



Article History

Received: 01-09-2025

Revised: 20-04-2026

Accepted: 09-07-2026

Published: 08-08-2026

Assessment of Awareness on Dog Bite Wound Management Among Health Personnel in Maiduguri Metropolis, Borno State, Nigeria

*Mohammed, S., Saad, J. Y., Mohammed, A., Saidu, A.S., Adamu, S. G., Sadiq, M. A. and Gashua, M. M.

Department of Veterinary Public Health and Preventive Medicine, Faculty of Veterinary Medicine, University of Maiduguri, 600001, Borno State, Nigeria.

* Author for Correspondence: msani600@gmail.com

ABSTRACT

Rabies remains a major but neglected public health problem in Nigeria, driven largely by dog bites and low dog vaccination coverage. This study assessed awareness of dog-bite wound management and rabies prevention among health personnel in Maiduguri. A cross-sectional survey was conducted among 129 respondents, including doctors, nurses, veterinarians, pharmacists, and other allied health workers, using a structured and pre-tested questionnaire. Respondents were selected through stratified sampling, and data were collected through face-to-face interviews using Kobo Toolbox. Knowledge scores were coded and categorized as poor (<50%), fair (50-79%), or good ($\geq 80\%$). Chi-square (Fisher's exact) analysis was used to test associations between demographic variables and knowledge level at $p \leq 0.05$. Only 38 respondents (29.5%) demonstrated good knowledge of dog-bite wound management and rabies prevention. Older respondents aged 46 years and above had the highest proportion of good knowledge (66.7%), compared with 40.4% among those aged 18-30 years and 20.3% among those aged 31-45 years. Males showed better knowledge than females, and only respondents with tertiary education had good knowledge scores. Age, sex, educational attainment, and profession were significantly ($p \leq 0.05$) associated with knowledge level. While 65.1% correctly identified the pre-exposure rabies vaccination schedule, only 31.8% knew the correct post-exposure schedule. Slightly more than half (56.8%) had received prior training. Mandatory training on rabies prevention and dog-bite care for all health workers, plus accessible vaccination, can reduce deaths. Hospitals should provide WHO-based refresher training, while medical, nursing, and veterinary schools should teach practical rabies management skills.

Keywords: assessment, awareness, management, dog bite wound, health personnel, Maiduguri, rabies

INTRODUCTION

Rabies is a viral zoonotic and epizootic disease that is cosmopolitan in distribution that cannot be treated but can be prevented through vaccines (Daodu and Oluwayelu, 2016). It is caused by the neurotropic organism, which belongs to the family Rhabdoviridae and genus Lyssavirus (WHO, 2016). The reservoir hosts for the rabies virus are jackals, foxes, raccoons, skunks, and dogs (Nyasulu *et al.*, 2021). The common route of transmission of rabies to humans is through the bite of a rabid animal, and this disease causes acute fatal encephalitis with an almost 100% case fatality rate (Ameh *et al.*, 2014). Canine-mediated rabies continues to pose a significant socioeconomic and public health challenge in low- and middle-income countries, resulting in an estimated 59,000 human fatalities each year (Hampson *et al.*, 2015). This number is likely an underestimate of the actual mortality burden, owing to widespread underreporting (Hampson *et al.*, 2015; WHO, 2018; Adesola *et al.*, 2023). In this context, it is essential

to enhance health personnel's awareness regarding the management of dog bite wounds and the prevention of rabies, as this knowledge is crucial for achieving rabies elimination targets by 2030.

The most efficacious method to avert rabies in people is vaccination, which can be administered both pre- and post-exposure (Aiyedun *et al.*, 2022). Postexposure prophylaxis is provided to roughly 1.1 to 1.5 million individuals per year. Notwithstanding the existence of efficacious vaccines for humans and animals, rabies preventive and control strategies may be inadequate, as some developing countries have reported elevated rabies-related mortality rates (Mascie-Taylor *et al.*, 2003; Hampson *et al.*, 2015; WHO, 2018). The impact of rabies on public health in Nigeria is challenging to determine because of the paucity of statistics on reported human cases, potentially resulting from under-reporting, misdiagnosis, and insufficient awareness of the disease (Awoyomi *et al.*, 2019).

Nurses and frontline clinical staff play key roles in wound care, rabies risk assessment, and post-exposure prophylaxis (PEP) for bite patients in primary health facilities, but often have knowledge gaps on WHO bite categories, vaccine regimens, use of rabies immunoglobulin, and correct observation of suspect animals, highlighting the need for targeted training and better PEP availability (Kenu *et al.* 2018; Rana *et al.* 2021; Chuchu *et al.*, 2022). Physicians provide higher-level case assessment, differential diagnosis (e.g., encephalitis), clinical management of suspected human rabies, and help develop treatment protocols and surveillance systems within the human health sector (Chuchu *et al.* 2022; Shaikh *et al.* 2025). Veterinarians and other animal health personnel are central to mass dog vaccination, investigation of biting animals, dog population management, and animal-side surveillance, often working through Integrated Bite Case Management to investigate suspect dogs, apply rapid diagnostic tests, and share data with health facilities (Lushasi *et al.*, 2020; Rysava *et al.*, 2022; Swedberg *et al.*, 2022; Shaikh *et al.*, 2025). Health educators and public health workers support community and school-based rabies education, behavior change communication, and coordination of One Health campaigns, using media, school programs, village broadcasts, hotlines, and community volunteers to promote responsible dog ownership, early reporting of bites, correct first aid, and participation in vaccination campaigns (Kiratitana-Olan *et al.*, 2022; Kyere *et al.*, 2025; Shaikh *et al.*, 2025; Bor *et al.*, 2025; Ali *et al.*, 2025). Together, these cadres form an interlinked One Health system that connects clinical care, veterinary action, and community engagement to prevent rabies and improve dog bite wound management (Tiwari *et al.*, 2021; Rupprecht *et al.*, 2023).

