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Preliminary cross-sectional survey of the knowledge and practices among urban and rural households regarding rabies in dogs, in Owerri, Nigeria

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Abstract

Rabies is a fatal zoonotic viral disease commonly transmitted to humans primarily through bites or scratches of infected dogs. This study assessed knowledge and practices regarding rabies in dogs among urban and rural households in Owerri, Nigeria. Using a cross-sectional survey design, data were collected through a structured questionnaire administered to 63 participants, comprising 30 from urban settings and 33 from rural areas. Informed consent was obtained before participation. Demographic analysis indicated a predominance of males and a significant representation of the Igbo ethnicity. Findings showed that urban households had notably higher awareness of rabies, with an odds ratio (OR = 7.3; p = 0.001), indicating they were 7 times more likely than rural households to know about the disease. This trend was consistent across various aspects, including knowledge that dogs can be carriers of the rabies virus (OR = 5.4; p = 0.01) and risks associated with free-roaming dogs (OR = 3.0; p = 0.04). Also, lower odds (OR = 0.32) were observed among urban households regarding the inability to identify sudden aggression by a dog as possible sign of rabies and the fatality associated with rabies (OR = 3.5; p = 0.03). Furthermore, urban households showed more proactive practices, including regular dog vaccination against rabies (OR = 29.3; p = 0.001) when compared with rural households, and reported dog bites to relevant health and veterinary authorities (OR = 3.3; p = 0.06). The study highlighted significant gaps in knowledge and practices between urban and rural households, suggesting a need for targeted educational interventions and improved rabies management strategies in rural communities.

Keywords: Rabies; Dogs; Knowledge and Practices; Urban and Rural households; Owerri, Nigeria.

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Introduction

Rabies is a fatal viral disease caused by the rabies virus in the genus Lyssavirus, family Rhabdoviridae. It is transmitted primarily through bites or scratches by infected dogs, which accounts for greater than 99% of human rabies deaths globally (CFSPH, 2009). Rabies is a preventable disease. It can be spread to people and pets through the bites and scratches of an infected animal (CDC, 2026). Rabies primarily affects the central nervous system, leading to severe brain disease and death, if medical care is not received, before symptoms start (Otolorin *et al*., 2015). Rabies fatality is 100% once clinical signs appear, with death occurring within days due to encephalomyelitis (CDC, 2026)

The World Organisation for Animal Health (WOAH) in 2024 reported that up to 1.2 million dogs die from rabies each year in Africa, with an estimated 5 to 7 million people exposed to rabies through dog bites (WOAH, 2024). Additionally, the World Health Organization (WHO) estimated that about 59,000 human deaths occur annually, with 40% occurring in children < 15 years of age (WHO, 2024). Asia and Africa account for 95% of the global burden of the disease, making rabies a major neglected tropical disease (WHO, 2023).

Canine rabies is considered endemic in Nigeria. An estimated 1500 – 3000 human deaths due to rabies occur per year, but this is likely under-reported due to poor surveillance, mis-diagnosis and deaths at home (OIE, 2021). Risk factors associated with human-animal transmission of the disease, include poor access to veterinary services. Studies from Plateau and Benue State, Federal Capital Territory (FCT) and Southwest Nigeria report low dog vaccination coverage of < 30%, with high rates of free-roaming dogs, and dangerous practices such as applying herbs to dog bite wounds instead of seeking post-exposure prophylaxis (PEP) vaccination (Aiyedun *et al*., 2020). Pre-exposure and post-exposure vaccination has been reported to be effective in preventing human deaths from rabies if administered at the appropriate time (Lavan *et al*., 2017). However, they do not provide an obvious approach to eliminating zoonotic rabies because they appear to have little effect on canine virus reservoirs (Lavan *et al*., 2017).

Knowledge, attitude and practices (KAP) studies are critical because human behaviour is known to drive rabies transmission. Poor knowledge leads to delayed pre-exposure and post-exposure vaccination, and negative attitudes lead to vaccine hesitancy, and unsafe practices could allow dogs to roam, thereby increasing chances of exposure to the virus (Aiyedun *et al*., 2020). Vaccination of dogs against rabies is considered one of the most effective strategies for preventing human deaths from rabies and is key to rabies elimination (Chazya *et al*., 2025). There is paucity of information in available literature on the knowledge and practices of rural and urban dwellers (compared) in Owerri, Imo State Nigeria, with regards to rabies in dogs. The present study assessed the knowledge and practices among urban and rural households regarding rabies in dogs in Owerri, Eastern Nigeria.

