Factors Lowering Levels of Rabies Vaccination: A case of Kibaha Town District of Tanzania

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Proceedings of the First One Health Conference (embedding the 37th TVA Scientific Conference)

Venue: Arusha International Conference Centre (AICC), Tanzania

Dates: 27th to 29th November 2019

TANZANIA VETERINARY JOURNAL
Volume 37 (2019): Special Issue of TVA Proceedings
ISSN: *0856 - 1451 (Print), ISSN: 2714-206X (Online)*
https://tvj.sua.ac.tz

https://dx.doi.org/10.4314/tvj.v37i1.8s

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SUMMARY

A study was conducted in Kibaha Town Council of Pwani Region of Tanzania to survey the probable factors that negatively affected the anti-rabies vaccinations leading to low percent coverage in some selected wards. The data used in this study were gathered from households keeping dogs and cats and institutions, using a semi-structured questionnaire and interviews. Another set of data was the record of the rabies control programme at the district veterinary office. Analysis of the data was done using SPSS.16, Microsoft Excel 2007 and EpiInfo™7. The enquiry instrument centred on three main fields, namely, knowledge of respondents about rabies, responsible dog ownership and their perception of issues pertaining to the conduct of the rabies control programme. The results showed that the last round of vaccination covered dogs for 57% of the sampled households in the selected wards. A huge percentage of the respondents (64%) kept the wrong perception that clinical rabies could be cured. Only 34% of the respondents indicated that they had been taught about rabies in a WHO project area. It was also learnt that there was an outbreak of rabies in the district after 2 years of consecutively vaccinating the dogs in the area. The Chi- square test for linear trends showed very highly significant statistical differences in the progression of numbers of dogs vaccinated over the years ($p<0.05$; = 0.0000). This study concludes that, lack of sufficient knowledge on rabies and negative attitude towards the control programme were the biggest drawbacks on the vaccination coverage.

Key words: *Factors, Rabies, Low, Vaccination, Coverage*

INTRODUCTION

In Tanzania, rabies was first reported in 1930 in the southern regions and has since spread to the rest of the country(Sambo *et al.* , 2013) and is now considered endemic throughout the country. However, for places where rabies is endemic, WHO has set minimum vaccination percentage coverage of at least 70% in order for the said vaccinations to be effective in disrupting the transmission cycle of rabies, depending on the level of interaction amongst dogs,(Fitzpatrick *et al.* , 2012) . To attain this recommended percentage of vaccination, programmes should use the following strategies: well-designed educational campaigns, Intersectoral cooperation, ensure community participation in the programme, involve the locals in planning and execution of the programme, involve the media in communicating messages to the community, ensure availability of recognized good quality vaccine and effective management of the activities by the veterinary and health services. These should be backed by a good surveillance system. Embracing these recommendations can make elimination of canine rabies a reality as has been reported

https://dx.doi.org/10.4314/tvj.v37i1.8s

in the success story of the Latin American and the Caribbean (WHO , 2005). Insufficiency of information to estimate realistic vaccination coverage that disrupts rabies transmission in the long term is a common problem for most places (Gsell et al., 2012).

The Bill and Melinda Gates Foundation (BMGF) rabies control project is a WHO programme that covers south-eastern Tanzania as part of its mandate, is assumed to have followed the recommendations of the WHO on the best way to conduct mass rabies control campaigns. It was, however, observed that the percentage of vaccination coverage was not very impressive in an area where good practices have presumably been followed (District Veterinary Summary Report on rabies Vaccination programme, 2013). This left one wondering as to what the problem might have been. The observation of this poor performance in vaccination coverage is what prompted this scholarly inquiry into the matter.

Insufficient vaccination coverage will often result in failure to break the transmission cycle of rabies, resulting in recurrence of outbreaks from time to time. Ultimately it becomes a waste of resources, as the objectives are not met. It was the objective of this research to investigate the probable reason for unsatisfactory vaccination coverage through assessing the knowledge of dog owners on rabies, their perception of the rabies control programme, how much the WHO recommendations on mass rabies vaccination had been followed and the trends in the vaccination records for success.

