# Epidemiological assessment of animal bite injury cases and rabies post exposure prophylaxis in Kisumu County, Kenya


## Abstract

### Introduction

Animal bite injury of humans provide an important source of epidemiological information which is crucial in enhancing rabies surveillance in humans and animals. Rabies post exposure prophylaxis consumes substantial resources, time and exerts a lot of financial burden on the victims. The overall aim of this study was to conduct a rapid epidemiological appraisal of animal bite injury and rabies post exposure prophylaxis in Kisumu County, Kenya in order to inform the ongoing rabies prevention and control strategies in the County.

### Methods

A retrospective cross-sectional study was conducted in 32 administrative units (Sub-locations or wards) in Kisumu County, Kenya. Data was collected from outpatient department (OPD) registers in four peri-urban health centres in Kisumu East Sub County, Kenya. An integration of epidemiological tools for disease mapping was applied in the study. Quantum Geographic Information System was used to create a thematic map and spatial distribution of the animal bite injuries in Kisumu County.

### Results

There were 133 (63%) males and 78(37%) female cases. The range in age was 11 – 40 years. The cases were highest among 11-17 years' age group. Among the cases were 14(6.6%) children less than 10 years, 63(29.9%) were of age group between 11-17 years, 49(23.2%) were in the age group between 18-24 years, 41(19.4%) were in the age bracket between 25-31 years, 24 (11.4%) were between 32 and 38 years, while 20(9.5%) were 38 years and above. Majority, (87.2 %) of the animal bite injuries were inflicted by domestic dogs. Wild dogs/stray dogs contributed 8.1% of the total number of animal bite injury cases. Cats and unknown animals contributed 1.4% and 3.3 respectively. The epidemiological curve shows that more than one case of animal bite injury occurred daily in Kisumu County between June and December, 2019 with the highest daily figure being 7. The study revealed the need to strengthen animal bite injury and rabies prevention and control strategies in Kisumu County.

### Conclusion

The rabies prevention and control strategies in Kisumu County should be built on the "One Health" approach with special focus on strengthening the rabies surveillance system in both human and animal population in order to collect accurate and reliable epidemiological data.

**Keywords:** Animal bite, Rabies post exposure prophylaxis, spatial distribution

## 1.0 INTRODUCTION

Animal bite of humans provides an important source of epidemiological information which is crucial in enhancing rabies surveillance in humans and animals [1]. Animal bite injury is a serious public health problem and an economic burden especially in developing countries like Kenya where canine rabies vaccination coverage is very low [2]. Animal bite injury is often a sequel for rabies, a viral zoonosis associated with bites from a number of animals within the *orders carnivore* and *chiroptera*. Rabies virus is transmitted to humans through entry of saliva into a wound, scratch or mucous membrane [ 3].

Globally, more than 15 million people are given rabies post exposure prophylaxis (PEP) following animal bite. This translates into about US$ 1.7 billion annually [4]. Animal bite of human inflict considerable physical and emotional damage on the victims and has other public health risks including contracting rabies, sepsis of bite wounds, psychological trauma and creates immeasurable hidden costs including high cost of seeking for rabies PEP. Dog bites account for 85% of all animal bite of human cases receiving medical attention [4]. Full scale of animal bite injury of human and rabies burden in developing countries is unknown, owing to inadequate surveillance, social and ecological factors [5]. From the perspective of human rabies, the vast majority (over 90%) of cases are mediated by domestic dog bites [6]. Most animal bites occur in familiar settings or by an owned animal known to the victim. Stray and wild animals also pose a threat in rural and urban environments [6, 7]. Surveillance for dog and other animal bites requires a substantial investment of time and resources, and underreporting is common in developing countries [7, 8]. A health facility passive surveillance study conducted in Uganda estimated that 6,601 dog bites are inflicted on humans each year [8]. Similar findings have been recorded in Tanzania [9].

In Kenya, a study conducted to assess epidemiology of human animal-bite injuries and rabies PEP, concluded that domestic dogs cause most bites in humans and remains a major public health problem [10, 11,12]. In Kisumu County, Kenya animal bite surveillance is not a routine practice, although from the hospital records dog bites are highly prevalent [11, 12].

