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EDITED BY  
Abhishek Pandey,  
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REVIEWED BY  
Samuel Kahariri,  
International Livestock Research Institute,  
Kenya  
Murungi Maurice Karani,  
International Livestock Research Institute  
(ILRI), Kenya

\*CORRESPONDENCE  
Gyesi Razak Issahaku  
✉ gyesi2g3@gmail.com

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# Analysis of dog bite surveillance data, Volta Region, Ghana, 2020

Sahr Raymond Gborie<sup>1</sup>, Gyesi Razak Issahaku<sup>1,2\*</sup>,  
Harriet Affran Bonful<sup>1</sup>, Delia Akosuah Bandoh<sup>1</sup>, James Squire<sup>1</sup>,  
Donne Kofi Ameme<sup>1</sup> and Ernest Kenu<sup>1</sup>

<sup>1</sup>School of Public Health, University of Ghana, Accra, Ghana, <sup>2</sup>Laboratory Department, Tamale Teaching Hospital, Tamale, Ghana

**Introduction:** Dog bite is the second most common injury sustained by humans after snake bites, and it is amongst the top 12 causes of non-fatal injuries worldwide. Globally, 59,000 human deaths occur annually due to rabies, and 95% of these deaths occur in Asia and Africa. Dog bites remained a public health concern in Ghana, with three out of every 1000 incidence resulting in human rabies. Analysis of the surveillance data is key in understanding the burden of dog bites in the Volta region. This study describes the epidemiology of dog bites in the Volta Region, Ghana, to inform policy on prevention and control.

**Methods:** We conducted a descriptive analysis of secondary data on dog bites. We obtained aggregate data from 2015 to 2019 from the District Health Management Information System (DHMIS). Variables extracted were gender, age, and location. Data were entered into a Microsoft Excel cleaned, reviewed, and analyzed. We used descriptive statistics to summarize results into frequency and proportion and displayed results in tables, graphs, and maps.

**Results:** During the study period, 4737 dog bite cases were identified from a population of 1,907,529 (incidence of 248 per 100,000). Twelve (0.25%) humans were confirmed for rabies with a 100% case fatality rate. Males accounted for 2455 (51.8%) of dog bite cases. The age group between 10 and 19 years (21.9%) was most affected. About 35.0% (1640/4737) were administered with the anti-rabies vaccine, and 25.3% (1200/4737) were administered anti-tetanus toxoid. Keta district (550 per 100000) reported the highest incidence of dog bites. Dog bite cases were highest in the third and fourth quarters of 2016 and the first quarter of 2017.

**Conclusion:** The incidence of dog bites and rabies was high in the Volta region. Children and adolescents were mostly affected. There was a low coverage rate of anti-rabies vaccine and anti-tetanus toxoids usage. We recommended that the Regional Health Directorates and the Regional Veterinary Department develop robust strategies to control stray or free-roaming dogs in the Volta region.

## KEYWORDS

surveillance, dog bite, rabies, Volta Region, Ghana

## Introduction

Human Dog bites cause injuries that lead to death from rabies infection (1). Globally, rabies accounts for over 59,000 human deaths annually, transmitted through the bite of rabid animal mostly dogs and with a case fatality rate of about 99% (2). Children below 15 years of age account for 42% of dog bite cases in developing countries (3). Between 2002 and 2004, the Ghana Health Service reported 144 human deaths due to rabies resulting from dog bites. The majority of dog bite cases were caused by stray dogs, which threaten the lives of Ghanaians (4).

Even though rabies is fatal, it can be prevented through vaccination in humans and animals (5). Approximately 15 million people worldwide receive anti-rabies vaccines annually (6). Nearly 200,000 people are vaccinated against rabies in Africa each year (7). The strategies to control human dog bites in Ghana depend primarily on routine surveillance, vaccination, dog population management and awareness creation. The data on human dog bites in Ghana are generally under-reported due to weak surveillance systems (8) and this could aggravate the increasing human rabies situation in Ghanaian communities.