Health personnel need to have up-to-date information on how to treat wounds caused by dog bites and wild animals, how to prevent rabies to accomplish the goal of achieving zero instances of rabies by the year 2030 through provision of relevance policy for rabies eradication, particularly in countries with low to medium incomes like Nigeria. Human cases of canine and wild animal bites are prevalent in Nigeria; yet, awareness regarding prevention and appropriate management of dog bite wounds and rabies prevention is inadequate among healthcare personnel in Maiduguri, Borno State, Nigeria.

The aim of this study is to assess awareness of the management of dog bite wounds and rabies prevention, factors associated with knowledge levels as well as knowledge of vaccination schedule among health personnel in Maiduguri metropolis, Borno State, Nigeria.

MATERIALS AND METHODS

Study Area

The study was conducted in Maiduguri Metropolis, Borno State, northeastern Nigeria, comprising Maiduguri Metropolitan Council and Jere Local Government Areas. The metropolis is located between latitudes 11°46'N and 11°56'N and longitudes 13°02'E and 13°14'E, with a semi-arid climate characterized by a short rainy season (June–September) and a prolonged dry season (October–May) (BOSADP, 1998). Maiduguri is the administrative capital of Borno State and hosts several public and private

healthcare facilities, including University of Maiduguri Teaching Hospital and State Specialist Hospital Maiduguri. The metropolis was selected for this study because of its large human and dog populations and the public health importance of appropriate dog bite wound management for rabies prevention (WHO, 2024).

Study Design

A cross-sectional study was designed to determine the awareness of dog bite wound management and rabies prevention among health personnel in Maiduguri metropolis, Borno State, using a digital questionnaire device.

Study Population

The study population comprises health personnel, which include Physicians, Veterinarians, Nurses, Physiotherapists, Medical Laboratory Scientists, Health educators, Environmental health officers, Pharmacists, and Community health workers.

Determination of Sample size

The minimum sample size was determined using Cochran's formula for proportions for cross-sectional studies. Assuming a 95% confidence level ($Z=1.96$), anticipated awareness of 50% ($p=0.5$) in the absence of prior data, and a margin of error of 9% ($d=0.09$), the initial sample size was 119. After finite population correction for the total number of eligible health personnel and allowing 8-10% for non-response, the final sample size was 129.

Inclusion/Exclusion Criteria

Inclusion/Exclusion criteria: all health personnel working within Maiduguri metropolis health facilities that were willing to participate in the survey were included, while those who declined were excluded.

Sampling Method

A multistage sampling technique was used to select 129 health personnel. Facilities were stratified by level and randomly selected, after which eligible staff were chosen proportionately using stratified or systematic random sampling where necessary. The questionnaire was proportionately distributed across facilities and cadres, with replacements made for non-cadre

Questionnaire Design

A structured questionnaire was developed using the Kobo toolbox application with mostly categorical questions. The questionnaire consists of two sections: Section 1. Demographic characteristics (age, gender, educational level, profession, year of experience), Section 2: Knowledge assessment, which has 16 questions (rabies, etiology, transmission, zoonotic potential, prevention, first aid, pre- and post-exposure rabies vaccine, rabies mortality) and continuing education on rabies. The knowledge was assessed using 16 questions, with each correct response scored as 1 and incorrect as 0.

Administration of Questionnaire, Validity, Reliability and Inform Consent

A well-designed questionnaire was administered in real time to 129 health personnel to assess their awareness of

dog bite wound care and rabies prevention in the Maiduguri metropolis. The questionnaire underwent pretesting with only a few members (five respondents) among the health personnel to ascertain clarity and validity. Modifications were implemented in response to comments to guarantee the questions were comprehensible. Reliability was guaranteed by the uniform implementation of the digital questionnaire. Cronbach's alpha for reliability assessment was 0.79, indicating acceptable reliability.

Data Analysis

Data was presented using descriptive statistics such as frequencies and percentages were calculated to summarize the data. Charts, tables, and graphs were generated to visually represent the findings. The data was coded, transformed, and categorized into good knowledge score 13-16 ($\geq 80\%$), Fair knowledge score 8-12 (50-79%) and Poor knowledge score 0-7 ($< 50\%$). Associations between categorical demographic variables and knowledge scores were examined using the Chi-square test of independence. When more than 20% of cells had an expected frequency < 5 , Fisher's exact test was used instead, as it provides an exact p-value and is recommended for small or sparse contingency tables. Both tests were implemented via the Crosstabs procedure in IBM SPSS Statistics version 23.0. A p-value ≤ 0.05 was considered significant.

Ethics approval and consent to participate

Prior to the interview, all participants were aware about the purpose, procedures, data handling, and confidentiality of the study. Verbal consent was sought from each participant, with autonomy to withdraw at any stage of the interview. No biological sample was involved in this study.