Materials and Methods

Study area: The study was conducted in Owerri, the capital city of Imo State, located in the southeastern region of Nigeria. Sampling was conducted in the urban city of Owerri Municipal Council, and rural areas at Owerri North and Owerri West. The presence of both urban and rural populations made Owerri an ideal setting for the comparative study on knowledge and practices regarding rabies among rural and urban households.

Study design: The study was a cross-sectional survey on knowledge and practices that

involved face-to-face interviews and questionnaire administration to urban and rural households in Owerri. The questionnaire was an open-ended, and informed consent was obtained from the respondents before the questionnaire was administered. The demographic characteristics of the respondents were obtained and recorded, and the questionnaire on knowledge and practices regarding rabies in dogs was administered in form of an interview schedule, and a discrete response marked as yes or no was recorded for each respondent

Survey procedure and data collection: The sampling was conducted between May and July 2026. A total of 63 questionnaires were used for the study; 30 questionnaires were assigned to urban households, while 33 were assigned to rural households. A random sampling method was used for urban and rural households with dogs. Questions were asked, and the responses were recorded. The data collected were carefully recorded in an Excel spreadsheet for further analysis.

Data management and analysis: Chi-square was used to determine the likely association between the responses of the two categories of the study group and their demographic characteristics. Furthermore, data obtained from the questionnaire responses were subjected to odds ratio (OR) to determine the likely odds among the urban and rural households. Additionally, 95% confidence intervals (CI) were determined at plausible values that are statistically significant in the study, and values of $p < 0.05$ were considered significant.

Table 1. Demographic characteristics of the respondents (n = 63) in a survey of knowledge and practices with regards to rabies in dogs, in rural and urban households in Owerri, Nigeria.

Variables	Categories	Classification		Total (n = 63)
		Urban (n = 30)	Rural (n = 33)	
Gender	Males	21 (70.0%)	19 (57.6%)	40 (63.5%)
	Females	9 (30.0%)	14 (42.4%)	23 (36.5%)
Occupation	Military	0 (0%)	2 (6.1%)	2 (3.2%)
	Civil servants	3 (10.0%)	10 (30.3%)	13 (20.6%)
	Teachers	6 (20.0%)	5 (15.2%)	11 (17.5%)
	Self Employed	21 (70.0%)	16 (48.5%)	37 (58.7%)
Tribe	Igbo	23 (76.7%)	21 (63.6%)	44 (69.8%)
	Hausa	2 (6.7%)	0 (0%)	2 (3.2%)
	Yoruba	12 (40.0%)	5 (15.2%)	17 (27.0%)
Religion	Christianity	27 (90.0%)	22 (66.7%)	49 (77.8%)
	Islam	3 (10.0%)	11 (33.3%)	14 (22.2%)
Education	Non-formal	0 (0%)	0 (0%)	0
	Primary	1 (3.3%)	11 (33.3%)	12 (19.0%)
	Secondary	11 (36.7%)	20 (60.6%)	31 (49.2%)
	Tertiary	18 (60.0%)	2 (6.1%)	20 (31.7%)

Results

Demographic characteristics of the respondents: Among the households surveyed, males constituted a higher proportion (40/63 = 63.5%) of the respondents, while self-employed respondents had a higher representation (58.7%) (Table 1). The respondents were predominantly Igbos (69.8%) and Christians (77.8%) (Table 1). Also, the majority of the respondents (49.2%) had secondary school education, with up to 31.7% having tertiary education (Table 1).