In the Volta Region of Ghana, human dog bite data is generated by routine surveillance. However, this data is not analyzed to understand the burden and epidemiology of dog bites in humans. Regular analysis of human dog bites data collected by routine surveillance systems is crucial to describe the burden of dog bites and come up with control measures. We analyzed human dog bites surveillance data in the Volta Region of Ghana from 2015 to 2019 to describe the trend and characteristics of dog bite cases.

## Methods

### Study design and data collection

We analyzed secondary data on dog bites collected from 2015 through 2019 in the Volta region. The analysis was conducted in 2020. Our study used dog bite surveillance data from the District Health Information Management System-II (DHIMS-II). The DHIMS-II host aggregate data from each facility on reportable conditions and events under surveillance. We collected data on, age, gender, districts, subdistricts, facility kinds, vaccination status, and death.

### Description of dog bite surveillance system in human health system

The Dog bite surveillance system is a passive surveillance system that relies solely on health care providers reporting human dog bite cases at all levels (District/municipal, regional, and national levels). Whenever a dog bites a person, the person reports to the Community-Based Surveillance Volunteers (CBSV) attached to a Community-Based Health Planning Services (CHPS) zone or directly to a health facility. The health personnel at the facility notifies the District Health Administration (DHA) immediately while capturing the patients clinical and demographic data in the patient folder,

consulting room register, and out-patients monthly morbidity register. A Public Health Surveillance Officer attached to the facility enters the records of the patients into the DHIMS and the IDSR weekly summary reporting form (paper-based). Every Monday before 12: 00 pm, the Public Health Surveillance officer shares the IDSR weekly summary report with the surveillance unit at the District Health Administration who intend shares their monthly summary with the Regional Health Directorate (RHD). notified the Regional Health Directorate (RHD) about the human dog bite and entered the patients 'information. Similarly,

### Description of dog bite surveillance system in animal health system

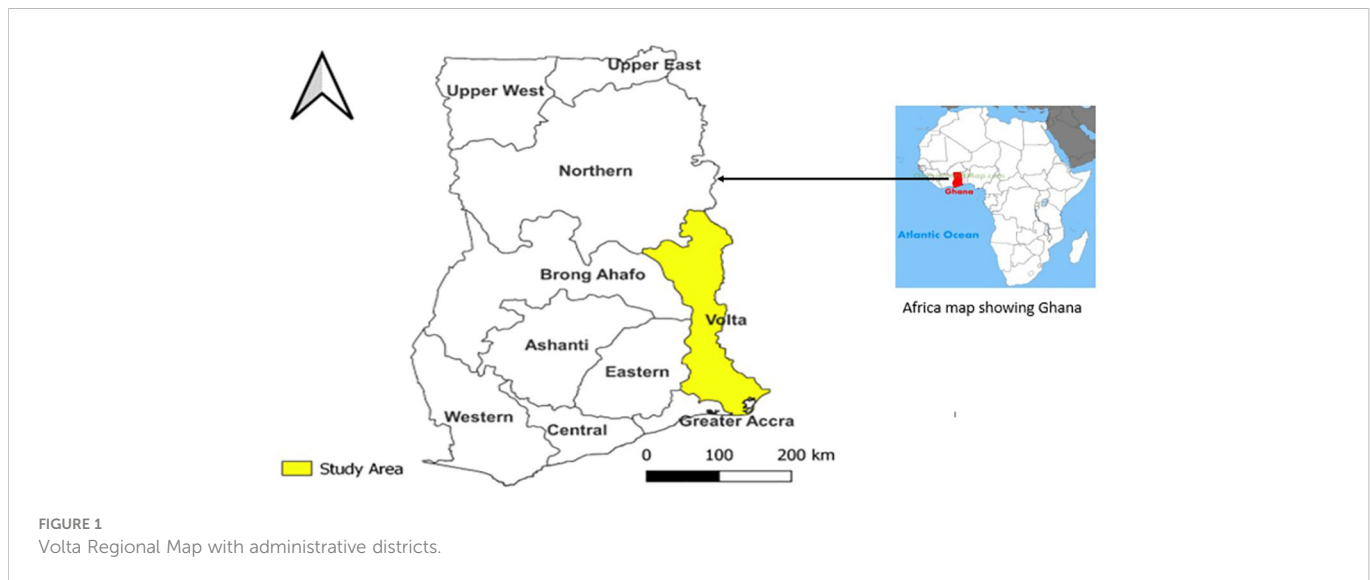
The surveillance of dog bites within the Animal Health system is also passive, meaning the community members report cases of dog bites to the Community Animal Health Workers (CAHWs) or the Para-Veterinary Officers. When these cases are reported, the dog bite victims are referred to a nearby Community Health Facility for further management. The Para -Veterinary Officers will track and quarantine the suspected rabid dog for 14 days. The dog under quarantine is observed for suspected signs such as profuse salivation, fear of water, loss of appetite, and paralysis. If the dog develops signs of rabies during the observation period, it is then killed the head cut off and transported to the Regional Laboratory for laboratory confirmation. If the suspected rabid dog is diagnosed as a positive case base on the outcome of the laboratory investigation, it is quickly reported within 24 hours to the national level. The veterinary form (VF-1) and the laboratory result are submitted to the veterinary officer at the Regional Veterinary Services Department.