RESULTS

Out of 129 respondents, 52 (40.3%) were in the age category of 18-30 years, 74 (57.4%) in the age category of 31-45 years, and 3 (2.3%) were 46 years and above.

Gender distribution of the respondents revealed that 85 (65.9%) were males and 44 (34.1%) were females. The majority of the respondents, 122 (94.6%), had attended tertiary institutions, 4 (3.1%) had attended secondary school, and 3 (2.3%) had not attended a formal education (Table 1).

Out of all the respondents, 37 (28.7%) were veterinarians, 31 (24.0%) were nurses, 26 (20.2%) were medical personnel, 21 (16.3%) were health attendants, and 14 (10.9%) were others (physiotherapists, radiologists, or medical laboratory scientists). Seventy-nine (61.2%) respondents had 1-5 years' experience in practice, 40 (31.0%) had 6-10 years in practice, and 10 (7.8%) had experience of 11 or more years in practice (Table 1).

Table 1: Demographic information of medical personnel in Maiduguri Metropolis

Variables	Frequency	Rate (%)
Age in Years		
18-30	52	40.3
31-45	74	57.4
46 and above	3	2.3
Gender		
Male	85	65.9
Female	44	34.1
Educational Level		
Non formal	3	2.3
Secondary	4	3.1
Tertiary	122	94.6
Occupation		
Veterinarians	37	28.7
Nurses	31	24.0
Physicians	26	20.2
Health attendant/educators	21	16.3
Other	14	10.9
Duration of Experience (Years)		
1-5 years	79	61.2
6-10 years	40	31.0
>11 years	10	7.8
Total	129	100

In this study, only 38 (29.5%) of the 129 respondents had a good knowledge status regarding the management of dog bite wounds and rabies. Respondents within the age group

of 46 years and above had higher (66.7%) good knowledge scores compared to those in the age categories of 18-30 years and 31-45 years, with 40.4% and 20.3% good

knowledge scores, respectively. Males had a higher good knowledge score (36.5%) compared to their female counterparts (15.9%). Respondents that attended tertiary institutions had higher knowledge scores of 31.1%. (Table 2). There was a statistically significant association ($p \leq 0.05$) between age, gender, educational level,

profession of the respondents, and knowledge level regarding the management of dog bite wounds (Table 2). The overall knowledge score revealed that 44 (36%) respondents had a poor knowledge score, 47 (36.4%) had a fair knowledge score, and 38 (29.5%) had a good knowledge score (Table 2).

Table 2: Assessment of Knowledge toward rabies and dog bite wound management and associated factors among health personnel in Maiduguri Metropolis, Borno State, Nigeria

Variables	Knowledge			χ^2	p-value
	Poor (%)	Fair (%)	Good (%)		
Age in Years					
18-30	17 (32.7)	14 (26.9)	21 (40.4)	9.14	*0.03
31-45	26 (35.1)	33 (44.6)	15 (20.3)		
>45	1 (33.3)	0 (0.0)	2 (66.7)		
Gender					
Male	28 (32.9)	26 (30.9)	31 (36.5)	6.59	0.037
Female	16 (36.4)	21 (47.7)	7 (15.9)		
Educational Level					
Non formal	1 (33.3)	2 (66.7)	0 (0.0)	7.2	*0.034
Secondary	4 (100)	0 (0.0)	0 (0.0)		
Tertiary	39 (32.0)	45 (36.9)	38 (31.1)		
Profession					
Health Attendant	11 (52.4)	5 (23.8)	5 (23.8)	26.6	0.001
Veterinarian	3 (8.1)	22 (59.5)	12 (32.4)		
Physician	9 (34.6)	7 (26.9)	10 (38.5)		
Nurse	11 (35.5)	10 (32.3)	10 (32.3)		
Others	10 (71.4)	3 (21.4)	1 (7.1)		
Duration in the Profession (in Years)					
1-5	31 (39.2)	27 (34.2)	21 (26.6)	6.38	0.174
6-10	10 (25.0)	18 (45.0)	12 (30.0)		
≥11	3 (30.0)	2 (20.0)	5 (50.0)		
Total	44 (34.1)	47 (36.4)	38 (29.5)		

*Fisher exact

About 75% of the respondents knew the correct first aid against rabies following dog bite, while only 23.3% received rabies pre-exposure vaccine. In addition, only 55.8% of the respondents had attended training on management of dog bite wound and rabies prevention

(Table 3). Eighty-four (65.1%) responded that Day 0, 7, and 21 is the pre-exposure ARV vaccine schedule; 22 (17.1%) responded that it is Day 0, 7, and 28; and 23 (17.8%) responded that it is Day 0, 14, and 28 (Figure 1).