It also investigated other factors that might have a bearing on the success of such programmes. It was hoped that this survey would reveal some important information about the purported scenario and hopefully prompt more detailed inquiry into the matter. The findings would be important in improving planning for similar activities in future.

MATERIALS AND METHODS

Study area

This study was carried out in Kibaha Town Council of Pwani Region of Tanzania. Kibaha Town District is one of the areas that were covered under the WHO's Department of Control of Neglected Tropical Diseases project for demonstration of control and eventual elimination of rabies in low-income countries funded by the Bill and Melinda Gates Foundation (BMGF).

Specifically, the research involved four wards, namely, Kongowe, Visiga, Msangani and Picha Ya Ndege, which were reported by the Kibaha Veterinary Office to be the poorest performing in the district.

Study Design and Sample size

A cross-sectional study design was employed where a total of 100 households were sampled based on 10 percent sampling used in a related study by (Knobel et al., 2008).

This was calculated from an estimated 800 dog-keeping households (reported by the District Veterinary Office) with a 20% mark-up for shortfalls.

Sampling

Four wards were purposively selected as they were on record for poor performance in rabies vaccination under the BMGF rabies elimination demonstration project. Prior to the beginning of work all the selected wards were visited to detail the communities on the objectives of the impending exercise, the participant selection procedure, arrange dates for the interviews and generally get them ready for the work.

A simple random selection technique was used to select names from the list of dog-owning households kept at the Veterinary Department Offices. The names of dog owners for each ward were written on pieces of paper and put in card boxes from which twenty-five were picked for each ward. The nearest dog owning household that had not been picked would be picked as replacement in the event that a selected household was not available at the time of conducting the interview.

Data Collection

A semi-structured, pretested questionnaire was administered to the heads of the selected dog-owning households or their representatives. In the pre-test, reliability test was run on 10 % of the proposed sample size with reliability coefficient of 0.869.
Information on dog owners' basic knowledge of rabies, means of creating community awareness of the anti-rabies vaccination programme and community's perception of the rabies control programme were collected.

Data for the totals of rabies vaccination coverage over the years of the project were also collected from the records at the Veterinary Department in Kibaha.

Data analysis

The frequencies of the respondents' knowledge and practices on the various variables, and perception of rabies control programme were calculated as percentages. Comparisons of the dependent variable (vaccination status of dogs) against the independent variables were made in terms of Chi square values, Odds ratios (with 95% confidence intervals) and p values to establish any associations and the significance of the observed differences.

Chi-square for trends and vaccination percentages were calculated on the vaccination data collected from the district veterinary office. The mean annual vaccination coverage and populations were also calculated together with their 95% confidence intervals.
Knowledge and perception indices were also created from the data processed in SPSS 16 software to check the degree and distribution of knowledge and the inclination of the respondents' perception of the rabies vaccination programme.

RESULTS

The data collected was in two categories: 1) fundamental knowledge about rabies and its prevention, available rabies control facilities, announcement of the rabies control at the beginning of anti-rabies vaccination programmes and responsibility over their dogs 2) their perception of the of the rabies control programme.

The former was designed to yield dichotomous 'Yes' and 'No' answers with an exception of a few that were open ended while the latter had Likert-scale format answers on perception.

Knowledge of basic facts about rabies

The proportions of respondents' knowledge on various aspects of rabies were distributed as shown (Figure 1). Knowledge index was formed based on the accumulation of knowledge points.

In formation of the index, answers to the questions on basic knowledge about rabies were awarded a score of one (1) if correct while an incorrect one got a zero (0). So a score of 1 meant that the respondent was knowledgeable while 0 meant that the respondent was not knowledgeable.

Total points for an individual respondent were accrued by counting the number of correct answers and dividing the sum by the total number of questions. Table 1 shows the results of the cumulative index scores.