## 2.0 MATERIALS AND METHODS

### 2.1 Study location

The study was conducted in 32 administrative units (Sub-locations or wards) in Kisumu County (Fig1). The study area lies within longitude $34^0$ 10' East of Green which and latitude $00^0$ 20 South. The area covers approximately $417Km^{2.}$ The northern part of Kisumu County is characterised by undulating topography of Kajulu hills. According to the 2019 Kenya population census, the area has a population of about 567,487 (KNBS, 2019).

A retrospective cross-sectional study design was applied in twelve peri urban health facilities 32 within the 32 wards in Kisumu County.

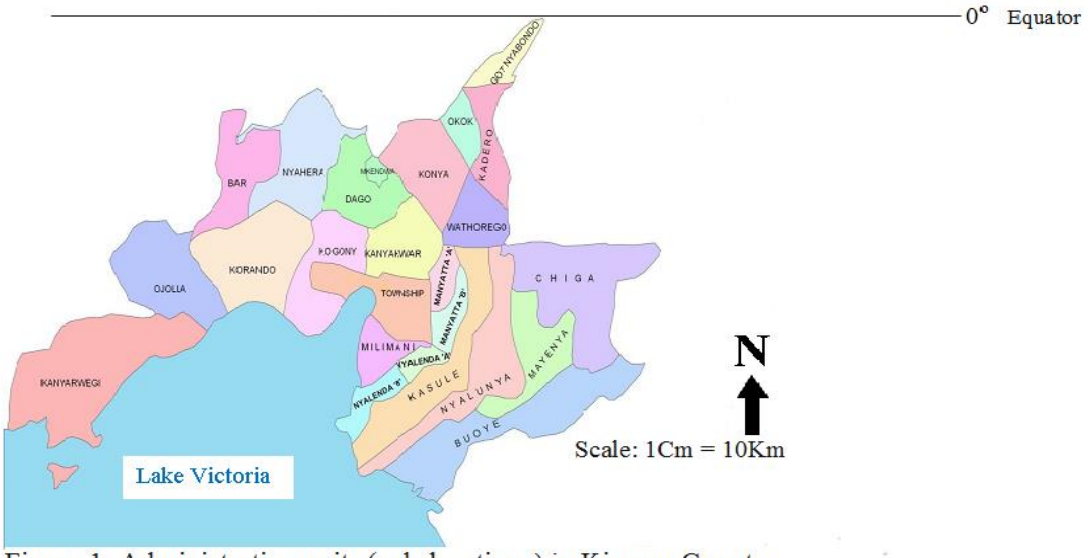


Figure 1: Administrative units (sub-locations) in Kisumu County

(Source: Kisumu City Planning Department).

**2.2 Data collection**

Data covered the period between September, 2018 and December, 2019. Data was collected from outpatient department (OPD) registers in four peri-urban health centres in Kisumu East Sub County, Kenya. Only non-identifying patient data was collected i.e. sex, age, part of the body bitten, species of biting animal, date and time of OPD visit, date and time of occurrence of incident, exact place (or spot) the incident took place, and telephone contact. Inclusion criteria for this investigation included any patient record that had both the word "bite" and a recognizable mammalian animal or the word "animal" (e.g. dog, cat, or other mammal). An integration of epidemiological tools for disease mapping was applied in the study. Using the telephone numbers provided in the register a follow up was undertaken with the assistance of local Community health volunteers (CHVs) to identify the location of the incident. The Global Positioning System (Garmin eTrexR) handset receiver was used to record the spot (geographic location i.e. x, y coordinates) where the incident took place.

**2.3 Data management and analysis**

Data transformation and analysis for health records was done using Microsoft Excel 2016 (Microsoft, Seattle, WA, USA), and analyzed using Epi Info version 7 (CDC, Atlanta, GA, USA) to generate descriptive statistics. Quantum Geographic Information System (QGIS) was

used to create the thematic map and spatial distribution of the animal bite injuries in Kisumu County.