Table 3: Responses of health personnel toward rabies first aid, Pre-exposure prophylaxis (vaccine) and update training on rabies prevent and control in Maiduguri metropolis

Respondents	Frequency	Rate (%)
Training on dog bite wound management		
Yes	72	55.8
No	57	44.2
First aid against rabies/dog bite		
Herbs	1	0.8
Irrigate with water	31	24.0
Irrigate with water and soap	97	75.2
Have you received rabies vaccine		
Yes	30	23.3
No	99	76.7
Total	129	100

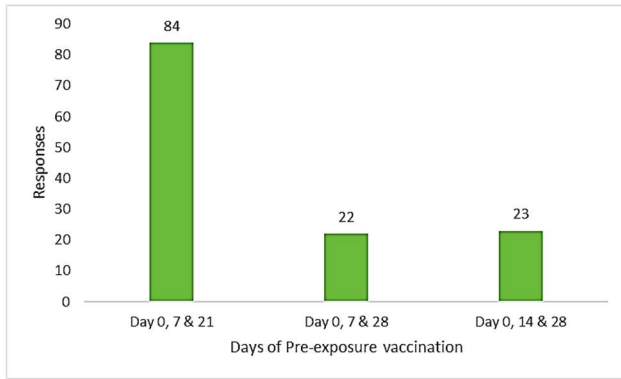


Figure 1: Respondents awareness on Pre-exposure anti rabies vaccination schedule

Fifty-one (39.5%) responded that Day 0, 7, 14, 21, and 28 are the post-exposure ARV vaccination schedule; only 41 (31.8%) mentioned correct answer: Day 0, 3, 7, 14, and 21 or 28, 7(5.4%) mentioned Day 0, 5, 7, 14 and 21 while 30 (23.3%) responded that they don't know the post exposure schedule (Figure 2). Out of all the respondents, 72 (55.8%) have received update on dog bite wound management while 57 (44.2%) have not received any update.

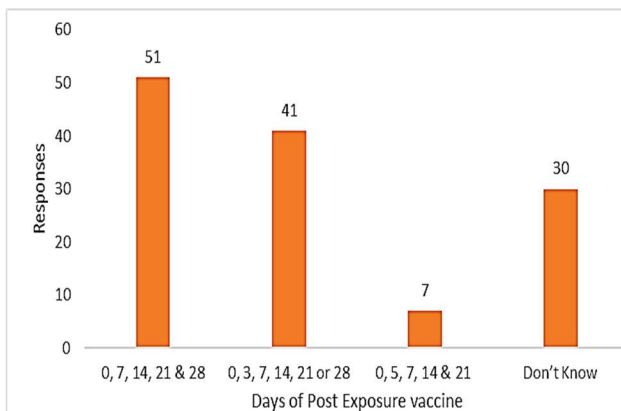


Figure 2: Respondents awareness on post-exposure anti rabies vaccination schedule

DISCUSSION

The study in Maiduguri fit within a wider body of findings showing that health personnel knowledge of rabies prevention and dog-bite wound management is often limited (29.5%) and influence by age, sex, education, and professional role, with important implications for post-exposure care quality and rabies control.

There is significant links between sociodemographic factors and awareness levels of dog bite wound management and rabies prevention among health personnel. This reinforces calls for stratified capacity-building of health personnel involved in dog-bite care. This finding stresses the need for targeted training of frontline staff, integrated bite-case management, and continuous professional education are essential to close these gaps and support the “zero human deaths from dog-mediated rabies by 2030” goal (Chuchu *et al.*, 2022; Nadal *et al.*, 2023; Kia *et al.*, 2026). This is in agreement with previous studies among healthcare personnel that reported suboptimal understanding of rabies, wound bite care, and appropriate pre- and post-exposure management,

even in high-burden African settings (Niang *et al.*, 2020; Mapatse *et al.*, 2022; Chuchu *et al.*, 2022). Similar gaps are seen in Nigerian dog handlers and community members, who frequently lack knowledge of wound care and post-exposure vaccination (Agbajelola and Agbajelola, 2024; Mohammed *et al.*, 2025). This similarity in findings may be attributed to sample population, study area and behavior.

Older or more experienced practitioners often show better understanding of rabies prevention and bite management, suggesting cumulative learning over years of practice as well as more training opportunities than younger personnel. This is in agreement with the findings of Chakraborty, (2025). Gender differences in awareness level in Maiduguri was documented. This may be attributed to the fact that male was more actively participated in health-related management and training compared to female counterpart with limited access to training. This agrees with the awareness survey conducted by Chakraborty. (2025), who reported higher rabies knowledge among males, underscoring context-specific patterns that can influence how training is targeted.

Educational attainment and professional background consistently correlate with rabies knowledge, including awareness of WHO bite wound care, and indications for PEP. This study is in agreement with the findings of Niang *et al.* (2020) in Senegal who reported that, large proportions of first-level health service providers are unaware of pre-exposure indications, post-exposure schedules, or even rabies incubation times, highlighting the importance of pre-service and in-service training tailored to cadre.

High recognition of appropriate first aid among health personnel is consistent with hospital- or urban-based surveys where many participants report wound washing with soap and water as the initial step after a suspected rabid dog bite (Kisaka *et al.*, 2020; Ravhuhali *et al.*, 2025). Studies from Kenya by Chuchu *et al.* (2022) and Mozambique by Mapatse *et al.* (2022) showed that, even when first aid is known, detailed adherence (e.g., 15-minute washing) and alignment with WHO categories often remains poor among health workers. Low uptake of rabies pre-exposure vaccination among personnel at-risk depicting Maiduguri metropolis, Nigerian and international data. This is in agreement with a survey carried out in Nigeria among occupationally exposed persons by Madaki (2023), who reported that just over half had received pre-exposure vaccine, with vaccination status significantly associated with age and occupation. Likewise, studies from Tanzania and Nigeria carried out by Chungalucha *et al.* (2019) and Mshelbwala *et al.* (2021) highlight persistent structural and financial barriers to rabies biologicals, limiting both PEP access and proactive pre-exposure coverage, even among those with frequent animal contact.