Knowledge of canine rabies among urban and rural households: Urban respondents exhibited markedly higher awareness of rabies, with an odds ratio (OR = 7.3; p = 0.0001), suggesting they were approximately seven times more likely to have heard of rabies than their rural counterparts (Table 2). Furthermore, when questioned about the role of dogs as carriers of rabies, urban households demonstrated superior understanding (OR= 5.4; p = 0.001), indicating they were five times more likely to know that dogs serve as rabies carriers. Urban households were three times more likely to know that rabies infection is fatal (OR = 3.5; p = 0.01). Additionally, urban respondents showed greater understanding of transmission via saliva (OR = 3.3; p = 0.02). Moreover, urban households exhibited greater awareness of effective dog management practices, being three times more knowledgeable regarding management of dogs in intensive settings to mitigate the risk of exposure through contact with rabid animals (OR = 3.5; p = 0.01). Notably, urban respondents were also three times more knowledgeable about the risks associated with allowing dogs to roam freely (OR = 3.0; p = 0.04). Surprisingly, urban respondents were less likely to recognize sudden aggression by a dog as a possible sign of rabies (OR = 0.32; p = 0.03).

Practices among urban and rural households regarding rabies in dogs: Results of the assessment of practices by the households surveyed are presented in Table 3. Urban households were 29 times more likely to vaccinate their dogs against rabies (OR = 29.3; p = 0.0001) than rural households, and were also 2 times more likely to keep a rabies vaccination certificate (OR = 2.1; p = 0.16). Urban households had 3 times higher odds of reporting a dog bite to the health and veterinary authority (OR = 3.3; p = 0.06). Regarding the need to seek clinical intervention immediately after a dog bite, urban households were 2 times more likely to undergo health intervention compared to the respondents in rural households (OR = 2.2; p = 0.18). However, respondents in the rural households were 4 times likely to seek for traditional healing or spiritual intervention for a dog bite and apparently believed that such intervention could cure the bitten individual of rabies (OR = 4.3; p = 0.01). With regards to the practice of avoiding approaching strangely behaving dogs to prevent the risk of dog bites, respondent from urban households are 6 times more likely to avoid the risk than rural households (OR = 6.0; p = 0.02). Respondents from urban households were 11 times more likely to participate in local anti-rabies vaccination for dogs (OR = 11.4; p = 0.0001). Also respondents from urban households have 12 times higher odds of leashing or caging dogs in public spaces (OR = 12; p = 0.0001). Regarding the need to provide regular veterinary health check, urban households have higher odds (OR = 6.4; p = 0.01), which were 6 times more likely than those of rural households.

Table 2. Knowledge among urban and rural households in Owerri Nigeria, regarding rabies in dogs.

Variables	Responses				OR	p-value
	Urban (n = 30)		Rural (n = 33)			
	Yes	No	Yes	No		
Heard of rabies in dogs.	22 (73.3%)	8 (26.7%)	9 (27.3%)	24 (72.7%)	7.3	0.0001
Rabies can be transmitted from animals to humans.	19 (63.3%)	11 (36.7%)	10 (30.3%)	13 (39.4%)	2.3	0.13
Dogs are carriers of rabies	24 (80.0%)	6 (20.0%)	14 (42.4%)	19 (57.6%)	5.4	0.001
A dog bite can transmit rabies.	18 (60.0%)	12 (40.0%)	11 (33.3%)	22 (66.7%)	3.0	0.03
An untreated dog bite can be fatal.	17 (56.7%)	13 (43.3%)	9 (27.3%)	24 (72.7%)	3.5	0.01
Rabies is transmitted by the bite of an infected dog.	25 (83.3%)	5 (16.7%)	23 (69.7%)	10 (30.3%)	2.7	0.18
Rabies can be transmitted via saliva to an open wound.	22 (73.3%)	8 (26.7%)	15 (45.5%)	18 (54.5%)	3.3	0.02
Allow dogs to roam the community.	22 (73.3%)	8 (26.7%)	24 (72.7%)	9 (27.3%)	1.0	0.95
Sudden aggression is a sign of rabies.	15 (50.0%)	15 (50.0%)	25 (75.8%)	8 (24.2%)	0.3	0.03
Manage dogs intensively.	23 (76.7%)	8 (26.7%)	15 (45.5%)	18 (54.5%)	3.5	0.01
Are rabies vaccines available for dogs?	16 (53.3%)	14 (46.7%)	17 (51.5%)	16 (48.5%)	1.0	0.87
Wash bite wounds immediately.	8 (26.7%)	22 (73.3%)	11 (33.3%)	22 (66.7%)	0.7	0.55
Allowing dogs to roam can lead to rabies.	12 (40.0%)	18 (60.0%)	6 (18.2%)	27 (81.8%)	3.0	0.04

Table 3. Practices among urban and rural households in Owerri Nigeria, regarding rabies in dogs.