## 3.0 RESULTS

Between September, 2018 and December, 2019, 211 animal bite cases were recorded.
There were 133 (63%) males and 78(37%) female cases. The range in age was 11 – 40 years. The cases were highest among 11-17 years' age group. Among the cases were 14(6.6%) children less than 10 years, 63(29.9%) 11-17 years, 49(23.2%) 49 (23.2%) were in the age group between 18-24 years, 41(19.4%) were in the age bracket between 25-31 years, 24(11.4%), being 32-38 years, while 20(9.5%) cases were 38 years and above, as depicted in table 1

Table1. Number of reported animal bite cases by sex and age group (N=211)

| Age group | Sex | | |
|---|---|---|---|
| | Male | Female | Total |
| < 10 yrs | 11(8.3%) | 3(3.8%) | 14( 6.6% ) |
| 11-17 | 43(32.3%) | 20 (25.6%) | 63(29.9% ) |
| 18-24 | 30(22.6%) | 19 (24.4%) | 49(23.2%) |
| 25- 31 | 28(21.0%) | 13 (16.7%) | 41(19.4%) |
| 32-38 | 9(6.8%) | 15(19.2%) | 24(11.4%) |
| 39 and above | 12(9.0%) | 8 (10.3%) | 20(9.5%) |
| Total | 133(100%) | 78 ( 100%) | 211(100) |

### 3.1 Identity of biting animal

Majority, (87.2 %) of the animal bite injuries were inflicted by domestic dogs. Wild dogs/stray dogs contributed 8.1% of the total number of animal bite injury cases. Cats and unknown animals contributed 1.4% and 3.3 respectively. Fig 2.

