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An analytical cross-sectional study on rabies prevention practices among dog owners in Mumias sub-County, Kakamega County Kenya

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Abstract

Introduction: *rabies has a high total case mortality rate once clinical signs appear; therefore, it is regarded as a zoonotic illness that poses significant concerns for public health. Domesticated dogs function as the principal carrier for the dissemination of rabies. Human rabies has been prevalent in Kakamega County for many years, whereby the population of stray dogs keeps on increasing due to the presence of a dog market in the area, thereby increasing the number of animal bite victims. This study was designed to*

determine rabies prevention practices among dog owners in Mumias sub-County, Kakamega County, Kenya. ***Methods:*** *an analytical cross-sectional design was used, and a sample size of 385 was achieved using multistage sampling. At each stage of the study, participants were recruited through a random sampling procedure, and data was collected using structured questionnaires.* ***Results:*** *the majority (41.8%) of the sample population had a moderate level of knowledge of rabies prevention practices. Dog confinement methods (65.7%), vaccination services (44.2%), and treatment methods (85.7%) were revealed as common rabies prevention practices. Furthermore, the study found an association between having a formal education, employment status, availability of veterinary personnel in the area (P=0.05), the availability of vaccination points in the dog market (P=0.01) and having a vaccinated dog.* ***Conclusion:*** *Mumias sub-County residents possess a moderate level of knowledge of rabies prevention practices. On prevention practices, the study revealed that Mumias sub-County residents used dog confinement methods, vaccination services and treatment methods as preventative measures against the transmission of rabies disease. The research also found that demographic characteristics, preventive measures, presence of a dog market in the region, accessibility of veterinary personnel, and availability of vaccination facilities within the dog market were factors associated with compliance with rabies prevention practices among dog owners in Mumias sub-County, Kakamega County.*

Introduction

The rabies virus directly targets the host's cerebral cortex, causing neurological conditions that eventually lead to death. The Centers for Disease Control and Prevention (CDC, 2021) state that rabies can infect a variety of animal species based on empirical research. But it is more common in dogs, cats, foxes and bats. In the continents of Africa, Asia, and Latin America, rabies is endemic worldwide. It is estimated that the death rate for tacks worldwide is almost 100%. One of the biggest barriers to any rabies prevention and control efforts is the lack of public awareness of the disease, which can occur as soon as a clinical sign manifests [1]. Although rabies is preventable, only a few nations; Australia, New Zealand, and the United Kingdom (UK) have carried out initiatives to eradicate the disease and are currently rabies-free [1]. Post-exposure prophylaxis (PEP) is not widely available in areas where rabies is common, which leads to avoidable human deaths [1]. Post-exposure prophylaxis (PEP) should only be administered after a thorough evaluation of the infection risk, which entails many criteria. The precise position, intensity, and location of the bite, the person's immunization history and the patient's behavior all influence the epidemiological state of rabies in a given geographic area [2].

Several African nations, including Kenya and other republics, exhibit a greater frequency of dog bites and rabies cases, which are linked to insufficient pet vaccination programs that facilitate the spread of the rabies virus. According to the World Health Organization, dogs who account for almost 99% of all rabies deaths-are the main cause of rabies-related deaths among humans [3]. With 76% to 94% of reported cases, the World Health Organization (WHO) plays a significant role in the recording of animal bite injuries in low- and middle-income countries. This virus has spread to the human population primarily through the actions of dogs. The disease rabies is deadly up until symptoms appear. The results have led to the estimation that the rabies-related death toll in Kenya is approximately 2,000 per year [4]. It is noteworthy that two of the top five regions with the highest frequency of dog attacks are Machakos and Kakamega counties. Canine rabies has been successfully reduced in both heavily populated urban and rural areas of Kenya and Tanzania by appropriate dog mass vaccination campaigns [5].

Despite the introduction of immunization, rabies remains a problem in Kenya, particularly in the

counties of Kakamega and Kisumu, as a result of low vaccination coverage and a high dog turnover rate. Kenya is presently implementing a comprehensive plan to eliminate rabies, with the ultimate objective of doing away with all human deaths caused by this illness by 2030 [6]. The main tactics used to prevent rabies include several crucial elimination procedures. These actions entail carrying out an extensive annual dog vaccination program with a minimum coverage rate of 70% in each selected location. Moreover, it is critical to ensure that those who have been bitten by potentially rabies-carrying animals receive post-exposure prophylaxis (PEP) promptly. Campaigns for public awareness that aim to educate people about the risks and preventative measures related to rabies are extremely important. To sum up, it is critical to continue monitoring and surveillance programs to ensure a competent reaction to the disease's emergence [7]. Previous studies have highlighted the importance of addressing the challenges associated with the delivery, accessibility and cost-effects of healthcare services within medical facilities [8].

Since rabies causes more than 60,000 deaths globally each year, it is a serious public health hazard. Report that canine rabies accounts for approximately 95% of deaths in the African and Asian continents [9]. There is a lack of knowledge among dog bite victims worldwide about how to properly care for the wounds that result from their bites, which contributes to the virus's transmission throughout the central nervous system. As a consequence of the previously mentioned problem, approximately 60,000 people die each year, with Asia and Africa having the highest rates of death [10]. Rabies is one of the most important zoonotic diseases in Kenya [11]. To mitigate the risk of clinical illness and death in patients who have been exposed to viruses, prompt administration of Post-exposure prophylaxis (PEP) is necessary. In extreme situations, rabies immune globulin and PEP may be required in combination. Kenya now uses a Post-exposure prophylaxis (PEP) treatment called the "Essen" regimen.

