



Dog anti-rabies vaccination coverage in Jos South LGA of Plateau State, Nigeria

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Domestic dog (*Canis familiaris*), a well-known companion of man, is the main reservoir host of rabies virus and source of infection to humans in 95% cases in Africa. Vaccination of dogs against rabies is the most effective way of controlling the disease. WHO recommends that annual vaccination coverage of dog populations should be 70% and above for effective control of rabies. However, vaccination coverage of dogs is very low in most African countries, including Nigeria, where the global burden of the disease is highest next to Asia. The aim of this study was to determine and compare rabies vaccination coverage of dog population in Jos South Local Government area (LGA), Plateau State, Nigeria, using two survey approaches. Data on vaccination profile of rabid suspected dogs in Jos South LGA, were retrieved from records of cases presented to the National Veterinary Research Institute (NVRI), Vom, Nigeria, for confirmatory diagnosis from 2011 to 2016. Field data on demography and vaccination profile of owned domestic dogs were also obtained by face to face interview with dog owners in the LGA using structured questionnaire. Vaccination coverage of 4.9% and 19.7% were obtained for record and field surveys respectively, for sample estimates. Although average vaccination coverage was estimated as 12.4%, the true population vaccination coverage could be between 12% and 18%, (95% CI). The P-value (0.000) for association between survey approach and true vaccination coverage of dog populations in Jos South LGA was significant. Consequently, evaluation of regular vaccination by active survey is key to achieving WHO recommended vaccination coverage. Nigeria can only align with the world rabies elimination target of 2030 set by the WHO, OIE and FAO by active disease surveillance and enforcement of responsible dog ownership.

Keywords: Domestic dog, Jos South LGA, Rabies, Surveillance, Vaccination

Introduction

Rabies is a neglected zoonosis of high public health importance caused by rabies *Lyssavirus* in the family

Rhabdoviridae. It is transmitted to humans by animal bites, commonly from domestic dogs (Hampson et al., 2015). Globally, rabies causes

more than 60,000 human deaths annually (WHO, 2017) with 44% of cases occurring in Africa (WHO, 2005). The disease has a huge financial burden as appropriate Post Exposure Prophylaxis (PEP) is quite expensive and not readily available in resource limited countries (Medley *et al.*, 2017).

Dog rabies is endemic in Nigeria and is maintained by dog to dog transmission (Oduye & Aghomo, 1985). Vaccination of dogs against the disease is the most effective method of prevention and control (WHO, 2013) and attainment of 70% vaccination coverage of dog population as recommended by the WHO (Medley *et al.*, 1996) is an important factor for breaking the cycle of its transmission. However, in many African countries, dog vaccination coverage is far below the WHO recommendation (Jibat *et al.*, 2015). In Nigeria, dog population is on the increase (Adaba *et al.*, 2004) and are poorly managed as only insignificant numbers are vaccinated against rabies (Ahmed *et al.*, 2000), in spite of availability of National Veterinary Research Institute (NVRI), Vom egg-based low egg passage fluffy rabies vaccine for dogs and several imported exotic cell culture vaccines found in major cities of the country.

Plateau State, located in North-central zone and the twelfth largest State in Nigeria (population figure 4, 200, 400 based on the 2016 population projection) (NPC, 2006) is the headquarters of dog and dog-meat trade from where hundreds are moved in and out of the state daily without any form of restriction to other parts of Nigeria (Kozing *et al.*, 2015). The objectives of this study were to determine and compare vaccination coverage of domestic dog population in Jos south LGA, Plateau state based on two survey approaches.

Materials and Methods

A descriptive and analytical cross-sectional study was conducted on archival records of rabies laboratory 2011-2016 to determine antirabies vaccination profile of dog samples (dog head) submitted for confirmatory diagnosis at the National Veterinary Research Institute (NVRI), Vom and also data on dog antirabies vaccination collected by random sampling and administration of structured questionnaire to dog owners during a field survey carried out in Jos South LGA of Plateau State. We described the point estimates of vaccination coverage for two survey approaches and tested the hypothesis of no significant difference between the two approach methods, using descriptive statistics and Chi-Square.

Results

From the record survey, the highest number of cases (79/284) and dogs without vaccination history 27.5% (78/284) (expired vaccination inclusive),

occurred in 2014. However, 2012 had the highest annual rate (100%) of dogs without current vaccination record, followed by 2014 (98.7%). Ninety percent or more of the dogs in the remaining four years had no current vaccination records. Overall, only 4.9% (14/284) had vaccination record while 91.6% (260/284) had none (Table1). It was also observed that 10 (3.5%) of the dog population had record of expired vaccination by two years or more (Table 1).

From the field survey however, only 19.7% (358/1815) of the dog population studied had current record of rabies vaccination, 69.0% (1251/1815) had none, while 11.3% (206/1815) had expired records of vaccination (Table 2). Consequently, Vaccination coverage for dog population under field survey was 19.7% (P1). The dogs were also categorized into confined (24.5%) and free roaming (75.5%) (Table 2). Table 3, depicts summary of record and field surveys, While Table 4 shows expected frequencies for the null hypothesis. At 95% CI, the true vaccination coverage for dog population in Jos South LGA was between 12% and 18%.