The proportion of health personnel who have ever attended specific training on rabies aligns with evidence from other settings where formal rabies/dog-bite training is incomplete or absent for most frontline staff. This may be the reason why rabies control efforts are abortive in Nigeria. This is in agreement with the findings of Chakraborty (2025), who reported that 92% of health

workers in rural Assam had no training specific to canine bite management. Studies from Kenya, Mozambique, and India similarly emphasize that lack of pre-service and in-service training on rabies guidelines, wound care, and vaccine use contributes to inappropriate management and knowledge gaps (Tiwari *et al.*, 2018; Chuchu *et al.*, 2022; Mapatse *et al.*, 2022).

This study revealed high-risk context of health personnel in Maiduguri, the coexistence of relatively good first-aid awareness, limited pre-exposure vaccination, and only partial training coverage underscores a critical need for structured, mandatory rabies modules for health personnel, combined with improved access to vaccines and integration of WHO-aligned protocols into routine practice.

Recent guideline updates show that PrEP regimens have shifted from older 3-visit intramuscular schedules (days 0, 7, 21 or 28) to simplified 2-visit schedules on days 0 and 7, with comparable immunogenicity (Kessels *et al.*, 2019; Bote *et al.*, 2023). Immunogenicity studies and ACIP/WHO evaluations confirm that reduced-visit regimens can maintain protective antibody responses, supporting global moves toward regimen simplification (Kessels *et al.*, 2019; Tarantola *et al.*, 2019). Despite these advances, multiple studies show that even recently trained health workers often misidentify PrEP schedules. Muraleedharan *et al.* (2023) reported that, fewer than 70% of Indian medical interns, could correctly state the PrEP regimen, despite high awareness of rabies and the importance of vaccination for professionals. (Muraleedharan *et al.*, 2023). Similar gaps in understanding rabies prophylaxis guidelines, such as timing of vaccination, have been reported among personnel in this study. This is in agreement with the findings of Shaban *et al.* (2025) in Sudan. In this context, the spread of responses across several different multi-day patterns in Maiduguri likely reflects failure of training as well as confusion between PrEP and PEP regimens, and limited exposure to the most recent WHO guidance, underscoring the need for regular, guideline-based training of frontline staff (Chuchu *et al.*, 2022).

Dog bite wound management among Maiduguri health personnel appear modest, reflecting a wider global pattern of inconsistent training on rabies prevention. Health worker preparedness for rabies control depends heavily on continuous education and refresher training. Studies from Kenya and India showed that gaps in knowledge of bite categorization, wound care, vaccine use and dose-sparing regimens are common, and specifically call for ongoing in-service training and continuous medical education on rabies and dog bite wound management (Ahmed *et al.*, 2020; Chuchu *et al.*, 2022; Chakraborty, 2025). Recent evaluations in Mozambique, Sudan, and Kenya similarly document substantial deficiencies in awareness of updated prophylaxis guidelines and correct bite management, and explicitly recommend targeted, repeated training to close these gaps (Mapatse *et al.*, 2022; Shaban *et al.*, 2025; Mwanyalu *et al.*, 2025). Work from India and Nigeria further shows that health workers' knowledge and

practices improve when structured training modules are introduced, and that regular refreshers are necessary because of evolving WHO recommendations on PEP and intradermal regimens are not widely internalized without formal updates (Sahu *et al.*, 2021; Mshelbwala *et al.*, 2021). In this context, the Maiduguri finding indicates that over half of personnel have at least some recent updating, but a sizeable minority still lack any update, underscoring the need to institutionalize regular, comprehensive rabies training for all cadres to support Nigeria's progress toward dog-mediated rabies elimination.

CONCLUSION

The study concluded that knowledge of dog bite wound management and rabies prevention was generally low, with only 29.5% of respondents demonstrating good knowledge. Older respondents, males, and those with higher education had significantly better knowledge scores. Although most respondents knew the correct first aid after a dog bite, major gaps remained in pre-exposure vaccination, training, and knowledge of vaccination schedules. Post-exposure prophylaxis knowledge was especially poor, with only a minority identifying the correct schedule. These findings showed that awareness has not yet translated into comprehensive professional preparedness. Regular targeted training and update programs are therefore needed to strengthen effective dog bite wound management and rabies prevention. Overall, the results highlight the need for targeted education and regular training to improve rabies prevention and dog bite wound management. The study recommended, that statutory periodic training on rabies prevention and dog bite wound management must be instituted for all healthcare personnel. Facilitate accessible vaccination and current practices to enhance patient outcomes and diminish rabies mortality. Seminars, workshops, case discussions, and online modules held in hospitals, adhering to WHO rabies guidelines, must deliver in-service continuous professional development training and refresher updates. Pre-service training must incorporate rabies and dog bite wound management within the curricula of medical, nursing, and veterinary programs, including simulation and skills-based training on wound hygiene, vaccination protocols, and rabies administration.

Limitation of the Study

The cross-sectional design prevents causal inference and captures knowledge at only one time point; a location-specific sample limits generalizability beyond health personnel in Maiduguri, and self-reported data may not reflect actual practices.