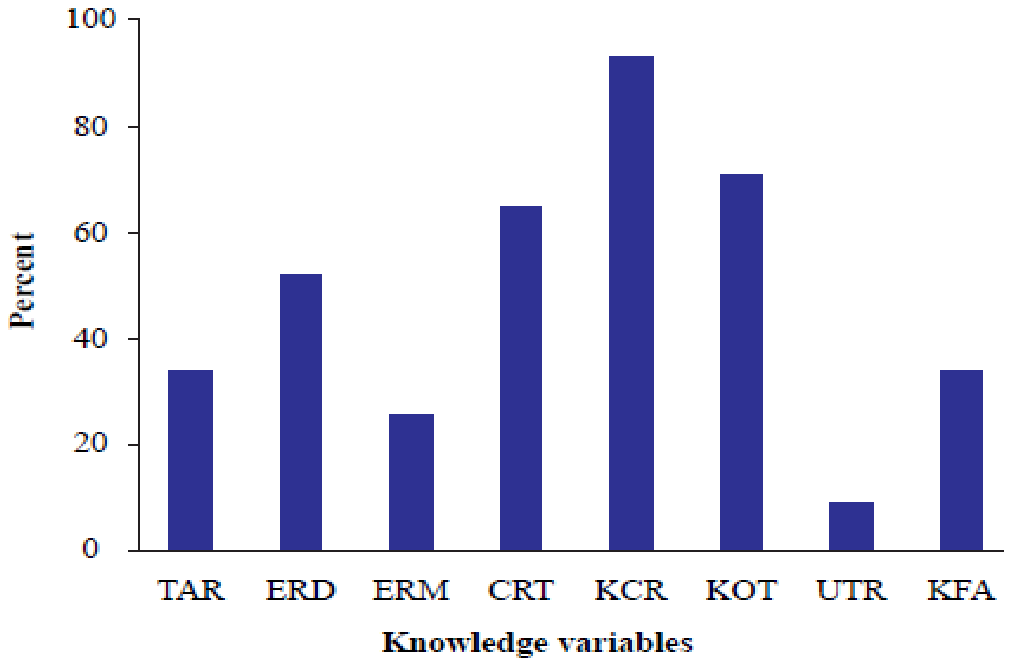

Figure 1. Distribution of respondents' basic Knowledge of rabies by percent. TAR=Taught about rabies, ERD=Experience of rabies in Dogs, ERM=Experience of rabies in man, CRT= if Clinical rabies is treatable, KCR=Knowledge of control of rabies, KOT=Knowledge of transmission of rabies, UTR=Use of traditional remedies, KFA=Knowledge of First Aid for suspected rabid bite.

Table 1. Distribution of respondents by rabies knowledge index scores

Knowledge index score Index Range (0-1)	Whole Sample, n=100 Number of respondents (Serves as % as well)
0	1
0.17	5
0.20	10
0.50	16
0.67	42
0.83	22
1	4
Total	100

Mean: 0.63, 95% CI (±0.04), Mode: 0.67, Min: 0, Max: 1

Responsible dog ownership and health management

Responses to questions on responsible ownership came out as follows: 87% said the parents were the exact owners of the dog (s) and 13% had child-owned dog(s). On vaccination information issues 57% said they had vaccinated their dogs in the 2013 anti rabies vaccination round; 43% said they took their dogs for medication when they were sick; 6% said they would only vaccinate their dogs when there was an outbreak of rabies, 47% that they wait for announcements to be made by the veterinary department and another 47% said they vaccinate as advised by the department; 81% said they take their dogs for medication when sick; 95% said parents are responsible for veterinary bills while 5% that children are responsible; 84% said they secure the dog(s) either by chain or housing; 73% said they allow their dog(s) to roam the streets.

