

**Vertebrate Animal Bite/ Scratch Injuries and Management among Patients
Reporting at Kakamega Provincial General Hospital,**

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Applied Epidemiology in the Jomo Kenyatta University of Agriculture and
Technology**

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

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DEDICATION

This thesis is dedicated to my late mother, Mary Okito who was my source of inspiration, my grandmother, Mwanamina Nelima whose immense support has brought me this far, my husband John Uhuru and children Ngaira, Muhanji, Makau and Shikuku.

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LIST OF ABBREVIATIONS AND ACRONYMS

AIDS	Acquired Immunodeficiency Syndrome
CDC	Centers for Disease Control and Prevention
ECG	Electrocardiogram
E.G.	For Instance
ERIG	Equine Rabies Immuno Globulins
FAT	Fluorescent Antibody Test
FELTP	Field Epidemiology and Laboratory Training Program
GBD	Global Burden of Disease
GIS	Geographical Information System
GPS	Global Positioning System
HIV	Human Immunodeficiency Virus
HMIS	Health Management Information System
JKUAT	Jomo Kenyatta University of Agriculture and Technology
MOMS	Ministry of Medical Services

MOPHS	Ministry of Public Health and Sanitation
OR	Odds Ratio
PEP	Post Exposure Prophylaxis
PET	Post Exposure Treatment
PGH	Provincial General Hospital
U.S.A	United States of America
WHO	World Health Organization

ABSTRACT

Animal and human bites are an important cause of morbidity, mortality and loss in person years. However, the public health importance of animal bites is under-estimated especially in developing countries where the true magnitude is unknown.

A cross-sectional study of vertebrate animal bites/scratch injuries and management of patients reporting at Kakamega Provincial General Hospital (PGH) in Western province of Kenya was carried out between 1st August to 31st October 2009. Data was collected using a semi-structured questionnaire and management practices observed. Locations of incidents were recorded using a hand-held Global Positioning System (GPS). In addition, hospital records on animal bites between 2006 and 2008 were analyzed to compare trends. *Epi-info 3.5.1* and Geographical Information System (GIS) mapping were used in data analysis.

During the study period, 207 bite patients were interviewed. Dog bites were constituted (71.5%), followed by bites from humans (16.8%), snakes (6.8%) and cats (3.4%). Dog bites were higher in children aged < 10 years (27.1%). Dogs of known ownership inflicted (91.9%) bites. Women aged 21-25 years were at increased risk of human bites. Anti-rabies vaccine was prescribed in 96.6% of the patients bitten by cats and dogs. Inadequate anti-rabies vaccine doses ranging between 1-3 was prescribed in 62.6% of the patients. Completion of prescribed anti-rabies vaccination course was significantly associated with age group 5-12, Kenya Expanded Program for Immunization (KEPI) as

source of vaccine and being bitten on the upper extremities (p -value < 0.05). There were seasonal variations of animal bite injuries with peaks coinciding with breeding seasons of dogs. The bites clustered around Kakamega municipality declining away from the urban center.

Animal bites, especially dog bites are common in Kakamega and often affect children. Post-exposure treatment is inadequate and not in line with the national guidelines.

There is need to educate the community on dog ownership, safety around animals and management of bites. The Ministry of health should develop and disseminate management guidelines to health facilities at all levels. Use of spatial models to generate risk maps may be useful in control strategies.

CHAPTER ONE

1.0 INTRODUCTION

1.1: Background Information

Animal bites are a significant public health problem that is under-emphasized. An estimated 2% of the world population is bitten each year (Dendle *and Looke*, 2008). Studies in Australia indicate that about 100,000 Australians are injured every year as a result of dog attack and only about 13,000 seek hospital treatment. The majority of animal bites are caused by dogs (85-90%), cats (5-10%), humans (2-3%), rodents (2-3%) (Mc Bean *et al.*, 2004). In 1994, the most recent year for which published data were available an estimated 4.7 million dog bites occurred in United States of America (Steele *et al.*, 2007). It is estimated that a dog bites almost half of all the children during their childhood (Beck *and Barbara*, 1985).

1.2 Statement of the Problem

Vertebrate animal bites are a significant public health problem. In 2001, in the United States of America, an estimated 368,245 persons were treated in the Emergency Departments for non-fatal dog bite related injuries and injury rates were highest among children aged 5-9 years (Morbidity Mortality Weekly Report, 2003). The incidence of animal bites in India is about 17.4 per 1000 people and a person is bitten every two

seconds and someone dies from rabies every 30 minutes. The annual number of person days lost due to animal bites in India is 38 million and the cost of post bite treatment is about \$25 million (Menezes, 2008). The magnitude of animal bites is unknown in Kenya and since the allocation of resources to combat a health problem is based on the burden imposed by different conditions, this has resulted in under funding for their control.

