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

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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 flurry 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 (Konzing 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 x 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 x 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         | 372 x 1815 = 321.67 | 372 x 284 = 50.33 | 372.0 |
| Unvaccinated       | 1727 x 1815 = 1493.33 | 1727 x 284 = 233.67 | 1727.0 |
| Total              | 2099         | 2099          | 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 surveillance. 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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