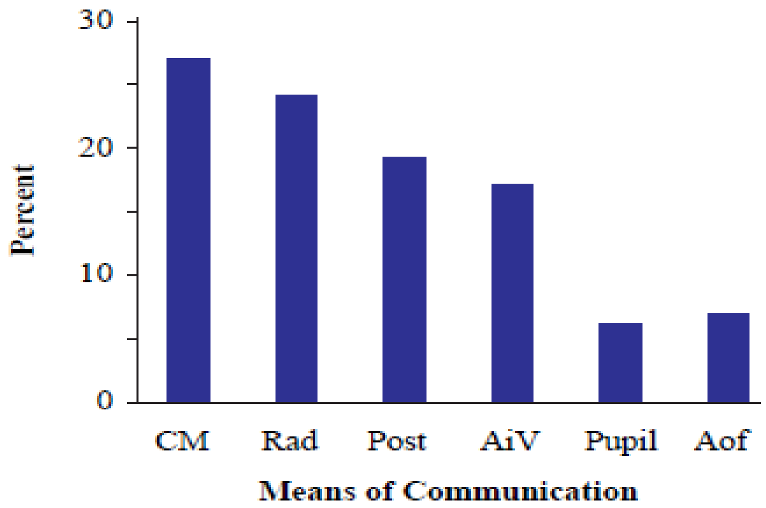

Figure 2a. First means of hearing about the rabies programme. CM=Community meetings, Rad=radio,Post=Poster.AiV=Announcers in Vehicles, AoF=Announcers on foot

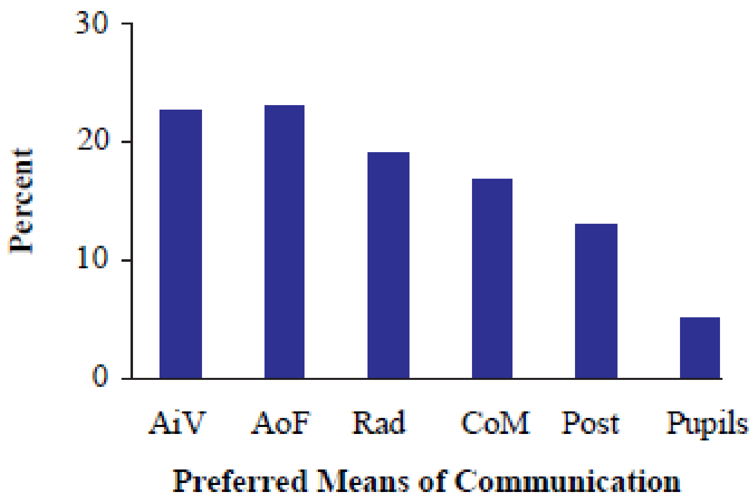

Figure 2b. Preferred means of communication. CM=Community meetings, Rad=radio,Post=Poster.AiV=Announcers in Vehicles, AoF=Announcers on foot

Mass communication of vaccination programmes and preferred communication method

Responses to the means by which the respondents first heard of the rabies control programme and the preferred means of communicating rabies control programmes are shown in Figures 2 a and 2b, respectively.

Reasons for keeping dogs and perception of rabies control programme

Dogs were kept as pets (5%), security (92%) and no reason (3%). The results of the attitude index towards the rabies control programme are shown in table 2. The highest score was 0.86 (10 % of the respondents) while the lowest was 0.21 (5% of the respondents), and the mode of the scores was 0.57.

Table 2: Distribution of Respondents by attitude index

Attitude index scores	Whole sample, n=100	
	Number of respondents	Percent on a score
0.21	5	5
0.28	5	5
0.36	10	10
0.43	9	9
0.50	12	12
0.57	16	16
0.64	16	16
0.71	9	9
0.79	8	8
0.86	10	10
Total	100	100

Mean: 0.57; Minimum: 0.21; Maximum: 0.86; Mode: 0.57

Multidisciplinary approach

From one-on-one interviews with some selected institutions it was declared that they were involved in the rabies control programme. The ward leaders, church leaders, schoolmasters and media houses (radio and television) were all involved in dissemination of information on the vaccination programme. The District Council (rabies coordinator) partnered with the Veterinary Department in planning and implementation.

The community development department was conspicuously not involved, while the Wildlife department, who have always been a part of such exercises in other places where similar programmes have been undertaken, did not exist (does not have
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offices in Kibaha town as there are no game parks or reserves that that fall under the jurisdiction of this council).

Vaccination Records from the Veterinary office

Vaccination data from wards (Tables 3-4) were used for statistical analysis and chi square values were calculated both for dogs and cats to check for statistical significance of the variation from one year to another over the project period.

The results indicate that the differences were statistically significant: for the combined wards, X^2=860.38 and p<0.05, while for the district, X^2 =822.9 and p<0.05.