1.3 Justification

Animal bites are a significant public health problem that is under-emphasized due to inadequate and unreliable data. Bites no matter how minor are a potential source of zoonotic infections particularly rabies and a source of entry of pyogenic organisms including *Clostridium tetani* that causes tetanus. Animal bite and scratch injuries result in morbidity, mortality and loss in person years. It is therefore necessary for the epidemiology and characteristics of animal bites to be well understood for effective prevention and control. In Tanzania and Uganda studies on the epidemiology of animal bites have been done and used to project the rabies burden in human using probability models (Cleaveland *et al.*, 2002) and Fevre *et al.*, 2005) respectively. There is no published data on animal bites in Kenya. This data is useful in assessing the impact of animal bites and scratches and the current control measures, which include vaccination of domestic animals against rabies, baiting of stray dogs.

1.4 Research Questions

- What are the characteristics and distribution of vertebrate animal bite injuries in patients reporting to Kakamega Provincial General Hospital?
- What are the factors associated with anti-rabies vaccine completion in patients reporting to Kakamega Provincial General Hospital?

1.5 Null Hypothesis

There are no specific factors associated with anti-rabies vaccine completion in patients with vertebrate animal bite injuries reporting to Kakamega Provincial General Hospital.

1.6 OBJECTIVES

1.6.1 General Objective

Determine the epidemiology and management of animal bite and scratch injuries among patients reporting at Kakamega Provincial General Hospital.

1.6.2 Specific objectives

1. To determine the socio-demographic characteristics of patients reporting to Kakamega Provincial General Hospital with vertebrate animal bite injuries
2. To determine the characteristics of the bites and the animals involved.
3. To determine the primary care bite management practices at home and hospital and the factors associated with completion of anti-rabies vaccination course in patients bitten by rabies suspect animals.
4. To determine the spatial distribution of vertebrate animal bite and scratch incidents in patients attending Kakamega Provincial General Hospital.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Sources of Animal Bites in People

Animal bites result from imperfect relationship between humans and the animals. These can result in physical and psychological trauma, wound infections, septicemia, rabies and death (Sinclair and Zhou, 1995).

2.1.1 Companion Animals

Companion animals (dogs and cats) inflict majority of animal bites. Dog bites are more common than cat bites but about 20-80% of the cat bites become infected compared to only about 3-18% of dog bites that get infected. Dogs have strong jaws and large dogs can exert more than 450 pounds of pressure per square inch. Since the teeth are not sharp, the wounds caused are usually crushing of the tissues, lacerations or tearing of the skin rather than puncture wounds. Most dog bites do not penetrate deeply enough to get bacteria into bones, tendons or joints but they often cause a lot of damage due to trauma (Hutson *et al.*, 1997).

Cat teeth are thin and sharp so that the wounds they cause are more likely to be puncture wounds. These wounds can reach into the joints and bones and introduce bacteria into the tissue. Puncture wounds are often difficult to clean so a lot of bacteria may be left in

the wound. Most cat bites are inflicted to the hand (Westling *et al.*, 2006). Cats are more likely than dogs to be exposed to rabid bats yet less likely to be vaccinated against rabies, increasing the risk of rabies among cat bite victims (Gail and O'Rourke, 1998). Cats carry microorganisms such as Bartonella, Tularaemia and *Pasteurella multocida* and also cause diseases like cat scratch fever (Dieter *et al.*, 2006)

2.1.2 Humans-inflicted Bites

Human bites usually occur because of 3 types of trauma: self inflicted such as nail biting and thumb sucking, bite wounds from fighting (clenched fist injury which occurs when an individual strikes on the mouth) or love making-“love bites”. “Love bites may affect breasts, lips, genitals and neck (Dieter *et al.*, 2006). Around 30% of clenched fist injuries lead to deep lacerations and infection in tendons, bone or other tissue away from the puncture site, which is particularly likely if there is a delay of more than 24 hours before the person seeks medical attention (Rest and Goldstein, 1985). Human bites have a higher complication and infection rate. Bacteria that often contaminate human bites include *Staphylococcus aureus*, *Streptococcus* species, *Haemophilus* species, *Fusobacterium* species and other anaerobic bacteria. Transmission of viruses (e.g. hepatitis B, hepatitis C, HIV) following human bites is less common (Morgan, 2003). Antiviral drugs should be offered to anyone who sustains a bite that breaks the skin from a person known to be HIV positive with a high viral load. Such prophylaxis should be given as soon as possible ideally within an hour (Merchant *et al.*, 2003). There is

no post exposure prophylaxis to hepatitis C which appears to be transmitted more easily than HIV. However, a patient exposed to hepatitis C will need sequential tests for sero-conversion and appropriate referral

2.1.3 Rodent-inflicted Bites

Rats cause majority of rodent bites. Others include chipmunks, gerbils, guinea pigs, hamsters, mice, prairies, rabbits and squirrels.