The recommended course of action involves injecting a total of five doses each one milliliter - intramuscularly on days set aside following a biting occurrence. Doses are administered on days 0, 3, 7, 14, and 28 after exposure, in compliance with the World Health Organization's guidelines. Vaccination rates for dogs in Kenya and other sub-Saharan African countries are substantially lower than the recommended level of 70% [12]. Machakos County, Kenya, discovered that just 29% of dogs had received their vaccinations. People die from rabies at a rate of one every 10 minutes, mostly in underdeveloped countries [13]. In particular, more than 90% of recorded deaths occur in Africa and Asia combined. Rabies kills an estimated 2,000 Kenyans annually, with those under the age of 15 having a higher susceptibility [14]. In Kenya, most victims inform veterinary offices about suspected incidents of rabies rather than taking the expected treatment and prevention measures. Therefore, post-exposure prevention strategies may be ineffective [15].

Mumias sub-County due to the presence of a dog market in the county, where vendors go from as far away as Tanzania and Uganda, Kakamega County has a significant dog population. This issue makes it necessary to prioritize dog care, raise public awareness of rabies, and implement rabies prevention measures effectively. Since the Kenyan counties of Kakamega, Bungoma, Vihiga, Busia, Siaya, and Kisumu are included in the rabies control area, they are regarded as high-risk areas for the disease. This classification is mostly due to the increase in dog trafficking nationwide, which has led to the uncontrolled movement of disease-susceptible animals [16]. The incidence of rabies will continue to rise in the absence of immediate intervention. Furthermore, the process of determining illness priorities involves inherent challenges because a detailed assessment of the extent and implications of the disease burden is necessary [15].

Documentation of fatal instances of rabies is rare and the disease is considered neglected. The sickness is most often found in rural settlements that are geographically isolated and do not have precautions in place to lessen the risk of the disease spreading from dogs to people. Furthermore, the aforementioned places experience a deficiency in precise reporting concerning the condition, which hinders the distribution of resources from various funding agencies [17]. This study is significant because it offers vital epidemiological information that can be utilized to persuade national officials about the ramifications of rabies for public health in Mumias sub-County, Kakamega County.

Data and research indicate that Kakamega County has seen a rise in rabies cases. Dog bites accounted for more than 45% of all patients at Kakamega General Hospital. Nevertheless, this study does not demonstrate the measures implemented by the management to avert this illness. Almost 89% of human-animal attack incidents in Kenya are caused by the domestic dog market, which is also the primary cause of rabies cases in the country. The World Health Organization has expressed worry about the possible correlation between vaccination rates and the incidence of rabies [18]. This research will provide targeted suggestions to relevant parties engaged in the prevention and control of rabies, including county health offices and regional livestock and agricultural organizations. The specific objectives was to determine the level of knowledge on rabies prevention practices in the Mumias sub-County of Kakamega County, Kenya; to assess rabies preventive practices among dog owners in Mumias sub-County, Kakamega County, Kenya and to identify factors associated with compliance with rabies prevention practice in Mumias sub-County, Kakamega County, Kenya.

Methods

Study design

This study aimed to make use of a cross-sectional analytic study design as a result of its effectiveness, being inexpensive, and covering a large population in minimal time. Data was collected from a group of subjects spread across the study area, ranging in demographics, knowledge status, and level of rabies prevention practices.

Setting

The research was carried out in the Mumias sub-district, which is situated in Kakamega County, a region in western Kenya. The sub-district is geographically delineated by four distinct wards, namely Central Mumias, North Mumias, Etenje and Musanda Ward. These wards collectively accommodate a population of around 111,862 individuals while occupying a land area of approximately 165.3 square kilometers. The geographical region under investigation was Kakamega County. The region consists of a total of twelve sub-counties. The geographical area under consideration is next to Uasin Gishu, Nandi, Vihiga, Siaya, Busia, Bungoma, and Trans Nzoia Counties.

Participants

Based on the assumption of a 50% predicted prevalence rate, the smallest sample size needed to fairly represent the occupants of the surveyed households was calculated. With a desired accuracy of 5%, a confidence interval of 95%, and the absence of a current prevalence rate, the goal of this strategy is to obtain the greatest sample size (Kongkaew, 2004). About 385 participants made up the sample. The Mumias sub-County was first split into wards, then into villages, and lastly into households, as part of the researcher's multistage sample technique. At every stage where the simple random sample technique was used, these households served as the sampling units. Respondents were carefully chosen based

on the previously mentioned inclusion and exclusion criteria. Structured questionnaires were the main means of collecting data for the study. The three separate sections of the questionnaire were arranged in line with the factors and aims of the research.

Inclusion and exclusion criteria

Inclusion criteria: the study comprised persons who were above the age of eighteen and resided in Mumias sub-County, Kakamega County and who had given their consent to participate. When all family members are present, the one occupying the role of the household head is typically consulted. If there is an absence of a family member who is 18 years of age or older, or conversely, if said member does not provide consent, the researcher proceeds to approach the adjacent residence.

Exclusion criteria: dog owners, household leaders, or their spouses over the age of 18, who have communication problems and have a mental illness and live in Mumias County, Kakamega County, Kenya, who do not meet the criteria were excluded from the study.