Variables	Responses				OR	p-value
	Urban (n = 30)		Rural (n = 33)			
	Yes	No	Yes	No		
Currently, keep a dog	28 (93.3%)	2 (6.7%)	27 (81.8%)	6 (18.2%)	3.1	0.14
Dogs vaccinated within last 12 months.	26 (86.7%)	4 (13.3%)	6 (18.2%)	27 (81.8%)	29.3	0.0001
Have rabies vaccination certificate.	22 (73.3%)	8 (26.7%)	13 (39.4%)	10 (30.3%)	2.1	0.16
Allow dogs to roam.	6 (20.0%)	24 (80.0%)	6 (18.2%)	27 (81.8%)	1.2	0.84
Think rabies can be cured.	18 (60.0%)	12 (40.0%)	9 (27.3%)	24 (72.7%)	4.0	0.004
Seek a clinic immediately after a dog bite.	25 (83.3%)	5 (16.7%)	23 (69.7%)	10 (30.3%)	2.2	0.18
Report a dog bite to the health/veterinary authorities.	26 (86.7%)	4 (13.3%)	22 (66.7%)	11 (33.3%)	3.3	0.06
Wash the dog bite wound before seeking help.	16 (53.3%)	14 (46.7%)	19 (57.6%)	14 (42.4%)	0.9	0.70
Seek traditional healers/spiritual intervention for a dog bite.	16 (53.3%)	14 (46.7%)	7 (21.2%)	26 (78.8%)	4.3	0.01
Avoid approaching a strangely behaving dog.	28 (93.3%)	2 (6.7%)	23 (69.7%)	10 (30.3%)	6.0	0.02
Participate in local mass vaccination campaigns.	26 (86.7%)	4 (13.3%)	12 (36.4%)	21 (63.6%)	11.4	0.0001
Use a leash or cage in public spaces.	19 (63.3%)	11 (36.7%)	4 (12.1%)	29 (87.9%)	12.5	0.0001
Go for regular veterinary check-ups.	16 (53.3%)	14 (46.7%)	5 (15.2%)	28 (84.8%)	6.4	0.001

Discussion

Rabies is reportedly maintained in two epidemiological cycles: urban and sylvatic. In the urban rabies cycle, dogs are the main reservoir host. This cycle predominates in parts of Africa, Asia and Central and South America, where the proportion of unvaccinated and semi-owned or stray dogs is high (CFSPH, 2009). This current study on urban versus rural households in Owerri, Nigeria showed that generally, respondents had a markedly higher awareness of rabies, which does not concur with an earlier report on rabies in Ghana by Dwaa *et al.* (2026a), whose results showed a moderate awareness and, apparently, a higher proportion of respondents were unable to understand the mode of transmission, pathogenicity, and prevention of the disease.

This present study showed that a higher proportion of urban households are more knowledgeable regarding dogs as carriers of rabies than their counterparts in rural households; this result is consistent with the earlier findings of Otolorin *et al*. (2015) in Nigeria, Tolessa and Mengistu (2017) in Ghana, Amaral *et al*. (2024) in Timor-Leste, Chazya *et al*. (2025) in Zambia, and Dwaa *et al*. (2026a) in Ghana.

Earlier reports by Tasiame *et al*. (2019) posited that the companionship between dogs and humans could increase the incidence of zoonotic disease due to the fact that dogs could be carriers of rabies. Additionally, in a study in Niger State, Nigeria. Garba *et al*. (2017) showed that the increase in the dog-to-human ratio from 1:12.1 in 1999 to 1:5.4 in 2017 portends a closer interaction between dogs and humans, which could pose public health challenges (Garba *et al*., 2017).

The results of the present study indicated significant higher knowledge of rabies fatality among urban respondents in comparison with rural households; this result contrasts with the reports of Dwaah *et al*. 2026b, whose findings showed that study participants failed to identify domestic dogs as the source of infection or recognize rabies as fatal once symptoms emerge.