These may result in rat bite fever caused by *Streptobacillus moviliformis* characterized by fever, rash and arthritis. Diagnosis of rat fever is difficult and can be confused with rheumatoid arthritis. Penicillin and Doxycycline are the drugs of choice (Fordham *et al.*, 1992).

2.1.4 Reptile-inflicted Bites

Snake bites cause considerable morbidity and mortality. It is estimated that 5 million snakebites occur worldwide causing 100,000 deaths with South Asia bearing the highest burden (Chandio *et al.*, 2000). In Africa, the annual incidence of snakebites is 50-100 bites per 100,000 in the dry savanna and sahara (Pandey, 2007). Populations in these regions have poor access to health services with scarcity of antivenin which is the only specific treatment. A large number of victims survive with permanent physical impairment due to local tissue necrosis (Kasturiratna *et al.*, 2008). Because most

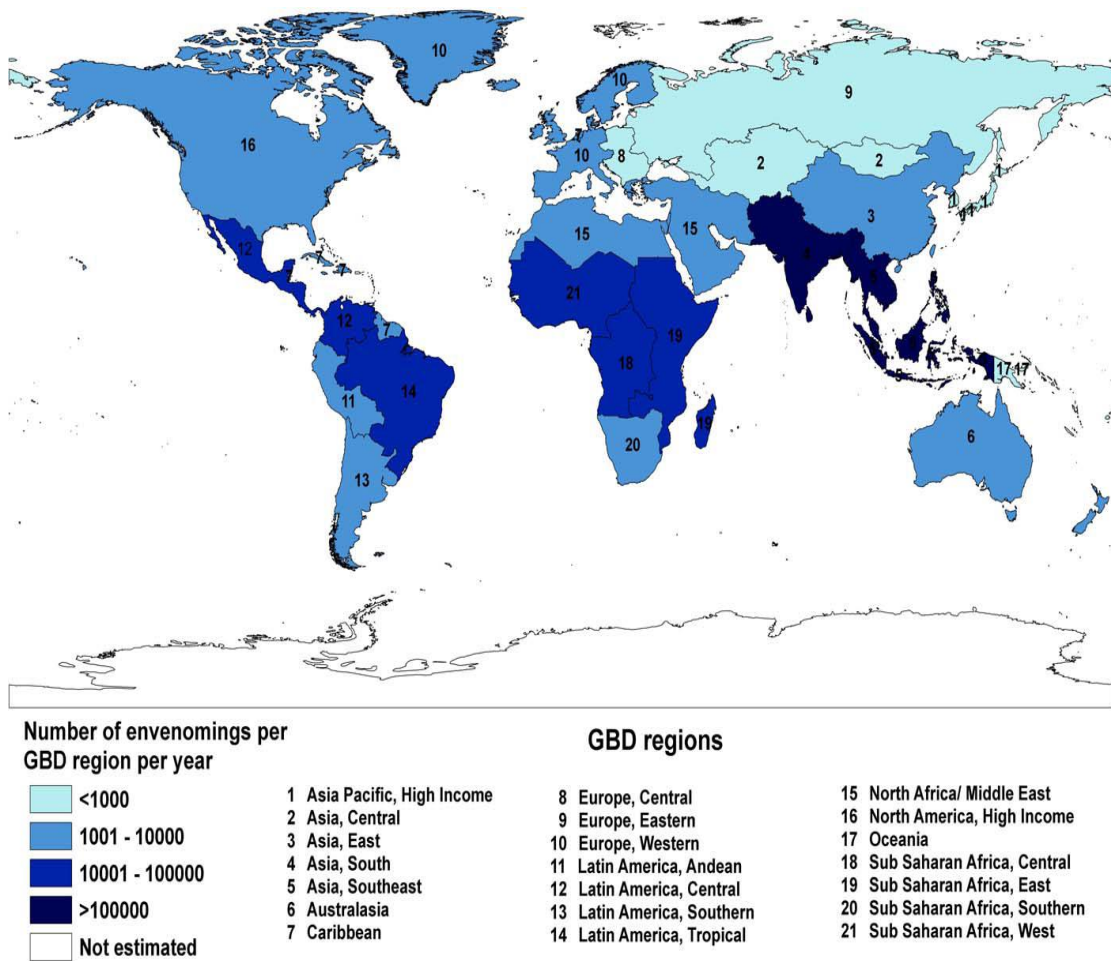
snakebite victims are young, the economic impact of their disability is considerable (Hansdak *et al.*, 1998).