### Study area

The Volta Region is one of the 16 administrative regions of Ghana. The region covers an area of approximately 20,570 km<sup>2</sup> in the south-eastern part of the country. According to the 2010 national population census, the region has a population of 33,475,870 inhabitants (9). The population density is 87 km<sup>2</sup>, with 30% of the population residing in urban areas and 70% in rural areas. The Volta Region is bordered on the north by the Oti region of Ghana, the Gulf of Guinea on the south, the west by the Volta Lake, and the east by the Republic of Togo (Figure 1). The region has 18 administrative districts, with Ho as the regional capital. Volta Region has 564 Government, Private and Christian Health Association healthcare facilities, including 321 Community Health -Based Planning Services (CHPS). The region has an estimated dog population of 2,059 with 14 Veterinary Clinics.

### Data analysis

Data retrieved from DHIMS-II was entered into a Microsoft Excel 2016. Descriptive statistics was used to summarize results in frequencies and proportions for categorical variables such as gender, age, and location using STATA version 15. The data were then displayed in tables, graphs, and maps.



## Results

During the study period, 4,737 dog bite cases occurred in the region among 1,907,529 human populations, giving an overall incidence of 248 per 100,000 persons. Twelve (0.25%) humans were confirmed for rabies out of 4737 dog bite cases, with a 100% case fatality rate. Males accounted for 2455 (51.8%) of dog bite cases. The age group between 10 and 19 years (21.9%) had the highest proportion of dog bite case while age group 20–29 years had the least (10.2%) (Table 1).

The number of reported human dog bite cases was highest in 2016 with 1145 cases. There was a steady decline in the number of recorded dog bite cases from 2017 to 2019 with the least number of bite cases (689) recorded in 2019. The number of persons who received rabies vaccine was however highest in 2017 with 753 people while 2019 recording the least number of persons vaccinated (77) (Figure 2). Among the reported human dog bites cases, twelve human rabies

TABLE 1 Demographic characteristics of dog bite cases in humans, 2015–2019.

Variable	N=4737	Frequency (%)
<b>Sex</b>		
Male	2,455	51.8
Female	2,282	48.2
<b>Age (Years)</b>		
0–9	729	15.4
10–19	1,037	21.9
20–29	483	10.2
30–39	716	15.1
40–49	625	13.2
50–59	544	11.5
≥ 70	603	13.0

cases were confirmed within the period. There was at least one confirmed human rabies case in all the years under review except for 2017. The highest number of confirmed rabies cases were recorded in 2015 and 2016 (Figure 3).

Dog bite cases were recorded in almost all the districts in the Volta region. The Keta, Ketu, and Krachi districts had the highest incidence (550 per 100,000 person) of dog bites compared to Akatsi district (25 per 100,000 person), which recorded the least dog bite cases (Figure 4). As shown in Figure 5, the majority of the reported cases of dog bites in the region (70%) came from the hospitals, this was followed by Health Centres (16%), with the CHPS zones recording the least proportion of cases (3%).