Variables

This study aimed to investigate the rabies prevention strategies, degree of adherence and factors associated with these practices among dog owners in Mumias sub-County, situated in Kakamega County, Kenya. The research utilized three distinct independent variables to achieve its objectives, with a specific emphasis on the demographic characteristics of individuals and dog owners residing in the Mumias sub-County, situated inside Kakamega County, Kenya. The examination encompassed the determination of participants' age, gender, and educational attainment. The second variable is to examine the adherence of dog owners in Mumias sub-County, Kakamega County, Kenya, to dog vaccination as a means to evaluate rabies preventive practices. A study was undertaken to evaluate the level of awareness of rabies prevention among individuals who own dogs in the Mumias sub-County, situated in Kakamega County, Kenya. The primary objective of this evaluation was to examine the participants' comprehension of suitable practices for the care and maintenance of dogs.

Data sources

Data was collected from participants through structured questionnaires as the primary tools for data gathering. The questionnaire was partitioned into three distinct sections, organized under the research objectives and factors. The study's initial phase consisted of gathering demographic information, then assessing the participants' level of knowledge, and finishing with a review of their adherence to rabies-prevention practices.

Bias

The researcher employed a multistage sample technique in which the Mumias sub-County was first divided into wards, then further subdivided into villages and finally into homes. These households were used as sampling units at each stage where the simple random sampling technique was applied due to its simplicity and accurate representation of the larger part of the village as well as avoidance of bias. Respondents were recruited strictly as per the inclusion and exclusion criteria described above. A pre-test study was conducted for questionnaire verification as well as the establishment of any deficiencies. The pre-test study helped in revealing deficiencies in the questionnaires. This helped in ensuring the improvement of content as per the uniqueness of the study area.

Study size

Determination of the minimum required sample size to accurately represent the inhabitants of the surveyed households was performed based on the assumption of an anticipated prevalence rate of 50%. This approach aims to obtain the maximum sample size given the absence of a current

prevalence rate, a desired accuracy of 5%, and a confidence interval of 95% (Kongkaew, 2004). A sample of 385 participants was selected.

Quantitative data

The data underwent a thorough examination to ensure its integrity and coherence, potentially influencing the subsequent analysis. Data analysis was conducted using a Microsoft Excel spreadsheet and Statistical Package for Social Scientists (SPSS) version 2.0.

Statistical methods

Descriptive statistics were employed to summarise the data, encompassing measures such as frequency, ratio, mean and range. Data was presented in several visual formats, including tables, graphs, charts and diagrams. The statistical techniques employed in this study encompassed chi-squared tests, correlation analyses and cross-tabulation analyses. These methods were utilized to elucidate and evaluate variations among the many study variables. A P-value below the threshold of 0.05 was considered to have statistical significance.

Results

Participants

The study comprised persons who were above the age of eighteen and resided in Mumias sub-County, Kakamega County, and who had given their consent to participate. When all family members are present, the one occupying the role of the household head is typically consulted. If there is an absence of a family member who is 18 years of age or older, or conversely, if said member does not provide consent, the researcher proceeds to approach the adjacent residence. Dog owners, household leaders, or their spouses over the age of 18, who have communication problems and have a mental illness and live in Mumias County, Kakamega County, Kenya, who do not meet the criteria were excluded from the study.

Descriptive data

A sample size of 385 participants was enlisted for this study. The gender distribution of the sample revealed that a significant proportion of participants (54.8%) identified as women, whilst a slightly smaller proportion (45.2%) identified as men. The age range of the participants encompassed individuals aged 50 years and older, with a mean age of 33.9 years. The household size varies from 1 to 22 individuals, with a mean of 5 individuals per home (ref. Table 1).

Main results

Demographic characteristics and dog's vaccination coverage

Respondents outcome on level of knowledge among dog owners

People in this study who were classified as having good knowledge of rabies using matrix (Figure 1) provided with an extensive guide that included recommended vaccination schedules, appropriate protocols for handling animals suspected of being infected with the rabies virus, and instructions on how to seek medical attention after a dog bite. Additionally, in Table 4, 41.3% of the sample population respondents had a moderate level of awareness of rabies prevention techniques. Even while the proportion of people with medium and a high level of knowledge was quite high (24.7% and 22.4%, respectively), 11.7% of people still possessed poor levels of knowledge.

Respondent's dog's ownership status

Majority of the respondent's (72.5%) indicated that they owned dog within their households while (27.5%) indicated that they did not own dogs. The study focused on dog owners only who had a frequency of 279 respondents as illustrated.

Preventive practices among dog owners

Dog confinement: this made it easier to assess dog confinement and limitation methods and choose

the best rabies preventive strategies. While 30.6% of respondents allowed their dogs to roam freely on the property, 23.6% kept their dogs confined, and the majority of respondents (32.5%) allowed their dogs to roam freely. In response, I said that at night I let them go free. Thirteen percent of the dogs were confined at night and released during the day as demonstrated in Figure 2 below.

Patient health-seeking behavior: regarding the amount of time they would need to spend in the hospital, the majority (85.7%) said they would go there right away following a dog bite; 3.1% said they would go the following day and 11.2% said they weren't sure when to go to the hospital (Figure 3).

Free-roaming dogs: 6.57 percent of respondents said there were too many dogs roaming around, 18.7 percent said there were several, 10.9% said there was just one, and 4.7% said there were none at all.

Availability of veterinary personnel

The majority (42.3%) of the respondents indicated that they were not sure whether there was a veterinary officer in their area, while 38.7% said there was a veterinary officer and 11.2% never knew about the veterinary officer, as shown in Figure 3.