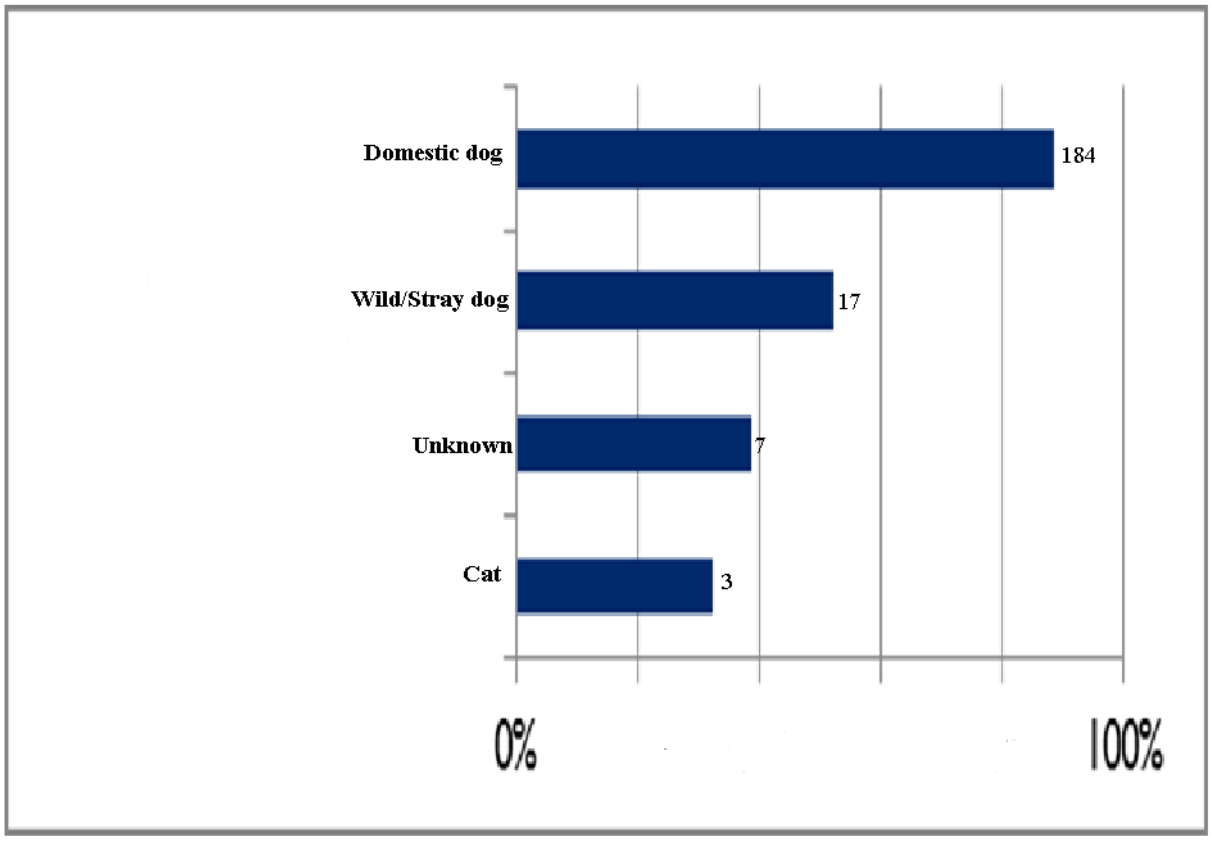


Figure 2. Distribution type of animal of animal which caused bite injury in Kisumu County between September 2018 and December, 2019.

**3.2 Rabies Vaccination Status of biting animals**

Ownership and rabies vaccination status of dogs and cats for which post exposure Prophylaxis was administered to bitten or exposed human victims, is summarized in table 2 below. There was no information on the status of 24 reported animal bite cases (classified as wild/stray and unknown).

**Table 2.** Rabies Vaccination Status of biting animals*

| **Species** | **Ownership Status** | **Vaccination Status (Current)** | **Vaccination status (Not Known)** | **Not Vaccinated** | **Unknown** | **Total** |
|---|---|---|---|---|---|---|
| Dog | Owned pet | 24 | 60 | 79 | 21 | 184 |
| Cat | Owned pet | 0 | 3 | - | - | 3 |
| * during analysis data was missing for 24 reported animal bite cases (classified as wild/stray and unknown in the OP register). | | | | | | |

### 3.3 Part of the body bitten and number

Majority (57.4%) of the bites were inflicted on the lower trunk (leg/thigh region) followed by bites on the body extremities i.e. hand/ arm. Bite injury to the upper trunk (back, stomach region and head) constituted 9.0% of the wounds

Table 3. Part of the body bitten and frequency

| Body part | Frequency(no) | Percentage (%) |
|---|---|---|
| Leg/Thigh | 121 | 57.4 |
| Buttocks | 17 | 8.0 |
| Hand/Arm | 54 | 25.6 |
| Stomach region | 4 | 1.9 |
| Back | 13 | 6.2 |
| Head/Face | 2 | 0.9 |
| Total | 211 | 100.0 |

(Analysis based on the OPD registers data).

### 3.4 Rabies post exposure prophylaxis

Of the 211 animal bite cases 19(9.0%) received all the prescribed 5 PEP doses administered on day 0(date of incidence), day3, 7, 14 1nd 28. Seventy-eight (36.9%) received only the first 3 doses, while 39(18.5%) did not get PEP on day 0 but received PEP on day 3and 7. Fourteen (6.6%) received only 1 dose on day zero only. The PEP vaccines were bought by the animal bite victims themselves.

Table 4. Number of PEP injections received

| No.of persons | Number of PEP injections received | | | | |
|---|---|---|---|---|---|
| | Day 0 | Day 3 | Day 7 | Day 14 | Day 28 |
| 19(9.0%) | ✓ | ✓ | ✓ | ✓ | ✓ |
| 78(36.9%) | ✓ | ✓ | ✓ | - | - |
| 39(18.5%) | - | ✓ | ✓ | ✓ | - |
| 14(6.6%) | - | ✓ | - | - | - |
| 44(20.9%) | ✓ | - | - | - | - |
| 17(8.1%) | - | - | - | - | - |
| 211(100%) | | | | | |

(Analysis based on the OPD registers data).

### 3.5 Epidemiological Curve of the animal bite injuries between September, 2018 and December 2019

The epidemiological curve shows that more than one case of animal bite injury occurred daily in Kisumu County from June to December, 2019 with the highest figure being 7. A total number of 163 cases of animal bite injuries were recorded between January and December, 2019.

