 times more likely to take their dogs for vaccination than that in the rural area and it was significant (P = 0.000). This was due to fact that in urban areas households are nearer to the vaccination centre. Households with head who has gone to school up to secondary and above were 0.636 times more likely to take their dogs for vaccination compared to those who have not gone beyond primary school and it was significant (P = 001), the cost of the vaccines was 1.52 times less likely to cause household fail to take dogs for vaccinations and it was not significant (P = 0.072) and households with less than two dogs were 0.800 more likely to take their dogs for vaccination as compared to those who had more than two dogs and it was significant (P = 0.005). The results further show that those household closer to the vaccination point were 1.586 more likely to take their dogs for vaccination compared to those who stayed at far distance and it was significant (P = 0.034).

Respondents said that distance was the most preventing factor to having their dogs vaccinated. They even suggested to have veterinary department to start conducting mobile vaccination services in all areas. Almost all households said that the cost which was K20 was not a preventing factor to having their dogs to be vaccination. Further, the study found that household who had knowledge on the disease were 1.129 more times likely to take their dogs for vaccination than those who did not have the knowledge this is despite it not being statically significant.

4. Discussion

This study was conducted to determine the levels of dog keeping in rural and urban areas of Chipata district and establish the vaccination status of the dogs and other available prevention measures in the district. This study found the majority 62.9% of dogs were not vaccinated. The reasons given by the households for not vaccinating their dogs were mainly to long distances to the vaccination centre. This was the state of affairs for both respondents from urban and rural areas. In Chipata for example vaccination points are only found in the central business area when the district has approximately 100km radius. How do one expect one from Chipangali which 84km from this area to bring the dogs for vaccination. This is in agreement with a study by Butler who found that dogs receive little veterinary care in developing countries, which contributes to the spread of disease and high mortality among dogs. Although in his study the reason for not taking the dogs for vaccination was not distance. He found that only 40.5 percent of households surveyed in Zimbabwe said they would take their dogs to the veterinarian if they were ill; 12.8 percent would try to cure their dogs with traditional medicine; and the remainder would seek no treatment (Butler, 2000).

This study found that households having knowledge about the rabies diseases were more likely to take measures to prevent disease as opposed to those who did not. It is therefore important that health in intensified in the communities in order to prevent the disease. This is in agreement with the study done in America by Andrea which study concluded that one of the primary methods for rabies prevention and control is practical and accurate public health information. Recognition of the signs and severity of rabies, exposure routes, behavioral and environmental risk factors, and appropriate domestic animal welfare are critical messages for disease prevention and require appropriate public education for persons of all ages (Andrea: 2012).

The results of the study revealed that the majority of rural households in the study area kept more than 2 dogs at one household. The reasons given for such situation was that animals helped them in terms of hunting. While both households in urban and rural areas said they kept dogs basically for security reasons as a result it never mattered on the total number of dogs kept. This is what a study by McCrindle also found that dogs living with humans may be classified into three or four categories: pets, community dogs, strays, and ferals. In developed countries the majority of dogs are pets (i.e., they are allowed in the house, given names, regarded as part of the family, and never eaten). Those dogs that are not pets are either stray animals or true ferals (a very small percentage). Except in some traditional communities (e.g., Native American), there are no community dogs. In most developing countries, the main function of dogs is to protect property. Dogs in Soweto, South Africa, are used primarily to guard livestock and property and to hunt (McCrindle et al. 1999).

This study found that feeding times was used a preventive measure for the dogs to be found on the street, as the more times the dogs were fed at their own household the less presence of stray dogs. The majority of households fed their dogs for two and three times a day and every day of the week which implied that there were few dogs found on the streets. However, in contrast the majority of the households did not tie their dogs which meant that they pre-deposed their dogs to become stray dogs. This is in agreement with what Joshi (1990) found that in Machakos, Kenya, 69 percent of dogs are never restricted. In the Thungsong District of Thailand, 74 percent of dogs are allowed to roam freely. In New Providence, Bahamas, 73 percent of households keep their dogs outside, and 43 percent of households allow at least one dog to roam (Fielding and Plumridge 2005). While most dogs may depend on a particular household or neighbourhood, the resources provided at "home" sites are often insufficient. Most dogs roam to forage for food since they are not fed daily by owners (McCrindle et al. 1999).

5. Conclusion

The aim of this study was to to determine the level of dog ownship, vacation statuses of dogs and to measure the socio-economic factors that rabies has on people of Chipata. The study concludes that most households owned more than 2 dogs and most of the dogs were not protected against rabies. There were inadequate access to vaccination points. However, most household had adequate knowledge about rabies prevention.

The number of dogs kept at a household, the influence of the marital status, religion and education level of the household head have impact on the vaccination status of the dogs. Further distance was a pre-determining factor for the dogs to be vaccinated or not, however, of the vaccines did not play any part in the reduction of dogs to be vaccinated. The study therefore recommends that households should minimize the number of dogs owned to two for easy managing, the level of awareness among the communities on the need to vaccinate their dogs should be intensified as the level of education was found to be important in the prevention of rabies and the veterinary department should open up more vaccination points or if possible conduct three months mobile dog vaccination. It is very important to take such a measure especially for the ruraldogs which are being used for hunting. Due to the wildlife interface the dogs may contract rabies from the wildlife.

Public health intervention to improve access to vaccination through outreach for rural households and education on the need to minimize dog keeping as a way to minimize the risk of dog bites and rabies in both animals and humans.

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Author Profile

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Annexed: The control and preventive measures available

Table 4 shows various preventive measures available in the district. Feeding times in this study was a preventive measure for the dogs to be found on the street, as the more times the dogs were fed at their own household the less presence of stray dogs. The majority of households fed their dogs for two and three times a day and every day of the week. While the majority70% (C.I = 66.2 – 73.8%) of the households did not tie their dogs which meant that they pre-deposed their dogs to become stray dogs. Finally, the majority 76% (C.I = 72.6 – 79.4%) of respondents had knowledge about rabies. However, all the studied variables were not significant pre-determinants of presence of stray dogs on the streets.

Table 4: The preventive measures available in the community

Variable	Response	Frequency	Percentage	P value
Feeding times	≤ 1 time	102	13	0.719
	Betwn 2 & 3	645	82	
	> 3 times	40	5	
Tying of dogs	Yes	235	30	0.995
	No	552	70	
Knowledge about rabies	Yes	595	76	0.989
	No	189	24	