Presence of dog market in the area

The majority (65%) of respondents pointed out that there was a dog market in the area; 30% indicated they were not sure and 5% indicated there was no market for dogs, as shown in Figure 4.

Availability of vaccination points in the dog market

The majority of respondents (69.1%) were unsure whether the market had a vaccination point, while 26.5% said there was a vaccination point and 4.4% said there was no vaccination point, as shown in Figure 5.

Level of knowledge and preventive practices

Vaccination coverage and level of knowledge about rabies: the results of the study showed a statistically significant correlation between the vaccination rates of family dogs and the degree of rabies awareness. There was a significant correlation between respondents who stated that their pets had received vaccinations and a moderate level of knowledge (χ^2 = 14.968, p = 0.005) (Table 2) and Figure 6 respectively.

Number of dogs kept and level of knowledge: the study's conclusions showed a statistically significant relationship between the number of stray dogs and people's level of knowledge about rabies. In comparison to respondents who indicated a low number of dogs kept and a high level of knowledge (10.0%), those who indicated a high number of roaming dogs likewise reported a low level of knowledge, and the difference was statistically significant (X^2 = 18.313; P = 0.005) (Table 3).

Patient health-seeking behavior and their level of knowledge on rabies: the study discovered a strong correlation between the patient's degree of rabies awareness and their care-seeking behavior following a dog bite. When compared to respondents who said they would go to the hospital the following day after getting bitten and those who were unsure (15.7% and 10.1%, respectively), those who said they should go to the hospital right away if they were bitten by a dog also showed a high level of knowledge (X^2 = 2.014, P = 0.003) (Figure 3) respectively.

Appropriate age for a dog's vaccination and level of knowledge about rabies: the age at which dogs should receive their rabies vaccination and the degree of rabies knowledge were significantly correlated. A poor degree of knowledge was also reported by respondents who indicated a high number of roaming dogs; this difference was statistically significant (X^2 = 16.543, P = 0.003) (Table 5).

Factors associated with adherence to rabies prevention measures in dog owners

Vaccination-seeking and adherence behavior: in terms of vaccination-seeking behavior, 62.9 percent of respondents stated they had never vaccinated their dogs, 23.6 percent said they did so every six months and 13.2 percent said they had done so after a year and a half.

Patterns of seeking vaccination information: just 2% of respondents reported that veterinary staff always vaccinate the animals; while the majority (67%) said they have never attended any vaccination campaigns. Additionally, 22% of respondents said they attend such campaigns every year.

Availability of veterinary personnel: while 38.7% of respondents stated there was a veterinary officer in their area, and 11.2% claimed they had never heard of one, the majority of respondents (42.3%) said they were unsure.

Presence of dog market in the area: the bulk of respondents (65%) mentioned that there was a dog market nearby; 30% said they were unsure; and 5% said there was no dog market at all.

Availability of vaccination points in the dog market: twenty-six point five percent of respondents indicated there was a vaccination station at the market, 4.4% said there was none, and the majority of respondents (69.1%) were undecided.

Patterns of seeking vaccination information and compliance with rabies prevention measures: the study discovered a strong correlation between respondents' compliance with rabies preventive measures and the frequent patterns in which they sought vaccination information. Low levels of compliance were also reported by respondents who said they had never participated in a vaccination campaign; these levels were significantly lower ($X^2 = 40.027$, $P < 0.001$).

Availability of veterinary personnel and compliance with rabies prevention measures: the results of the study showed a strong relationship between the presence of veterinary professionals and the use of rabies prevention measures. Low compliance with rabies prevention measures was also observed by respondents who said they were unsure if there was a veterinarian ($X^2 = 45.24$, $P = 0.001$).

The presence of a dog market in the area and compliance with rabies prevention measures: the results of the study showed a strong relationship between following rabies prevention guidelines and the presence of a canine marketplace. High levels of compliance with rabies protection measures were also reported by respondents who said that there was a dog market in the neighborhood; in fact, compliance was much higher ($X^2 = 2.723$; $P = 0.005$).

Availability of vaccination points in the dog market and compliance with rabies prevention measures: the results of the study showed a statistically significant relationship between rabies preventive practice adherence and the availability of vaccination facilities in the dog marketplace. The level of compliance with rabies prevention measures was substantially lower ($X^2 = 15.686$) ($P = 0.003$) among respondents who said they were unsure if there was a vaccination site in the market.

Patterns of seeking vaccination information and compliance with rabies prevention measures: the research found a significant association between the frequency patterns within which respondents were seeking vaccination information and compliance with rabies prevention measures. Respondents who indicated that they never attended any vaccination campaign also indicated low levels of compliance, and they were significantly lower ($X^2 = 40.027$, $P = 0.001$) (Table 6).

Availability of veterinary personnel and compliance with rabies prevention measures: the research findings indicated a significant correlation between the presence of veterinary workers and adherence to rabies prevention methods. Respondents who indicated that they were not sure whether there was a veterinarian also reported a low level of compliance with rabies prevention measures ($X^2 = 45.24$, $P = 0.001$).