Table 3: The information for the wards where the research data came from

Year	Ward	Total population		Number vaccinated		Vaccination Coverage Percent Dogs/Cats
		Dog	Cat	Dog	Cat	
2010	Kongowe	292	18	112	10	38/55.5
	Visiga	212	31	140	26	66/83
	Msangani	182	10	73	9	40/90
	Picha/ndege	198	11	104	10	52.5/90.9
2011	Kongowe	284	38	116	18	40.8/47
	Visiga	148	9	52	5	35/55.5
	Msangani	136	25	42	20	30.9/80
	Picha/ndege	280	21	123	12	44/41.4
2012	Kongowe	413	40	360	39	87/97.5
	Visiga	335	28	244	25	72.8/89
	Msangani	260	33	123	27	47/82
	Picha/ndege	482	32	371	32	77/100
2013	Kongowe	531	51	499	46	94/90
	Visiga	292	25	218	21	74.6/84
	Msangani	244	31	204	30	83.6/97
	Picha/ndege	499	56	476	52	95.4/93

Table 4: The record information for the whole district

Years	Total Population		Number Vaccinated		Vaccination coverage Percent Dog/Cat
	Dogs	Cats	Dogs	Cats	
2010	3706	362	2418	245	65/68
2011	1791	398	1157	181	64/45
2012	4000	390	3415	348	85/89
2013	4120	452	3597	349	87/77

NB: The fluctuation in dog population between 2010 and 2012.

The chi-square for trends on both the combined wards and the district showed p-values of 0.0000. The mean annual vaccination coverage in dogs over the project years for the wards were Kongowe (72%, 95% CI±19.31), Visiga (66.3%, 95% CI±10.78), Msangani (53.8%, 95% CI±9.68), Picha Ya Ndege (73.6%, 95% CI±18.9). There was an outbreak of rabies in July 2013 after years of consecutive vaccinations. Over the project period, a total of 18-dog brain specimens were collected and presented for rabies diagnosis and 7 tested positive.

DISCUSSION

The current study was set to determine the factors that affected the levels of rabies vaccination based on the basic knowledge about rabies, practices and the perception of the rabies control programme by the dog owners in the study area. Overall, it was shown that there were many knowledge gaps on rabies though their attitude was slightly positively inclined. It also revealed insufficiency in dog demographic knowledge by the Veterinary Department.

The results of this research revealed that the percentage of rabies vaccination coverage

(57%), in the selected wards of Kibaha Town Council was lower than the WHO recommended range of at least 70%. In a similar study, (Kongkaew et al., 2004) observed 80% coverage. According to (Okonko *et al.* , 2010) even countries with potentially sufficient resources have been shown to not often meet and sustain these rates. Low vaccination coverage risks failure to attain population immunity that is protective.

In this study it showed that securing dogs was associated with increased vaccination levels (OR=2.58, 95% CI [0.086-7.7.76]) but the p value (0.086) could not prove any statistical significance in the differences. The low level of vaccination coverage observed (57%) in this study does not tally well with the 84% score on securing of dogs. (Davlin , 2011) and (Kongkaew *et al.* , 2004) showed that confinement of dogs gave higher odds of vaccination. This result could be an effect of purposive selection.

This study showed strong and significant association between knowing the mode of transmission for rabies and vaccination rates OR=6.4, 95% CI (2.46-16.7), (p=0.007). (Davlin , 2011), in the Philippines, showed that knowledge score was positively and significantly associated only with attitude and practice scores. In the current study it is uncertain that the dog owners' knowledge is from being taught since only 34% were taught, and this was insignificantly associated with vaccination, (p=0.26) though with good OR=1.62, 95% CI (0.69-3.81).

Apparently, the recommended well-designed educational campaigns were ignored. The findings that only 57% would take their dogs for treatment and the revelation that there are no facilities for treatment of dogs are antagonistic of each other and invalidate the claims that dogs are taken for treatment at all. In contrast, (Kongkaew *et al.* , 2004) found that rabies vaccination services were available throughout the year from various providers. These findings indicate lack of a binding rabies control policy with room for a state of lawlessness. The average number of dogs per household was calculated to be 2.8 (95% CI ±0.5), which is higher than what (Knobel *et al.* , 2008) found in their study of factors affecting ownership of dogs. However, this did not show significant association with vaccination rates, p>0.05.