Snakebites are classified into various categories (WHO, 2008), these include: (i) Cytotoxic bites- characterized by painful and progressive swelling with watery blood leaking from the bite wound, shock, blistering and discoloration. Species involved include puff adder, Gaboon adder and spitting cobras. (ii) Neurotoxic bites- characterized by moderate swelling, cold and clammy feet, dilated pupils, drooping eyelids and aching joints. Species involved include black and green mambas and non-spitting cobras.

(iii) Haematotoxic bites - characterized by bloody gums, nose, and corner of eyes. Species that inflict these bites include Boomslang and Vine snake.

Most severe cases of snakebite envenoming are inflicted by species of the family *Elapidae* (cobras, kralts, mambas) and the family *Viperidae* e.g. rattle snakes and lance headed pit vipers.

Other reptiles commonly involved in bites include crocodiles and lizards. Crocodile attacks are usually fatal but if the victim survives, the injuries are likely to be infected. The flora of the crocodile mouth may consist of the flora of the feces of the previous prey. Lizard bites can also transmit *Salmonella* species (Wells *et al.*, 2004).



GBD – Global Burden of Disease

Fig 2.1: Global Burden of Snake Bites (Kasturiratna *et al.*, 2008)

2.1.5 Non-human Primate-inflicted Bites

Primate bites due to monkeys can cause severe penetrating injuries to researchers and animal care staff. These can result in serious bacterial and viral infections including rabies and post exposure treatment for rabies should always be administered (Janda *et*

al., 1990). Macaque monkeys are infected with Herpes B Virus. This can be transmitted by a bite or scratch and although asymptomatic in monkeys, it causes fatal human encephalitis (Engel *et al.*, 2001).

2.1.6 Bat-inflicted Bites

Bats are a high-risk species for rabies transmission and all persons require post exposure rabies immunization after their bites.. In recent years most cases of human rabies in the United States of America are due to bat bites causing 1-2 deaths annually (Willoughby and Hammarin, 2005). In Kenya, bat rabies due to Duvenhage virus was reported in a visiting Dutch woman (Van Thiel *et al.*, 2009). Bat bites are a special problem because the tiny teeth marks are difficult to see and the bite may not be noticed (Jackson and Fenton, 2001).

2.1.7 Farm Animal-inflicted Bites

Horses, cows, camels, sheep, donkeys and goats rarely bite. Most injuries are sustained from kicking although camels can cause severe injuries with their large incisors and there are cases of camels biting their handlers to death. Pig bites are uncommon and can be severe and have a high risk of infection from multiple infections (Escande *et al.*, 1996).

2.2 Sites of Animal Bites in People

Extremities are the most common anatomical sites involved except in children where the head, ears and lips are involved. Men and boys are bitten more often than women and girls as the former are likely to own pets and come in close contact with unleashed free roaming dogs. Bites to the hand are potentially dangerous because of the structure of the hand. There are many bones, tendons and joints in the hand and there is less blood circulation in these areas. This makes it hard for the body to fight infection in the hand. Infections that develop in the hand may lead to severe complications e.g. osteomyelitis or septic arthritis (Rest and Goldstein, 1985). In small children, bites to the face, neck or head are hazardous. Their small stature often puts their heads near the animals' mouth. The bites can cause fractures of the face and skull leading to brain and nervous system infections (Talan *et al.*, 1999). There is evidence that about 50% of children who have experienced minor dog attacks suffer from traumatic stress disorder. The injuries sustained from an animal bite or scratch are dependent upon the characteristics of the biting animal, the method and ferocity of the attack, the animal's dentition and the anatomical location of the bite. Injuries can range from minor abrasions to amputation of limbs and death. Death usually occurs to children who sustain trauma to the head or neck (Brogan *et al.*, 1995). An attack by an animal is terrifying and fear of another is a common consequence.

2.3 Infections Associated with Vertebrate Animal Bites

2.3.1 Rabies

Rabies is an acute fatal encephalitis transmitted from animals to man through exposure to saliva from infected animals (from bites, scratches or licks on broken skin and mucus membrane) (Rezaeinasab *et al.*, 2007)

Animal bites to humans are reportable to the health authority in order to assess the risk of transmission of rabies virus from animals to humans and determine need for rabies post exposure prophylaxis (PEP). Rabies is a nearly 100% fatal viral encephalomyelitis of warm-blooded animals once clinical signs develop and can be efficiently averted by preventive immunization, avoiding contact with animals and post exposure prophylaxis (Altman *et al.*, 2009). The diagnosis of rabies is challenging because of the long incubation period (20-60 days on average with rare reports of 5-6 days and up to 7 years) and the lack of specificity of early prodromal symptoms and neurological symptoms, including paresthesias, pruritis and pain at the site of viral entry (Blanton *et al.*, 2007). Rapid diagnostic tests are not available. Once clinical signs of rabies appear, the disease is usually fatal. Non-lethal exceptions are extremely rare. The modern cell culture vaccines used in combination with rabies immunoglobulin are virtually 100% effective in preventing human deaths if administered promptly to rabies exposed patients following appropriate wound management (Hampson *et al.*, 2007). The most important element in PEP is wound care. Thorough washing of the wound with 20% soap solution

and irrigation with a virucidal agent such as Povidone iodine are recommended and may reduce subsequent disease by as much as 90% (Nicolle, 2002).