Discussion

Key results

The study found that 48.3% of participants in the survey finished their elementary and secondary education requirements, which is consistent with findings from studies conducted in Tanzania and Kenya. Almost 74% of students who started primary school and finished secondary school completed their education. Given that prior studies have demonstrated a favorable association between school attendance and understanding of the disease, formal education is essential in the fight against rabies. The study discovered a strong relationship between people's willingness to vaccinate their dogs and their knowledge about rabies. The majority of respondents (61.8%) were aware of the potentially lethal rabies etiology. This is consistent with earlier research by Cleaveland and Thumbi (2018), who discovered a relationship between the presence of vaccinated dogs and families impacted by rabies. According to the survey, 20.3% of respondents got their information on rabies from friends or neighbors and 28.3% of respondents got it from medical centers.

Furthermore, a separate study conducted in Tanzania revealed that a significant proportion of participants, specifically 70%, relied on information sources such as neighbors, family, and acquaintances [19]. The study found that 44.2% of the assessed population of dog owners administered immunizations to their dogs. The results described in this study are inconsistent with the results of a prior study conducted in Ethiopia, which documented a vaccination rate of 33.3% among dogs living in households [20]. In a similar vein, a separate investigation carried out in the Machakos region of Kenya documented a vaccination prevalence of 29% among the canine population under examination. The study discovered a strong link between owning vaccinated dogs and animal bites, which are the main way that rabies is spread. This implies that the person who is not vaccinated can be held financially accountable for the dog's injuries. According to a Kakamega poll, 73.4% of respondents said that animal bites were the primary method of transmission. Educating the public about the features of rabies is essential to improving rabies control. The study discovered a strong link between owning vaccinated dogs and animal bites, which are the main way that rabies is spread.

Limitations

The study faced some constraints which included: some households were guarded with security-trained dogs hence not easy to access them however the village elders who had volunteered helped in informing owners that on a specific day, there would be visitors hence easier and well-planned visits and data collection took place. Also, some respondents thought there were compensation procedures attached to the study whereby after learning there was no compensation some withdrew their participation. Despite the study providing information on vaccination-associated factors and assessing the associated issues with compliance with rabies prevention practices, the information was limited to prevention practices only isolating treatment measures.

Interpretation

The present investigation revealed a significant relationship ($p < 0.001$) between individuals' level of understanding regarding the nature of rabies as

an affliction and their propensity to administer vaccinations to their dog companions. The observed relationship can be affiliated with the fact that a significant majority (61.8%) of these individuals know the etiology of rabies as well as basic education. The findings of a survey conducted in Kakamega revealed that a considerable percentage of participants, particularly 73.4%, recognized animal bites as the principal mode of transmission for rabies (Mucheru *et al.* 2015). Furthermore, the results of the investigation revealed that a significant proportion of participants (62.2%) demonstrated their commitment to regularly administering vaccinations to their canines as a strategy for effectively controlling the incidence of rabies. The inclination of individuals who own pets to offer assistance to their ailing animals presents a potential hazard of human exposure. To optimize the efficacy of a rabies control program, it is crucial to disseminate information to the general population regarding the prevailing characteristics of rabies in animals. This measure will benefit persons by reducing their interactions with the mentioned wildlife, hence decreasing the probability of human encounters. The aforementioned conclusion demonstrates resemblances to the study conducted by Muruki in the year 2016.

According to this study, having a vaccinated dog was linked to several demographic traits, including job status and educational attainment. Those with secondary education or more and those in any kind of employment were linked to having a vaccinated dog. According to the accepted matrix, there is a modest degree of knowledge among dog owners in the population of the Mumias sub-County. Residents of Mumias sub-County employed vaccination programs, treatment techniques and dog confinement techniques as preventative measures against rabies. This study found that several variables, including the presence of dog markets in the area, educational attainment, job status, the accessibility of veterinary professionals, and the availability of immunization sites, were linked to adherence to rabies prevention measures.

Conclusion

Majority of the study participants (42.6%) had a moderate level of knowledge concerning rabies prevention practices. Residents of Mumias sub-County use dog confinement methods, vaccination services and treatment methods to protect themselves from rabies disease. However, vaccination coverage was below the recommended 80%, with only 42.7% of the participants having vaccinated their dogs in the previous year. Demographic characteristics, such as employment status and education level, were associated with having a vaccinated dog. Those who had secondary education and above were associated with having a vaccinated dog in the last year, as were those who were employed at any level. Mumias sub-County has several factors associated with compliance with rabies prevention practices, such as the availability of dog markets in the area, the level of education, employment status, availability of veterinary personnel and availability of vaccination points in the dog market area.

Generalisability

The findings from this study were generalizable for the whole county of Kakamega and also the western part of Kenya where dog trade is carried on.

What is known about this topic

- *Rabies is classified as a neglected disease, with infrequent occurrences of fatal cases being documented due to research carried before;*
- *Most areas lack accurate data regarding the condition;*

- *The prevalence of the disease is frequently observed in remote rural settlements lacking preventive measures to mitigate the transfer of the disease from dogs to humans.*

What this study adds

- *This study provides crucial epidemiological data that can be used to influence policymakers within the country regarding the public health implications of rabies;*
- *The study offers specific recommendations to pertinent stakeholders involved in the mitigation and management of rabies;*
- *The study provides critical data and gaps that will ensure that sub-district health administrators enhance levels of knowledge and awareness of rabies prevention measures.*

Competing interests

The authors declare no competing interests.

Authors' contributions

All authors have contributed to this work. All have read and agreed to the final manuscript.