This study revealed that announcers on foot and in vehicles were the favourite means of communicating messages. In comparison (Kongkaew *et al.* , 2004) had the administrative office and use of para-veterinarians as the most effective means. Some serious link was missing between the community and schools. Schools harbour children (author's opinion) who are disproportionately the victims of rabid dog bites,(Knobel *et al.* , 2008) as sited by (Lembo *et al.* , 2011) and should be one of the targets.

This study showed that, among all the knowledge parameters investigated, only knowledge of the rabies control methods and mode of transmission were significantly association with vaccination rates [p=0.002, OR=5.74, 95% CI (1.72-19.19)] and [p=0.000, OR=6.4, 95% CI (2.46-16.7)] respectively. Sambo (2012) found that 81% of respondents knew the mode of transmission of rabies while 63% knew that clinical rabies was not curable, but did not relate this to the odds of vaccination of dogs.

Being taught about rabies did not have significant association with vaccination of dogs (p>0.05), OR=1.62 95% CI (0.69-3.81). With 64% of the respondents saying clinical rabies could be cured coupled with only 33% knowing the first aid for dog bites is a dangerous anomaly in knowledge.

The modal index value was 0.67 (67% knowledgeable) with forty-two percent of the respondents in it. This actually higher than what (Davlin , 2011) reported (8.36 on a 1-24 scale) as compared to 0.67 on a 0-1 scale. The mean index score was 0.63, 95% CI (±0.04). In general the population would be considered knowledgeable as the mean score falls above 64% recommendation for Likert scale (Xiang *et al.* , 2010).

The modal index was 0.57 (range 0 - 1), which had 16% of the respondents. 41% 0f the respondents were below while 43% were above the modal index score. This mean attitude score is a lot smaller than what (Davlin , 2011) calculated (5.65 on 2-6 scale) in his study in the Philippines. This does not reach the 64% score to qualify as a positive attitude. It effectively implies that the community does not strongly support the rabies control programme.

There was an occurrence of cases of rabies in dogs in July 2013. At the time the project had run two annual rounds of vaccinations. Much speculation can be done ranging from vaccine mismatch to low numbers of dogs vaccinated through loss of herd immunity due to mortality and loss of individual immunity (Gsell *et al.* , 2012). This is, however, a subject for further studies. Assuming that all had been done well, the event goes against the model predictions of (Zinsstag *et al.* , 2009) that a mass vaccination against rabies that covers 70% and more is sufficient to stop transmission of dog rabies for about six years.

This study also proved what others have reported in some studies that the use of a central-point during vaccination campaigns enables vaccination of more dogs than other strategies under diverse conditions (Kaare *et al.* , 2009). The majority of the respondents (78%) had their dogs vaccinated at central-point when compared with the other two alternatives (Kaare *et al.* , 2009).

From the evaluation of the results of this study, it can be concluded that lack of sufficient knowledge on rabies and negative attitude towards the control programme were the biggest drawbacks on the vaccination coverage. The latter and all other factors anchor on knowledge, which also covers that of dog demographic information by government actors.

RECOMMENDATIONS

This study emphasizes more on community education in future programmes of similar nature. Further laboratory-based research needs to be carried out to ascertain the immunity levels of the dog population. This is in the wake of an outbreak of rabies in the midst of the annual vaccinations. Deliberate effort should be made to involve all stakeholders in future anti rabies campaigns. Further broader studies in factors affecting vaccination uptake should be considered as the current study could only investigate a few due to limitation in time and resources. Studies to get sufficient demographic information on dogs should seriously be considered.

ACKNOWLEDGEMENT

First and foremost, it is my pleasure to convey my deep appreciation to my sponsors The Southern African Development Corporation-Trans-boundary Animal Diseases project (SADC-TAD’s) and their funders African Development Bank for the great initiative they took to fund such a valuable training course.

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