Mass vaccination of domestic dogs has successfully eliminated or controlled domestic rabies in many parts of the world. Despite this, an estimated 55,000 human deaths from rabies occur annually of which over 99% are in developing countries where the disease is endemic in domestic animal population (Hampson *et al.*, 2008).

The important advance of the past 30 years is the development of safer vaccines. With the risk of post vaccination encephalomyelitis no longer of concern, more liberal use of PEP is possible. Post exposure prophylaxis should be given regardless of how much time has elapsed since exposure (Nicolle, 2002).

2.3.2 Pasteurellosis

Pasteurella multocida is a non-motile gram negative coccobacillus. The organism may be responsible for up to 50 and 90% of infections resulting from dog bite and cat bite wounds, respectively (Guertler, 1988) and is the most common isolate from victims hospitalized with infected bites (Feder *et al.*, 1987). Complications of bite wounds infected with *P. multocida* include; tendosynovitis, septic arthritis, osteomyelitis, abscesses and fatal sepsis (Weber *et al.*, 1984).

2.3.4 Capnocytophaga Infection

This is a rare but dangerous infection caused by a bacterium called *Capnocytophaga Canimorsus*. Most people who have developed this infection were bitten by dogs. In many instances the bites are tiny and would not have warranted any special medical care. The bacterium can cause septicemia particularly in people whose immune systems are compromised. Approximately 30% of people who develop this septicemia die. People who have had their spleens removed are at a higher risk of developing this infection. Early symptoms include nausea, headache, muscle aches and reddened patches on the skin.

2.3.5 Other common bacterial Infections

These include: Staphylococcus- *S. aureus*, *S. epidermidis*, *S. saprophyticus*, *Streptococcus* species, *Neisseria* species, *Moraxella* species, *Escherichia coli*, *Enterobacter aerogenes*, *Pseudomonas fluorescens*, *Acinetobacter cloaca-ceticus*, *Corynebacterium* species, *Actinomyces* species, *Bacillus* species, *Mycoplasma* species (Rest and Goldstein, 1985). People at increased risk of infection after bites include those over 50 years of age, with diabetes, circulatory problems, liver disease, alcoholism, Human Immunodeficiency Virus/Acquired Immuno-Deficiency Syndrome (HIV/AIDS), those who have had a mastectomy or organ transplant, on chemotherapy or long term steroids and those who have had a splenectomy (August , 1988).

2.4 Risk Factors for Animal Bites

The risk factors depend on the agent, host and environmental model. Several factors influence the dog's propensity to bite and these include heredity, sex, socialization and training, health, reproductive status and quality of ownership. Male dogs are more likely to bite and so are sexually intact dogs (Gersham *et al.*, 1982).

Children are more likely to be bitten with boys experiencing more bites. Due to their curious nature they are more likely to provoke dogs. Environmental factors include season with more bites occurring during warm weather (Sinclair and Zhou, 1995).

Human bites are more common in children and adolescent males due their aggressive nature. High risk environmental factors reported include; institutionalized patients (psychiatric history and poor impulse control), occupational risk (law enforcement staff), and late night alcohol drinking (Henry *et al.*, 2007)

2.5 Management of Animal Bites

Serious infection can result from animal bite wounds from organisms in the oral cavity of the biting animal and the patient's skin (Brook, 2005). Antibiotics are indicated in patients with bites on the hands, human or cat bites and when injury is severe, bone or joint penetration is possible, involvement of genitalia or face injury that has been closed. Antibiotic therapy is also recommended in people with increased risk of infection. These include people over 50 years of age, with diabetes, circulatory problems, liver

disease, alcoholism, Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome, those who have had a mastectomy or organ transplant, on chemotherapy or long term steroids and those who have had a splenectomy (Morgan and Palmer, 2007). Since no antimicrobial agent eradicates all pathogens in bite wound infections, microbial cultures are required to guide definitive therapy (Brook, 2003).

A risk assessment should be made in human bites and where appropriate hepatitis B vaccine and or specific hepatitis B immunoglobulin and or HIV post exposure should be offered. HIV post exposure prophylaxis should be offered to anyone who sustains a bite that breaks the skin from a person known to be HIV-positive with a high viral load ideally within one hour (Merchant *et al.*, 2003).