Tables and figures

Table 1: demographic characteristics of the respondents

Table 2: level of knowledge and vaccination status

Table 3: level of knowledge and number of dogs kept

Table 4: cross-tabulation for the level of knowledge and source of rabies in dogs

Table 5: level of knowledge and vaccination-seeking behaviour

Table 6: level of knowledge and duration for vaccination of dogs

Figure 1: conceptual framework

Figure 2: respondent's dog confinement practice

Figure 3: respondents patient health seeking behaviour

Figure 4: existence of dog market in the area

Figure 5: availability of vaccination points in the dog markets

Figure 6: respondents vaccination coverage

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Table 1: demographic characteristics of the respondents		
Variable	**Frequency**	**Percentage (%)**
Gender		
Male	174	45.2
Female	211	54.8
Education status	**Frequency**	**Percentage (%)**
Illiterate	17	4.4
Primary	186	48.3
Secondary	113	29.4
Tertiary	17	17.9
Occupation	**Frequency**	**Percentage (%)**
Formal employment	96	12.2
Informal employment	96	24.9
Unemployed	176	45.7
Student	22	5.7
Self-employed	44	11.4
People per household	**Frequency**	**Percentage (%)**
1-4	59	15.3
5-10	252	65.5
11-20	56	14.5
21 and above	18	4.7
Age limits	**Frequency**	**Percentage (%)**
15-19 years	5	1.3
20-29 years	59	15.3
30-39 years	136	35.3
40-49 years	152	39.5
50 years+	33	8.6

Table 2: cross-tabulation for the level of knowledge and source of rabies in dogs								
		Level of knowledge						**Chi-square statistic (P)**
		High		**Moderate**		**Low**		
Where do these dogs get rabies from?		**Frequency**	**%**	**Frequency**	**%**	**Frequency**	**%**	
	Drinking contaminated water	23	26.7	17	12.0	11	21.0	0.001
	Scavenging	17	20.0	19	13.0	13	25.0	
	Bites from rabid animals	26	31.1	99	70.0	11	20.5	
	Not aware	18	21.4	7	5.0	18	34.1	
Total		**84**		**142**		**53**		

Table 3: level of knowledge and vaccination status								
		Level of knowledge						**The Pearson chi-square statistic (P)**
Have you ever vaccinated your dog against rabies for the last one year?		**High**		**Moderate**		**Low**		
		Frequency	%	Frequency	%	Frequency	%	
	Yes	14	47.0	89	47.3	20	25.3	0.005
	No	12	40.0	49	26.1	26	33.0	
	I don't know	4	13.3	50	26.6	33	41.8	
	Total	30		188		79		

Table 4: level of knowledge and number of dogs kept								
On average how many stray dogs do you see in a day?		**Level of knowledge**						**The Pearson chi-square statistic (P)**
	One More than one Uncountable None	**High**		**Moderate**		**Low**		0.005
		Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**	
		9	18.0	15	10.0	7	9.0	
		11	22.0	37	25.0	41	52.0	
		26	52.0	78	52.0	22	28.0	
		4	8.0	20	13.3	9	11.4	
Total		**50**		**150**		**79**		

Table 5: level of knowledge and vaccination-seeking behavior								
When would you present to the hospital after a dog bite?	Immediately after being bitten The next day after being bitten Not Sure	**Level of knowledge**						**The Pearson chi-square statistic (P)**
		High		**Moderate**		**Low**		
		Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**	0.003
		103	67.3	51	74.0	38	67.0	
		30	19.6	10	14.5	15	26.3	
		20	13.1	8	12.0	4	7.0	
Total		153		69		57		

Table 6: level of knowledge and duration for vaccination of dogs								
		Level of knowledge						**The Pearson chi-square statistic (P)**
		High		**Moderate**		**Low**		
After how long a dog should be vaccinated against rabies?	After six months After one year After two years Not Aware	**Frequency**	**%**	**Frequency**	**%**	**Frequency**	**%**	0.003
		27	52.0	67	49.6	56	60.8	
		11	21.2	40	29.6	13	13.2	
		9	17.3	16	11.9	11	12.0	
		5	9.6	12	9.0	12	13.0	
Tota		**52**		**135**		**92**		