Discussion

Low proportion of vaccinated dogs observed in this study with the two survey approaches is a proof of poor attitude of dog owners towards vaccination of their dogs against rabies across Nigeria (Fagbami *et al.*, 1981) in general and in Jos South LGA in particular. The minute proportion of vaccinated dog population is also an indication of poor herd immunity among dog population which implies that both humans and other warm-blooded animals in Jos South LGA, Plateau State are at risk of infection with the disease. It is worrisome to have about 80% of the dog population surveyed unvaccinated and moving freely in the communities without restrictions (Table 2). This category of dogs will remain vulnerable to rabies and serve as source of infection to people and other animals. The result of this study agrees with the review findings of Jibat *et al.* (2015) that reported 18% vaccination coverage rate in "owner-charged" dog rabies vaccination schemes for generality of African countries. It is believed that majority of dogs in Africa are owned (Jibat *et al.*, 2015) and should be accessible for parenteral immunization; making the control of rabies in the country and Jos south achievable if there is will power on the part of dog owners to ensure annual vaccination of their dogs. Animal control and vaccination strategies have proved successful in preventing spread of rabies in a number of countries (WHO, 2017). The recommended vaccination coverage by the WHO have in several

Table 1: Record of dog vaccination profile based on sample submissions to NVRI, Vom for rabies confirmatory diagnosis from 2011 to 2016

Year	Dog sample submission	Dog Vaccination Status		
		Current vaccination	Expired vaccination	Unvaccinated
2011	53	4	4	45
2012	52	0	1	51
2013	50	5	2	43
2014	79	1	1	77
2015	26	2	0	24
2016	24	2	2	20
TOTAL	284	14(4.9%)	10(3.5%)	260(91.6%)

Vaccination coverage $14/284 = 0.049 \times 100 = 4.9\%$ (P2)

Table 2: Distribution of dogs sampled in November 2016 during field survey in Jos south LGA, Plateau State by vaccination status and management system

Dog Vaccination Records	Total No. Sampled (%)	Dog Management System	
		Confined	Free-Roaming
Current	358 (19.7)	67(18.7%)	291(81.3%)
Expired	206 (11.3)	49 (23.8%)	157 (76.2%)
None	1251 (69.0)	329 (26.3 %)	922 (73.7%)
Total	1, 815	445(24.5%)	1370(75.5%)

Vaccination coverage $= 358/1815 = 0.197 \times 100 = 19.7\%$ (P1)

Table 3: Observed frequencies based on summary of sample estimates

Vaccination Status	Field survey	Record survey	Total (%)
Vaccinated	358	14	372 (17.7)
Unvaccinated	1457	270	1727 (82.3)
Total	1815 (86.5%)	284 (13.5%)	2099 (100)

Table 4: Expected frequencies

Vaccination status	Field survey	Record survey	Total
vaccinated	$\frac{372 \times 1815}{2099} = 321.67$	$\frac{372 \times 284}{2099} = 50.33$	372.0
Unvaccinated	$\frac{1727 \times 1815}{2099} = 1493.33$	$\frac{1727 \times 284}{2099} = 233.67$	1727.0
Total			2099

regions of the world sustained herd immunity and interrupted transmission circle of rabies (Medley *et al.*, 1996; Hampson *et al.*, 2009).

The vaccination coverage observed in the study is far below the recommended threshold needed to break the transmission cycle of the virus. Some of the factors responsible for this may range from low level of awareness of danger of rabies, financial constraint or even owner apathy. According to Aga *et al.* (2016), rabies control programs are low priority to governments of developing countries. Despite its impact on public health and economy, rabies is highly neglected as little or no funds are allocated for its control and prevention.

Government interventions, by way of enforcement and/or provision of highly subsidized or free vaccination, could enhance compliance. Thus,

creation of public awareness on the danger of rabies, importance of vaccination of dogs against rabies through the media, schools, religious organizations, in addition to enforcement would play important role in improving compliance with the dog vaccination laws and subsequent attainment of rabies free country.

The findings of this study have also shown that communities in Jos South have not made adequate use of what NVRI, Vom has to offer in terms of protection of animal health, such as availability of lowcost rabies vaccines and numerous veterinary services. It is either the community is ignorant of the facilities and services available at NVRI and the teeming veterinary surgeons on the plateau or has a wrong attitude towards seeking health services for their animals.

By law, it is the duty of the local government authority to implement and enforce the dog laws as provided in its legal documents (FRN, 1988). Enforcement and issuance of dog licenses will serve as a source of revenue generation for Nigerian government. The World Health Organization (WHO), World Organization for Animal Health (OIE) and Food and Agriculture Organization (FAO) have set a target for World rabies elimination by 2030 (Scott *et al.*, 2015; Jarvis, 2016) and Nigeria should not be surpassed in the global community in attaining this target. An important aspect to achieving this goal is active disease survey. This was clearly shown in the study where determination of dog anti rabies vaccination coverage by field survey showed a significant difference from record survey. Although we do not downplay the role of records in disease monitoring and surveillance activities, the enormity of rabies in Nigeria as it stands requires proactive steps by stakeholders. The NVRI, in collaboration with Federal Department of Livestock and Pest Control Services needs to ensure regular and active disease searching in addition to disease evaluation until the desired vaccination coverage is attained.

In conclusion, the imperative to eradicate rabies in Nigeria through active disease searching and effective vaccination coverage is paramount. The authors advocate for free mass vaccination scheme and enforcement of responsible dog ownership in order to achieve 70% dog vaccination coverage for effective rabies control and elimination by 2030 as set by WHO, OIE and FAO.

Conflicts of Interest

The authors declare no conflicts of interest.

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