2.5.1 Management of Snake Bites

The Ministry of Health Kenya by the end of this study (2009) had no guidelines on snakebite management and treatment is varied depending on the clinician's discretion. According to the WHO guidelines for snakebites in South East Asia, management is composed of first aid and clinical management. First aid involves patient reassurance, limb immobilization with makeshift splints or slings and quick transport to a medical center. Clinical management involves rapid clinical assessment, resuscitation, anti-venom treatment if indicated, supportive treatment and treatment of the bitten part. Elevation of the affected limb, intravenous fluids and analgesics during and after administration of anti-venom forms the basis of snakebite management (WHO, 2005).

2.5.2 Use of Rabies Vaccine in Animal Bite Victims

According to the provisional guidelines of February 2009 by the Ministry of Public Health and Sanitation Kenya, pre- exposure rabies immunization is indicated in subjects at risk of contamination. These include veterinary surgeons, students and technical personnel working with them, laboratory personnel handling contaminated material, farmers and gamekeepers (Ministry of Health Kenya preliminary dog bite management guidelines, 2009)

Post Exposure comprises of first aid, passive immunization and active immunization. First aid involves washing with running water and mild soap and application of a suitable disinfectant for example 70% alcohol, tincture of iodine or Povidone iodine.

Passive immunization is administration of anti-rabies immune globulin (RIG) in case of a severe bite especially if the bite is near the brain (i.e. on the head, neck, face etc).

Active immunization is the administration of an anti-rabies vaccine as recommended by WHO guidelines. There are two types of intramuscular schedules.

Essen Schedule (Standard 5 dose classical intramuscular regimen) refers to one dose is administration on days 0, 3, 7, 14 and 28.

Zagreb schedule (reduced multisite 2-1-1 schedule refers to two doses given given on day 0 on the left arm and right arm, one dose on day 7 and another one on day 21. The

Ministry of Public Health and Sanitation Kenya approves both the classical Essen and the Zagreb 2:1:1 schedule in categories II and III exposures. However, due to the

opportunity to save on vaccine and cost of administration, the 2:1:1 schedule is preferred.

Table 2.1: World Health Organization Guide for Post-exposure treatment of Animal Bite Injuries

Category of severity	Type of contact	Recommended treatment
I	Touching or feeding of suspect animals, Licks on intact skin	No exposure, therefore no treatment, if reliable case history is obtained
II	Nibbling of uncovered skin, minor scratches or abrasions without bleeding. Licks on broken skin	Administer vaccine alone immediately*
III	Single or multiple transdermal bites or scratches. Contamination of mucous membranes with saliva licks	Administer rabies immunoglobulins and vaccine immediately*

* Stop treatment if dogs or cats remain healthy throughout an observation period of 10 days or if the animal is euthanized and found to be negative for rabies by appropriate laboratory techniques.

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Study Design

This was a cross-sectional study involving vertebrate animal bite or scratch patients reporting at Kakamega PGH.

3.2 Study Site

The study was carried out at the Kakamega PGH (Eastings 565687.41, Northings 2042676.45) in Kakamega district. The district is partly covered by Kakamega forests which is made up of several forests : Bunyala (825 ha), Kakamega (2400 ha), Malava (719 ha), Kisere (484 ha) and Kaimosi (720 ha) (Tsingalia and Kassily, 2009).

There are seven dog markets in the district namely Nambacha , Lubao , Shikulu , Kakunga, Butali , Shinyalu and Matete. These markets are active throughout the year selling about 200 dogs per week with Lubao selling the highest number of about 80 per week. Each market has one market day in a week. Dogs are sold in an open area set aside for this purpose. Kakamega Central is predominantly agricultural with most farmers practicing peasant farming. The total arable land is about 380km². Land under sugar cane is about 110 km² (Source: Mumias Sugar Company Operational Report, 2008). Cultivated land under food crops is about 150 km² (Kakamega Central Annual Agricultural Report, 2008). Main food crop is maize which is planted between March

and April and harvested between August and September. Sugarcane farming, dog markets together with existence of large forest area has brought humans, domestic and wild animals into close proximity hence increasing animal bite incidences in humans and domestic animals in the region.

The hospital is a level 5 referral facility according to Kenya's Ministry of Medical Services (MOMS). The total catchment population for the hospital is 74,159 from Kakamega Central (**Hospital Profile Report**, 2009). The facility serves as a referral hospital for all twenty-eight districts of western province with a population of 4,050,000 people (Central Bureau of Statistics, 1999). It also serves populations from neighboring provinces such as Nyanza, Rift Valley and Eastern parts of Uganda (Busia Uganda, Tororo, and Malaba). The facility also serves as a district hospital for Kakamega Central.

3.3 Study Population

All patients presenting at Kakamega provincial general hospital with vertebrate animal bite and scratch injuries between 1st August and 31st October 2009.