Findings in the present study that knowledge of how rabies is transmitted is more significantly higher among urban households, is thought to probably be due to the fact that urban areas are closer to government authorities, where public health sensitization is commonly done (Suu-Ire *et al*., 2026). The result of this is consistent with the findings on rabies transmission by Chazya *et al*. (2025), in a study in Zambia on sensitization to rabies transmission across the rural-urban divide, which indicated that rural communities do not commonly recognise the link between management practices and rabies transmission.

Saliva can serve as a medium for transmitting rabies to dogs; therefore, free-roaming dogs could increase the incidence and transmission pattern of rabies, especially in rural communities where the epizootiology of rabies is not adequately understood, making it difficult to mitigate the spread of rabies among the susceptible dog population. However, there remains a debate regarding the role played by rural communities in the maintenance of rabies virus transmission (Mancy *et al*., 2022). Similarly, Dwaah *et al*. (2026b), in a study on the One Health approach, posited that the maintenance of rabies is an intersection between human behaviour and animal management; therefore, rural community education, increased epidemiological surveillance (Wallace *et al*., 2015), and free rabies vaccination campaigns, will improve behavioural changes and awareness towards rabies.

Similarly, this study demonstrated that respondents in urban household have greater likelihood of vaccinating their dogs against rabies when compared to those in rural areas.

This could be a reflection of the level of education, which is high among the respondents in urban households, and this concurs with the reports of Tolessa and Mengistu (2017). In addition, the greater availability of private and government veterinary health facilities in urban municipality as compared to rural communities hitherto provides the former with more access to veterinary services than the latter. In addition, the cost of veterinary services (including rabies vaccination cost) may not be easily borne by low-income rural households; this may have accounted for the relative lower proportions of respondents in rural areas who admitted having vaccinated their dog within the last 12 months.

The low level of compliance with annual rabies vaccination in rural areas can jeopardise the One Health approach of mitigating the transmission of rabies (Otolorin *et al*., 2015). Previous studies by Wallace *et al*. (2019) and Bardosh *et al*. (2014) showed that vaccination programs aimed at rural communities could be costly, invariably due to logistics/expenditures associated with transporting vaccines and personnel to rural areas over long distances (Yu *et al*., 2025). Additionally, an earlier study highlighted that achieving and sustaining annual rabies vaccination coverage should be significantly above 70% coverage, to effectively control rabies and establish herd immunity for effective mitigation and prevention of the spread of the disease (Otolorin *et al*., 2015). While education could continue to be a determining factor in this current study, the role it plays in ensuring effective information regarding rabies, especially among urban households, seems to be more rewarding. Therefore, practices that are aimed towards providing useful information on mass vaccination campaigns and the challenges associated with their absence, could pose a significant risk to rural communities, and this is in tandem with the reports of Karshima *et al*. (2013) on the risk factors associated with rabies.

A study in Beijing by Yu *et al*. (2025) demonstrated that, in rural areas, dog owners were frequently reluctant to have their dogs vaccinated, and this practice could exacerbate the spread and increase the prevalence of rabies in dogs. To effectively improve practices among rural households, local authorities must fulfil their responsibilities of adequate information dissemination through local government epidemiology units. Traditional institutions are also not left out in ensuring adequate information is delivered, and town unions should be engaged in ensuring that the community is informed on the challenges associated with rabies.

Additionally, this study has demonstrated that the practices of leashing and caging of dogs in public space was significantly higher in urban respondents than rural respondents. Earlier reports by Suu-Ire *et al*. (2026) and Chazya *et al*. (2025), showed that dogs that are under confinement play a minimal role in the maintenance of rabies virus transmission.

Conclusion and Recommendation: The findings in this study have identified gaps in knowledge and practices among rural households, with significantly higher odds among rural households. Respondents from urban households were more knowledgeable about the risk factors associated with the transmission of rabies in dogs. Respondents from rural households were not adequately knowledgeable about the subject of the study.

It is recommended that government policies be tailored towards interventions in rural households in the areas of mass education campaigns on rabies and rabies vaccinations, and cottage veterinary clinics should be established in rural areas, which will be saddled with the responsibility of providing veterinary care to dogs in rural households. Additionally, local town and market unions and other voluntary public health and non-

governmental organizations in rural area must own up to the responsibility of enlightenment of rural households on the need for attitudinal changes towards rabies and anti-rabies vaccination in dogs. Future studies should explore larger sample size.

Conflict of interest

The authors declare no conflict of interest

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