Based on the population of the county, the overall incidence of animal bite injury of human in the County, (per 100,000 populations) was 28.7 cases per year. Fig 3 shows the Epidemiological Curve of the animal bite injuries between September, 2018 and December 2019.

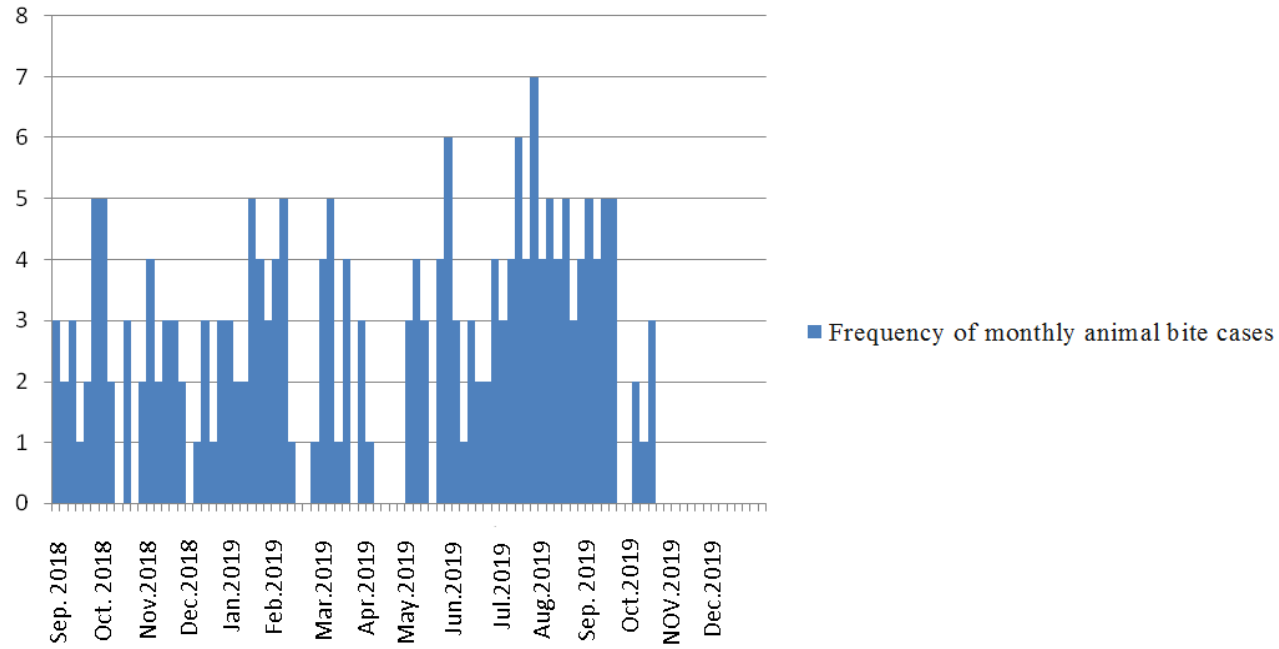


Fig.3. Epidemiological Curve of the animal bite injuries between September, 2018 and December 2019 in Kisumu County, Kenya. (Analysis based on the OPD registers data).

### 3.6 Spatial distribution of the animal bite injuries

Animal bite injuries were recorded in 19 sub locations in Kisumu County. Animal bite hot spots were evident in wards located in the southern and northern parts of Kisumu city. Clustering of animal bite hot spots were identified in 8 wards neighboring Kisumu City.Fig.3.