3.3.1 Inclusion Criteria

All consenting patients with vertebrate animal bite or scratch injuries presenting to the

Kakamega provincial general hospital between 1st August and 31st October 2009 were included in the study.

3.3.2 Exclusion Criteria

- Vertebrate bite or scratch patients not consenting to participate in the study.
- Patients bitten by invertebrate animals.

3.4 Sampling Method

All vertebrate bite or scratch patients presenting at Kakamega provincial hospital were recruited into the study until the minimum sample size was realized.

3.5 Sample Size Calculation

Cochran formula was used (Cochran, 1963)

$$n = z^2 \times p \times (1-p) / d^2$$

n = sample size

Assumptions considered:

z = Value of the standard distribution corresponding to a significance level of alpha (1.96 for a 2 sided test at the 0.05 level).

p = prevalence of animal bite injuries (0.5%)

d = absolute desired precision 7% = 0.07

$$207 = 1.96 \times 1.96 \times 0.5 \times 0.5 / 0.07^2$$

3.6 Study Period

Period for the study was three months (1st August 2009-31st October 2009)

3.6 Data Collection and Management

3.6.1 Data Collection

Data was collected using a semi-structured questionnaire (Appendix I) which had been pretested at Malava district hospital. For patients unable to respond to the questionnaire, responses were obtained from the care givers accompanying them. Variables collected included socio-demographic characteristics of the patient, place where bite occurred, anatomical site bitten, species and nature of biting animal, all aspects of wound management, circumstances under bite and post exposure treatment obtained. Management of the bite injuries of each patient was observed from the clinician's consultation room and recorded.

The sites of the bite incidents were traced with aid from the patients and the geographic

locations recorded using a hand-held GPS (Garmin International, Olathe, Ks, USA). The forests, roads and hospital were also geo-referenced with the device. Retrospective data of animal bites recorded by the hospital for the past three years was reviewed to compare the trends and determine whether there were significant differences in the number of cases over the years.

3.6.2 Data Management

Data was coded during collection and Epi Info version 3.4.3. Statistical software (free software provided by WHO/CDC for developing countries) was used for data entry and analysis. Double data entry was done during the study period to minimize errors by identifying inconsistently entered data file and cleaned prior analysis. To ensure confidentiality, the computer access was restricted by password protection.

3.7 Data Analysis

Epi-info 3.5.1 computer software was used in the data analysis. Univariate analysis was done to describe the frequencies of various variables: Age, gender, location of bite, circumstances of bite, time of delay to presentation to the hospital. Measures of central location: Mean, mode and median were determined.

Dummy tables were used to direct the subsequent bivariate analysis. A subset of the

entire data was used for bivariate analysis. This subset data encompassed study subjects suffering from dog or cat bites which are the main rabies reservoirs (n = 155) close to humans. During bivariate analysis for factors associated with completion of rabies vaccine, the measure of association was Odds Ratio (OR). The cross multiplication method was used to calculate the OR using a “2 by 2” table for separate exposure groups. An odds ratio (OR) of < “1” was taken to be protective while an odds ratio of > “1” was taken as a risk factor. An odds ratio of “1” indicated that there was no difference between the study group with the outcome variable under study and that without the outcome variable of interest along various exposure factors.

A 2-tailed Chi square test with Yates correction or, when appropriate, by Fisher’s exact test was used for categorical variables (nominal data) at 95% CI and alpha level of significance set at 0.05. A p -value ≤ 0.05 was considered statistically significant. Confidence interval (CI) was used to assess the variability of the odds ratio. A confidence interval which included 1 was interpreted to be not significant.

Factors that were significant during bivariate analysis ($P \leq 0.05$) were taken to the unconditional logistic regression where a backward stepwise elimination method was used to obtain the final model. During the backward stepwise methods all the significant factors were entered in the model and the regression run. The factor with the highest P-Value was removed before the model was run again. This was repeated until only factors that were significant at ($P \leq 0.05$) were retained in the model which was the final “best”

model.

Data from the Global Positioning System was entered into a relational data base (Excel, Ms Corporation, Inc, USA, 2007). The data was georectified and imported into a Geographical Information System (GIS) (Arc View Version 9.2, ESRI,Inc.New York, NY) and converted to shapefiles as points. These were added to existing shapefile polygons for respective administrative boundaries and stratified by species. Descriptive maps were created to illustrate the spatial distribution of the bites.

3.8 Ethical Considerations

A written informed consent was sought from the patients and confidentiality maintained during data collection, management and dissemination. Special assent was obtained from parents of children below the age of 18 years. Study approval was sought from Jomo Kenyatta University of Agriculture and Technology, National Council for Science and Technology and Ministry of Public Health and Sanitation.