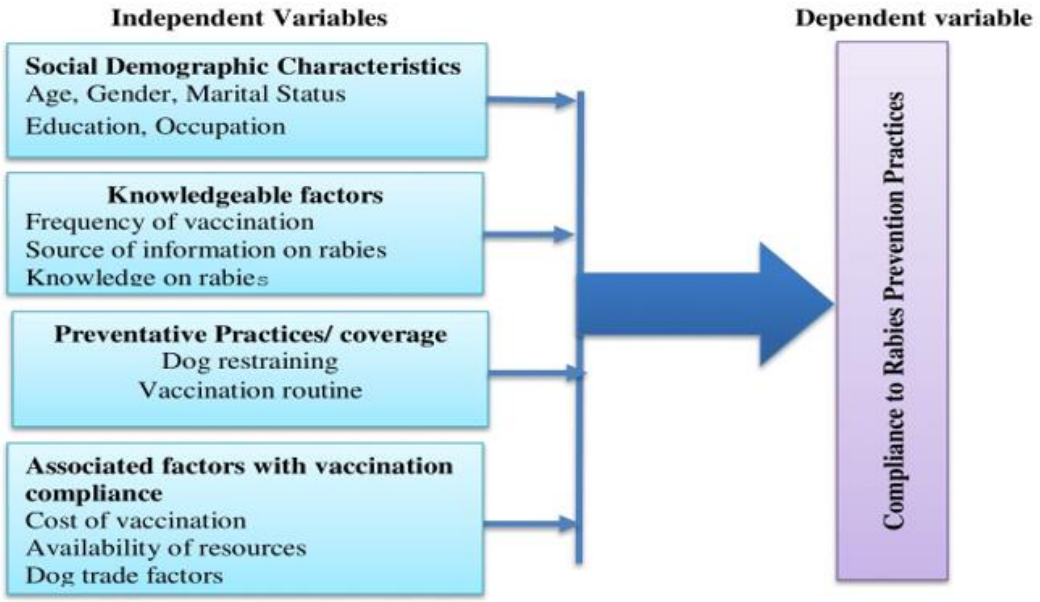

Figure 1: conceptual framework

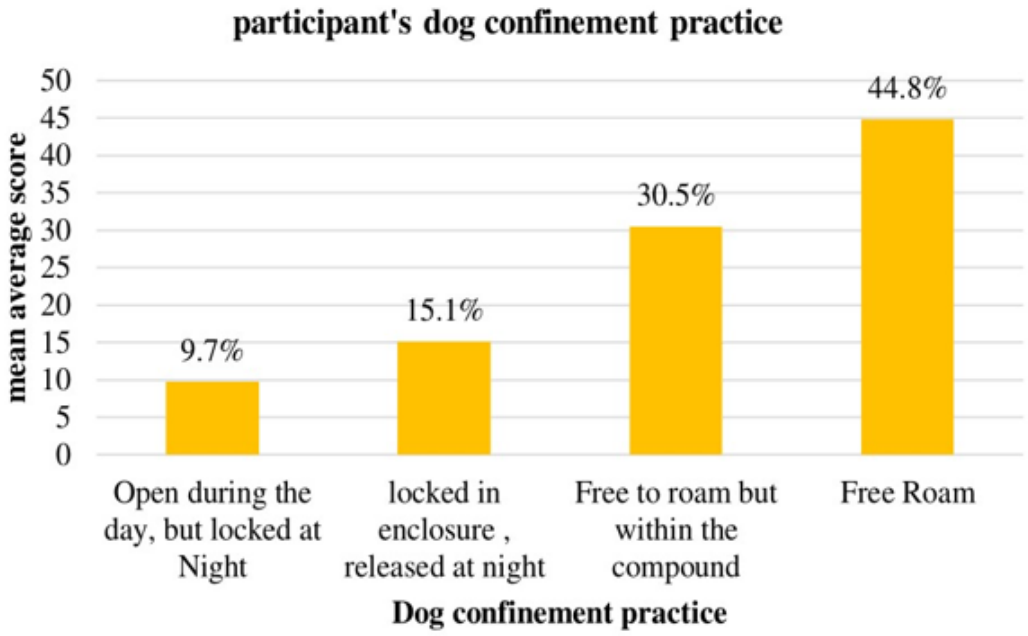

Figure 2: respondent's dog confinement practice

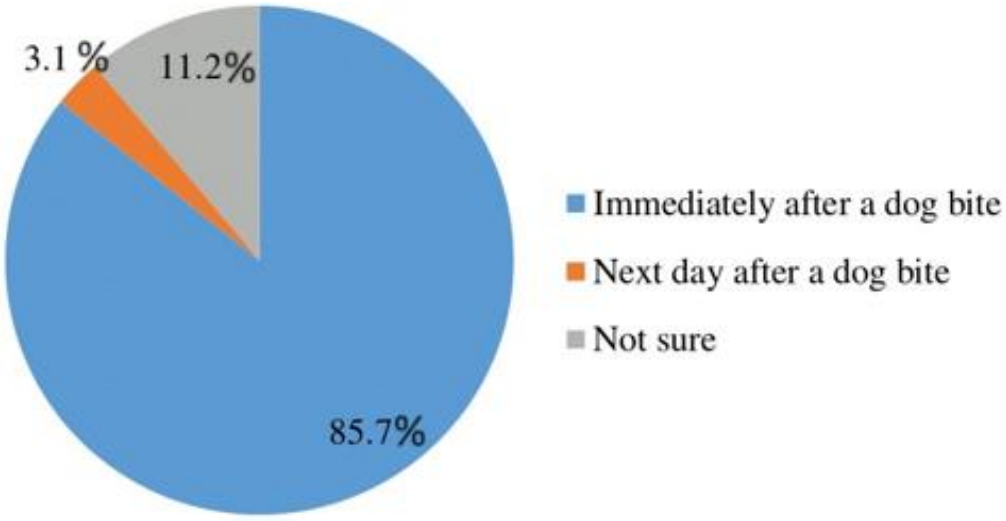

Figure 3: respondents patient health seeking behaviour