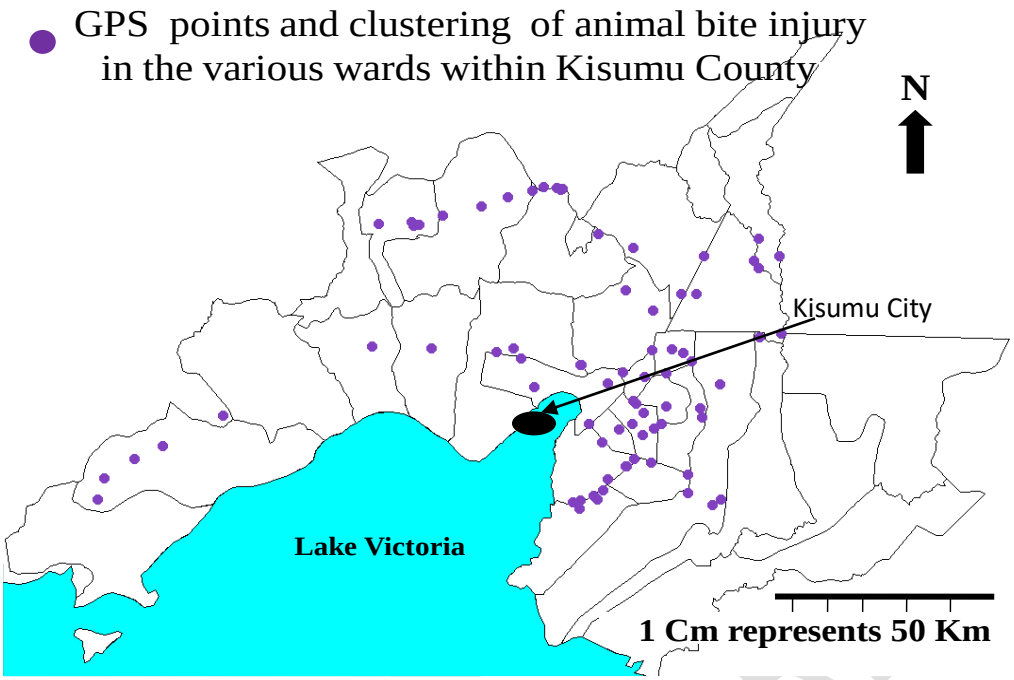


**Fig.4** Spatial distribution of animal bite injuries in Kisumu County, Kenya (Source author).



## 4.0 DISCUSSION

The use of outpatient records to conduct passive surveillance on animal bite injury and rabies epidemiology may indicate possibility of early detection of rabies outbreak in the local domestic dog population. Owned dogs were implicated in most animal-bite injuries. This is consistent with other studies that have implicated owned dogs in most of bite injury incidents [10, 11]. The sex and distribution of people with bites reported in this study is similar to that reported elsewhere. In most cases, the young people (mostly children) are at higher risk. Males were also at higher risk possibly because of their social behaviour such as aggressiveness. This is consistent with results reported from other studies conducted elsewhere [8]. The epidemiological curve shows that there was probably a canine rabies outbreak in Kisumu County between September, 2018 and December, 2019 which passed unreported by the public health and veterinary authorities in Kisumu County. However, the percentage of animal bites which could be rabid was not ascertained. A more comprehensive surveillance system is necessary to collect accurate data to better assess the burden of animal bite injury of human and to assist in targeting community public health outreach and education to address the problem.

## 5.0 CONCLUSION

There is need to strengthen animal bite injury and rabies prevention and control strategies in Kisumu county. Interventions, such responsible dog ownership education, vaccination of pets against rabies, appropriate use of PEP, and reduction of feral cat and dog populations, should be

instituted, or better enforced in Kisumu County. The prevention strategies should be built on the "One Health" approach with special focus on strengthening the rabies surveillance system in both human and animal population to be able to collect more reliable data. The current study reveals the need to have rabies PEP at all lower health facilities in the County. Animal bite of human data captured in the health facilities provides an easy-to-use and comprehensive epidemiological tool to monitor potential rabies outbreak. Clustering of animal bite injury spots also offer a logical framework for timely response, and possibility of achieving more effective and efficient control and prevention of the injuries and canine mediated rabies.

**List of Abbreviations**

CHVs - Community health volunteers

OPD - Outpatient department

PEP - Post exposure prophylaxis

## Availability of data and materials

All analysed data in this article are available in the health centres in Kisumu East Sub County, Kenya and can be accessed with the permission.

## Ethics approval and consent to participate

No ethical approval by an institutional ethics review board was needed. No personal identifying information was collected during data review.GPS locations were provided by the local community health volunteers. The animal OP register is available for public health surveillance purposes. Permission to use the register was granted by the Sub County Public Health Officer.

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