Acknowledgements

The authors would like to acknowledge the contributions of the health personnel in Maiduguri Metropolis for their support and assistance during the period of questionnaire administration.

Conflict of Interest

The authors declare that there is no conflict of interest with regards to the publication of this manuscript.

Grant

This research study was self-funded (out of pocket). Therefore, there was no funding for the research.

Authors' contribution

SM, JSY and AM, designed the study, JSY collected the data, and wrote the first draft of the manuscript. ASS and SGA, and MMG oversaw the entire research and reviewed the manuscript. SM and MSA contributed to data collation, cleaning, and managed the data analyses for the study. Finally, SM also conducted the literature searches. All authors read and approved the final draft manuscript.

REFERENCES

- Adesola, R., Akinniyi, H., and Lucero-Prisno, D. (2023). An evaluation of the impact of anti-rabies programs in Nigeria. *Annals of Medicine and Surgery*, 85, 358 - 364. doi.org/10.1097/ms9.0000000000000250.
- Agbajelola, B. S., and Agbajelola, V. (2024). Review Article - A narrative review of the knowledge, attitudes, and health-seeking Practices to human rabies and dog-bite injuries in Nigeria. *Journal of Community Medicine and Primary Health Care*, 36(3), 91-97.. <https://doi.org/10.4314/jcmphc.v36i3.8>
- Aiyedun, J. O., Darajat, A. T., BO, D., OO, O., Olorunshola, I. D., RIO, N., and Oluboyede, I. S. (2022). Assessment of the Knowledge, Attitude and Practices of Dog Owners on Rabies in Ilorin, Kwara State, Nigeria. *Journal of Applied Veterinary Sciences*, 7(4), 81-87. <https://doi.org/10.21608/javs.2022.154332.1168>
- Ahmed, M., Dasgupta, I., and Maiti, S. (2020). Knowledge and Awareness of Emergency Health Workers and Nursing Staff regarding Rabies Immunisation. *International Journal of Advanced Research*, 8(2), 670-703.. <https://doi.org/10.21474/ijar01/10500>
- Ali, A. M., Ali, A., & Bhatti, M. (2025). Rabies and Public Health: A Narrative Review on Epidemiology and Control Strategies in Pakistan. *International Annals of Health Sciences*, 2(2). doi.org/10.69491/i2v2mjsu
- Ameh, V.O, Dzikwi, A.A. and Umoh J.U. (2014). Assessment of Knowledge, Attitude, and Practice of Dog Owners to Canine Rabies in Wukari Metropolis, Taraba State Nigeria. *Global Journal of Health Science*, 6(5), 226- 240 <https://doi.org/10.5539/gjhs.v6n5p226>
- Awoyomi, O. J., Bankole, N. O., Kehinde, O. O and Adebowale, O. O. (2019). Assessment of Dog Owners' Knowledge on Dog Rabies Vaccination in Rural Communities in Ogun State, Nigeria. *Nigerian Veterinary Journal*, 40 (4), 278 - 286. doi.org/10.4314/nvj.v40i4.3
- Bor, N., Njenga, G., Slater, A., Munywoki, P., Chepyatich, D., Owino, D., ... & Thomas, L. F. (2025). Rabies control via co-creation: A model for sustainable one health interventions. *PLOS Neglected Tropical Diseases*, 19(8), e0013350. doi.org/10.1371/journal.pntd.0013350
- BOSADP (1998). *Borno State Agricultural Development Programme: Annual Report*. Maiduguri, Nigeria.
- Sahel J. Vet. Sci. Vol. 23, No. 2, Pp 1-9 (2026)
- Bote, K., Nadal, D. and Abela, B. (2023). WHO's latest rabies recommendations and guidance save lives and reduce the cost of treatment. *One Health and Implementation Research*, 3, 11-15. <https://doi.org/10.20517/ohir.2022.46>
- Changalucha, J., Steenson, R., Grieve, E., Cleaveland, S., Lembo, T., Lushasi, K., Mchau, G., Mtema, Z., Sambo, M., Nanai, A., Govella, N., Dilip, A., Sikana, L., Ventura, F., and Hampson, K. (2019). The need to improve access to rabies post-exposure vaccines: Lessons from Tanzania. *Vaccine*, 37, A45 -A53. <https://doi.org/10.1016/j.vaccine.2018.08.086>
- Chakraborty, S. (2025). Canine bite management awareness and practices among health care workers in a rural area of Assam. *European Journal of Public Health*, 35(Supplement 4). <https://doi.org/10.1093/eurpub/ckaf161.1612>
- Chuchu, V. M., Kitale, P., Bichanga, P., Ksee, D., Muturi, M., Mwatondo, A., Nasimiyu, C., Maritim, M., Mutono, N., Beyene, T., Druelles, S., Hampson, K., and Thumbi, S. (2022). Rabies Elimination in Rural Kenya: Need for Improved Availability of Human Vaccines, Awareness and Knowledge on Rabies and Its Management Among Healthcare Workers. *Frontiers in Public Health*, 10, 769898. <https://doi.org/10.3389/fpubh.2022.769898>
- Daodu, O. B., and Oluwayelu, D. (2016). Rabies knowledge and pre-exposure vaccination status of clinical veterinary medicine students in Nigeria. *Vom Journal of Veterinary Science*, 11, 117-125.
- Hampson, K., Coudeville, L., Lembo, T., Sambo, M., Kieffer, A., Attlan, M., ... and Global Alliance for Rabies Control Partners for Rabies Prevention. (2015). Estimating the global burden of endemic canine rabies. *PLoS Neglected Tropical Diseases*, 9(4), e0003709
- Kenu, E., Ganu, V., Noora, C., Adanu, R., & Lartey, M. (2018). Management of dog bites by frontline service providers in primary healthcare facilities in the Greater Accra Region of Ghana, 2014–2015. *Infectious Diseases of Poverty*, 7. doi.org/10.1186/s40249-018-0398-3
- Kessels, J., Tarantola, A., Salahuddin, N., Blumberg, L., and Knopf, L. (2019). Rabies post-exposure prophylaxis: A systematic review on abridged vaccination schedules and the effect of changing administration routes during a single course.. *Vaccine*, 37, A107-A117. <https://doi.org/10.1016/j.vaccine.2019.01.041>
- Kia, G., Samuel, M., Ferguson, E., Ibrahim, I., Lushasi, K., Okpanachi, J., Chng, N. R., Kwaga, J. K. P., and Hampson, K. (2026). Experiences of piloting integrated bite case management in Zaria Metropolis, Nigeria. *Frontiers in Tropical Diseases*, 7, 1757621. <https://doi.org/10.3389/ftd.2026.1757621>
- Kiratitana-Olan, K., Chaisowong, W., Thongkorn, K., & Kreausukon, K. (2022). One Health perspectives on sustainable rabies prevention in Thailand: a qualitative interview study. *Veterinary Integrative Sciences*, 20(2), 443-457. doi.org/10.12982/VIS.2022.033