## Discussion

Our study showed a high incidence of human dog bites in the Volta region of Ghana. The incidence was higher compared to a study conducted in the Eastern Region, with an annual incidence of 172 cases per 100,000 population (8). The possible predisposing factors for the region's high prevalence of dog bites could be either due to free-roaming dogs or poor strategies to control the dog population. Males were the most affected victims as they were more curious to provoke dogs which could therefore bite them in self-defense (10). A study from the Trinidad found that males were more likely to sustain dog bite injuries across all age groups (11). Our findings were also consistent with a previous study conducted in Iran, which found that males were more likely to be bitten by dogs due to outdoor games (12).

The age group with the highest burden of a dog bite was below 19 years. The finding was in line with a study conducted in Iran (13), which revealed that about 30–50% of casualties are children under 15 years of age. A similar result was reported by a study in Belgium, which reported 22 bites per 1000 children under 15 years (14). The cases of dog bites among children were attributed to the children's provocation or maltreatment of dogs. Also, children are likely to invade the dog territory, such as passing close to a dog or touching a dog with puppies, feeding, or parting. In addition, children are the

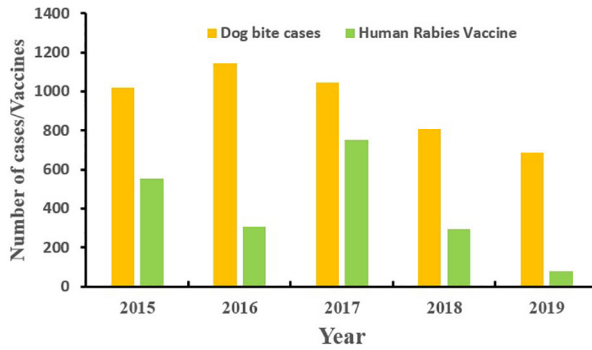


FIGURE 2 Number of case of dog bites (orange) s well as number of humans that received rabies vaccine (green), 2015–2019.

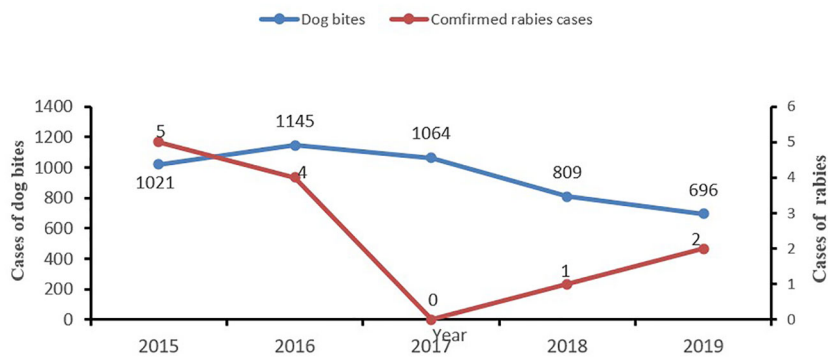


FIGURE 3 Yearly reported dog bites and rabies cases in the Volta region, 2015–2019.

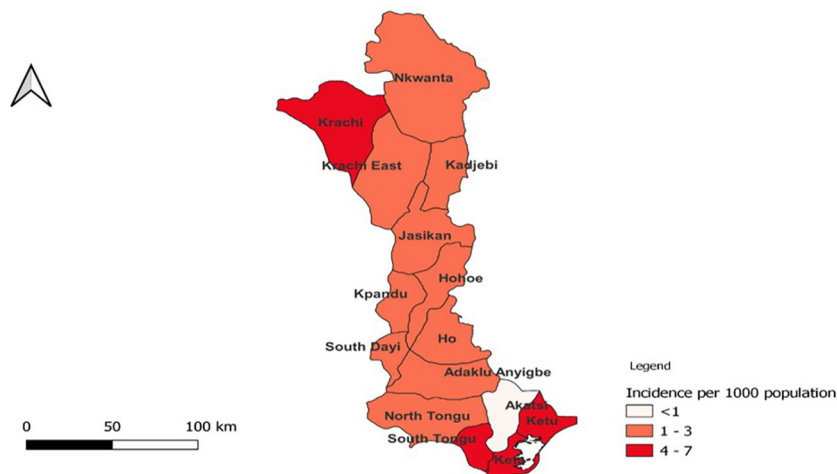


FIGURE 4 Incidence of Dog bited in the Volta Regoin per 100,000 population, 2015 to 2019.

ones who usually bring dogs for vaccination, and they stand a high risk of dog bites (15).