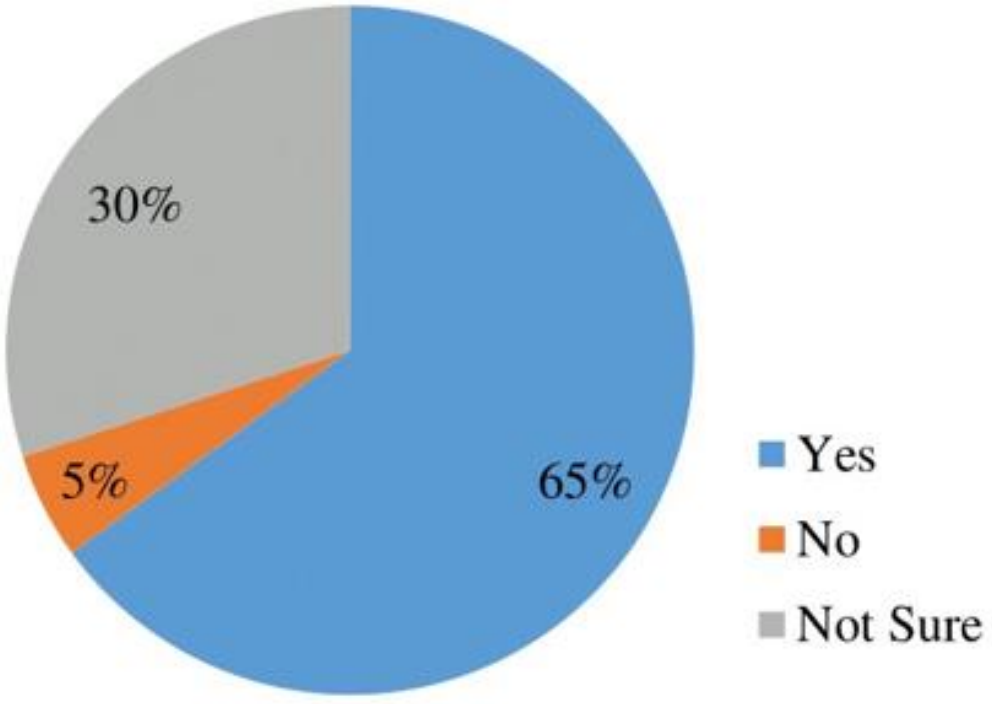

Figure 4: existence of dog market in the area

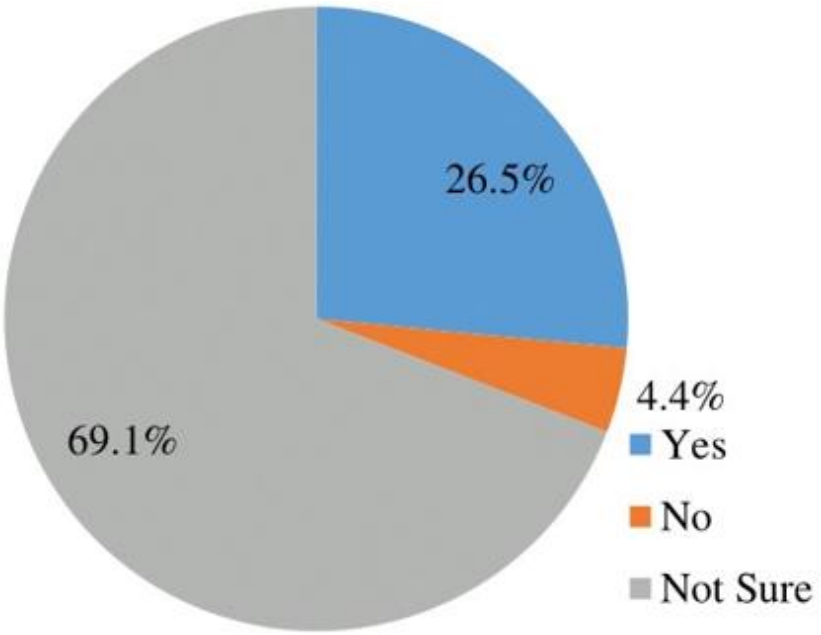

Figure 5: availability of vaccination points in the dog markets

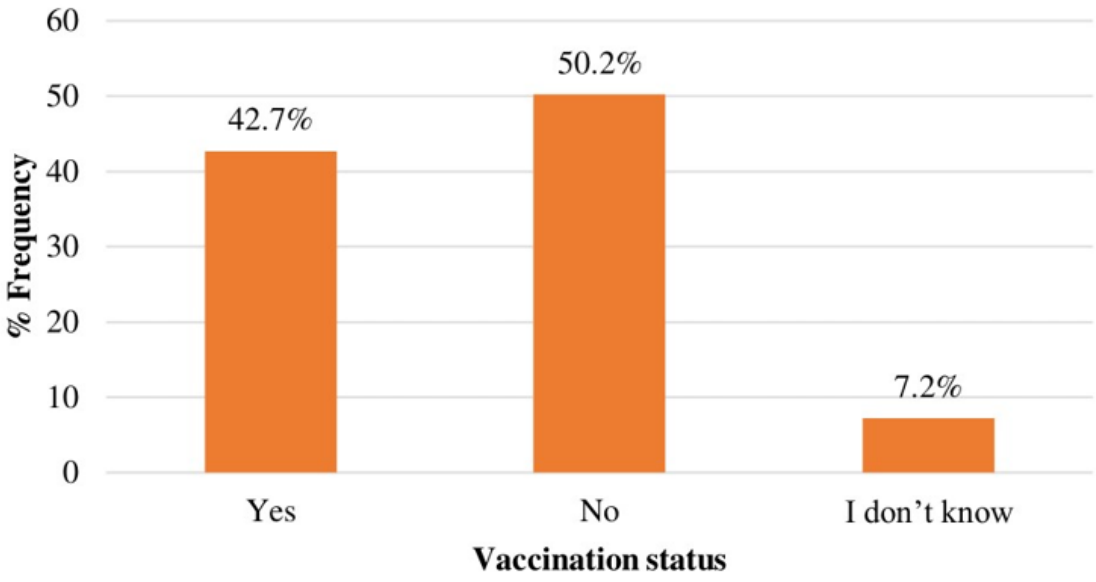

Figure 6: respondents vaccination coverage