- Kisaka, S., Makumbi, F., Majalija, S., Bangirana, A., and Thumbi, S. (2020). Epidemiology and preclinical management of dog bites among humans in Wakiso and Kampala districts, Uganda: Implications for prevention of dog bites and rabies. *PLoS ONE*, 15(9), e0239090.
- Kyere, D. P., Yaa, A. B. N., Anthony, O. T., Sakran, A. K., David, K., Solomon, O., & Gyan, L. (2025). Empowering dog owners and One Health teams to eliminate rabies: A community-Led approach from Techiman metropolitan, Ghana. *One Health Outlook*, 7(1), 50. doi.org/10.1186/s42522-025-00164-6
- Lushasi, K., Stenson, R., Bernard, J., Changalucha, J. J., Govella, N. J., Haydon, D. T., ... & Hampson, K. (2020). One health in practice: using integrated bite case management to increase detection of rabid animals in Tanzania. *Frontiers in public health*, 8, doi.org/10.3389/fpubh.2020.00013
- Madaki, P. D. (2023). Rabies pre-exposure vaccination of occupationally high risk Individuals in Nigeria. *Arid Zone Journal of Basic and Applied Research*, 2(4), 2811-2881. https://doi.org/10.55639/607.787776
- Mapatse, M., Sabeta, C., Fafetine, J., and Abernethy, D. (2022). Knowledge, attitudes, practices (KAP) and control of rabies among community households and health practitioners at the human-wildlife interface in Limpopo National Park, Massingir District, Mozambique. *PLoS Neglected Tropical Diseases*, 16(3), e0010202. https://doi.org/10.1371/journal.pntd.0010202
- Mohammed, S., Kia, G., Ezema, K., and Ashafa, M. (2025). Assessment of Rabies Knowledge Gaps and Management of Dog Bite Wound among Dog Handlers in Gombe State, Northeastern Nigeria. *Sahel Journal of Veterinary Sciences*, 22(3), 31-36. https://doi.org/10.54058/21khy334
- Mshelbwala, P., Weese, J. S., Sanni-Adeniyi, O. A., Chakma, S., Okeme, S., Mamun, A., Rupprecht, C., and Magalhães, R. (2021). Rabies epidemiology, prevention and control in Nigeria: Scoping progress towards elimination. *PLoS Neglected Tropical Diseases*, 15(8), e0009617. https://doi.org/10.1371/journal.pntd.0009617
- Muraleedharan, D., Damor, K. L., Kewalramani, S., and Kumawat, P. (2023). Knowledge, Attitude and Practice about Rabies Pre-exposure Prophylaxis Among Interns in SMS Medical College, Jaipur, Rajasthan: A Cross -Sectional Study. *Global Journal for Research Analysis*, 122277-8160.
- Mwanyalu, N., Mwatondo, A., Chuchu, V. M., Maina, K. E., Muturi, M., Mutiiria, M., Chepkwony, D., Owiny, M., and Munyua, P. (2025). Documenting challenges in achieving rabies elimination by 2030 in low-middle income countries; a Kenyan case study from Lamu County, 2020–2022: mixed methods approach. *One Health Outlook*, 7(1), 6. https://doi.org/10.1186/s42522-024-00129-1
- Nadal, D., Bote, K., Masthi, R., Narayana, A., Ross, Y. B., Wallace, R., and Abela, B. (2023). Rabies post-exposure prophylaxis delivery to ensure treatment efficacy and increase compliance. *Ijid One Health*, Sahel J. Vet. Sci. Vol. 23, No. 2, Pp 1-9 (2026) 1, 100006. https://doi.org/10.1016/j.jjidoh.2023.100006
- Niang, K., Tine, J., Ndao, A. B., Diongue, F., Diallo, A., Faye, A., Ndiaye, P., and Tal-Dia, A. (2020). Knowledge and Attitudes of Health Care Providers and the Population about Rabies in Sokone Health District, Senegal. *Open Journal of Preventive Medicine*, 10(04), 63-71. https://doi.org/10.4236/ojpm.2020.104004
- Nyasulu, P. S., Weyer, J., Tschopp, R., Mihret, A., Aseffa, A., Nuvor, S. V., ... and Drosten, C. (2021). Rabies mortality and morbidity associated with animal bites in Africa: a case for integrated rabies disease surveillance, prevention and control: a scoping review. *BMJ open*, 11(12), e048551. doi.org/10.1136/bmjopen-2020-048551
- Rana, M. S., Jahan, A. A., Kaiser, S. G., Siddiqi, U. R., Sarker, S., Begum, M. I. A., ... & Shamsuzzaman, A. K. M. (2021). Knowledge, attitudes and perceptions about rabies among the people in the community, healthcare professionals and veterinary practitioners in Bangladesh. *One Health*, 13, 100308. doi.org/10.1016/j.onehlt.2021.100308
- Ravhuhali, K., Makamu, M., Naidoo, S., Zuma, S., Mvelase, S., Ntuli, T., Shandu, X., Myeni, V., Buthelezi, Z., Mlambo, S., Hlanganyana, P., Mbanjwa, S., Thompson-Pillay, J., Rambally, S. D., Phoswa, M., Mchunu, S., Zondi, N., Gangat, R., Phafane, P. and Kuonza, L. (2025). Knowledge and practices on dog bite management for rabies prevention in eThekweni, South Africa. *Journal of Public Health in Africa*, 16(4), 1391. https://doi.org/10.4102/jphia.v16i4.1391
- Rupprecht, C. E., Mshelbwala, P. P., Reeves, R. G., & Kuzmin, I. V. (2023). Rabies in a postpandemic world: resilient reservoirs, redoubtable riposte, recurrent roadblocks, and resolute recidivism. *Animal diseases*, 3(1), 15. doi.org/10.1186/s44149-023-00078-8
- Rysava, K., Espineda, J., Silo, E. A. V., Carino, S., Aringo, A. M., Bernales, R. P., ... & Hampson, K. (2022). One Health surveillance for rabies: a case study of integrated bite case management in Albay province, Philippines. *Frontiers in Tropical Diseases*, 3, 787524. doi.org/10.3389/ftd.2022.787524
- Sahu, D., Ps, P., Bhatia, V., and Singh, A. (2021). Anti-Rabies Vaccine Compliance and Knowledge of Community Health Worker Regarding Animal Bite Management in Rural Area of Eastern India. *Cureus*, 13(3): e14229.
- Shaban, M. A. A., Sidahmed, T. S. M., Elobied, H. E. S., Omer, M. M. E., Yusuf, A., El-Haj, A. M. K., Yassin, M., Abbas, H., AbdAlrhman, F. A. M., and Ahmed, O. (2025). Assessment of the awareness of rabies, rabies prophylaxis guidelines and rabies practice among physicians in Sudan: a national cross-sectional study, 2024. *BMC Public Health*, 25(1), 892. https://doi.org/10.1186/s12889-025-21949-4
- Shaikh, A., Habib, S. S., Saleem, A. F., & Salahuddin, N. (2025). Towards rabies elimination in Pakistan:

- Barriers, facilitators, and the role of One Health. *Journal of Epidemiology and Global Health*, 15(1), 102. doi.org/10.1007/s44197-025-00441-7
- Swedberg, C., Mazeri, S., Mellanby, R. J., Hampson, K., & Chng, N. R. (2022). Implementing a one health approach to rabies surveillance: lessons from integrated bite case management. *Frontiers in tropical diseases*, 3, 829132. doi.org/10.3389/fitd.2022.829132
- Tarantola, A., Tejiokem, M., and Briggs, D. (2019). Evaluating new rabies post-exposure prophylaxis (PEP) regimens or vaccines. *Vaccine*, 37, A88-A93. doi.org/10.1016/j.vaccine.2018.10.103
- Tiwari, H. K., Gogoi-Tiwari, J., & Robertson, I. D. (2021). Eliminating dog-mediated rabies: challenges and strategies. *Animal Diseases*, 1(1), 19. doi.org/10.1186/s44149-021-00023-7
- Tiwari, H. K., Vanak, A., O'Dea, M., and Robertson, I. (2018). Knowledge, attitudes and practices towards dog-bite related rabies in para-medical staff at rural primary health centres in Baramati, western India. *PLoS ONE*, 13(11), e0207025. <https://doi.org/10.1371/journal.pone.0207025>
- World Health Organization (WHO), (2016). Rabies Factsheet. Geneva, Switzerland :<http://www.who.int/mediacentre/factsheets/fs099/en/>
- World Health Organization. (2018). Rabies vaccines: WHO position paper, April 2018—Recommendations. *Vaccine*, 36(37), 5500-5503. <https://doi.org/10.1016/j.vaccine.2018.06.061>
- World Health Organization (WHO), (2024). *Rabies Fact Sheet*. Geneva: World Health Organization. Available at: who.int [Accessed 4 May 2026]