The usage of anti-rabies vaccine is low in the Volta region. The anti-rabies vaccine is typically offered at cost recovery in all healthcare facilities since rabies threatens people in Ghana. However, the anti-

rabies vaccine is not forthcoming, and many people find it difficult to afford it from the health facility. Victims’ delay in obtaining vaccines has also increased the Volta region’s default rate.

Similar studies have estimated the cost of the anti-rabies vaccine (post-exposure prophylaxis) in Africa at US\$ 40 and Asia at US\$ 49,

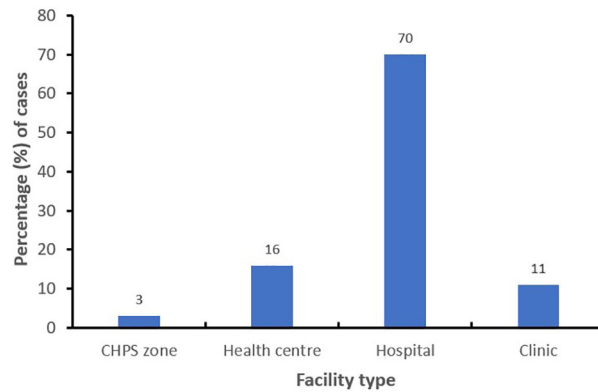


FIGURE 5  
Distribution of dog bite injuries by type of health facility, 2015 to 2019.

which has increased the financial burden on affected households with an estimated daily income of US\$ 1-2 per person (15).

Additionally, the incidence of dog bites was high across the region. However, the districts of Keta Ketu, and Krachi had the highest incidence of dog bite cases, which presumed that the districts might have a higher population of free-roaming or owned dogs. A previous study showed that almost 98% of dogs in Africa are kept for socioeconomic, hunting, and security reasons (16). The majority of dog bite victims reported to hospitals and health facilities. The reported cases at the hospitals could be referred cases from other facilities with the notion of quality services by the nurses and medical doctors.

## Limitation of the study

There was a discrepancy in the age grouping from the dog bites data source (DHIMS-II), which does not conform to the World Health Organization (WHO) age grouping matrix. Nevertheless, this study can be considered a prototype study to guide future regional research.

## Conclusion

The incidence of dog bites is very high and remains a public health problem in the Volta region. More of the cases of dog bites are concentrated in urban districts of the Volta region. Children made up most of the cases of dog bites, and males were more exposed to dog bites. The cases of dog bites were not well managed in some healthcare facilities, and there were no efforts to control the dog population. A multidisciplinary approach is needed between the Regional Health Directorate and Veterinary Health Department to control the dog populations.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

We adopted a framework of the Integrated Disease Surveillance and Response matrix implemented by the Ghana Health Services for our data analysis. We did not undergo a formal review by the Ethical Review Committee. The study was approved by the Ghana Field Epidemiology and Laboratory Training Program. The Volta Regional Health Directorate and the Veterinary Services Directorate (VSD) provided administrative permission to access the dataset. All extracted data was anonymized and did not have any individual identifiers. Only authorized persons had access to the data held in password-protected computers.

## Author contributions

SG, DA, EK and GI conceived the idea. GI, SG, HB, JS, DB, and DA framed the design, conducted the investigation and performed the statistical analysis. SG, GI, JS, HB, DB and DA drafted and revised the initial manuscript. GI, SG, DB, DA, HB, and EK edited and reviewed the manuscript. All authors contributed to the article and approved the submitted version.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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