3.9 Limitations of the Study

Only injuries reported to Kakamega provincial hospital were included. Injuries treated in other health facilities and those injuries where no formal care was obtained, were not included. However, the bite characteristics are not expected to be very different. Lack of

a reliable relational database in public hospitals contributes to skewed or subjective analysis. Further epidemiological studies using more intensive methods or more detailed inquiries into records of patients bitten by animals may be requested through co-operation of hospital administrators.

Lack of updated national census data leads to inaccurate denominator population hence influencing the overall outcome of disease estimates.

Accessibility to health facilities, nearness to major roads, physical barriers (forests), cultural practices and level of education are major confounders to the prevalence of bites in this study.

CHAPTER FOUR

4.0 RESULTS

4.1 Socio-Demographic Characteristics of Animal Bite Patients

A total of 207 patients reported to the hospital with animal bite wounds during the study period were interviewed. Males were 106/207 (51.2%).

4.1.1 Sex and Age

During the study period 86/207 (58.1%) of patients bitten by dogs were males while 21/34 (61.8%)of human bite patients were females. All cat bite patients were females.

The age range for patients with vertebrate animal bite and scratch injuries presenting at Kakamega PGH during the study period was 2-70 years with 9 and 35.5 years as the mode and median age respectively. Dog bites were highest in children below 10 years 50/148 (33.8%) with more males 32/50 (64.0%) being bitten in this age group than females. Human and snake bites were mainly inflicted in individuals aged between 21-25 years as shown in Figure 4.1 below.

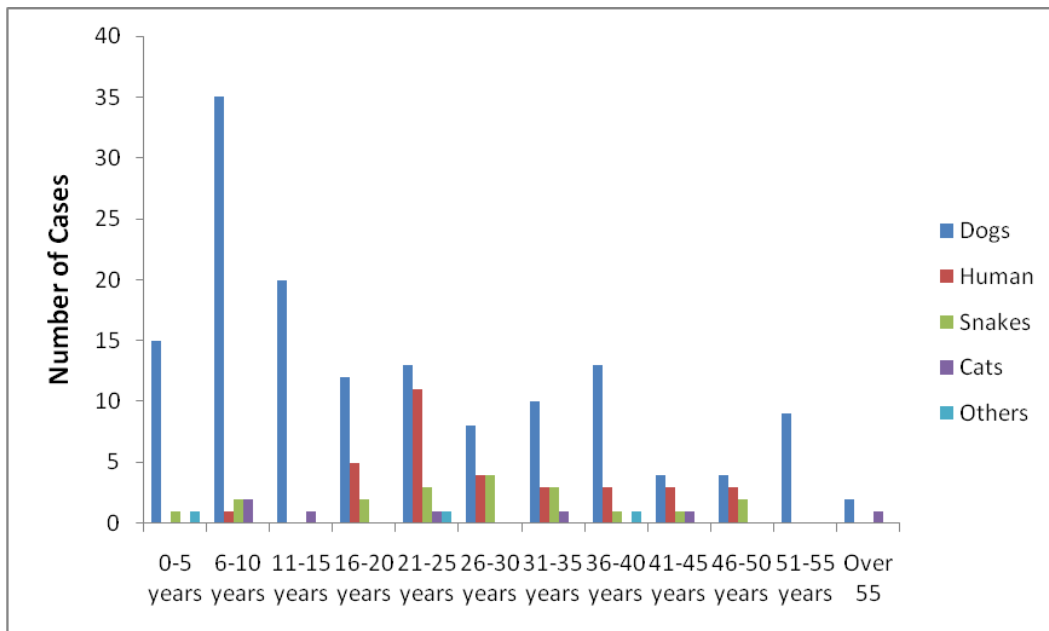


Figure 4.1: Age of animal bite patients reporting to Kakamega Provincial General Hospital stratified by animal type

4.1.2 Education Level of Patients with Vertebrate Animal bite Injuries Reporting to Kakamega Provincial General Hospital

Most patients (62.3%) had attained primary level education followed by secondary level (15.9%) (Table 4.1)

Table 4.1: Highest Education Level Attained by Patients with Animal Bite Injuries Reporting to Kakamega Provincial General Hospital

Education Level	Frequency	Percent	95% CI
No formal education	13	6.3	3.4%-10.5%
Pre primary	16	7.8	4.5-12.2%
Middle level college	14	6.8	3.7%-11.1%
Primary	129	62.3	55.3%-68.9%
Secondary	33	15.9	11.2%-21.7%
University	2	*1.0	
Total	207	100.0	

*95% Confidence Intervals are not reported when at least one of the categories contains fewer than 5 patients because their validity is questionable or they are undefined when there are no patients in a category

4.1.3 Occupation of Bite Patients

A majority of the bites were inflicted on students 82/207 (39.6%) followed by unemployed 47/207 (22.7), self-employed 42/207 (20.3%), casual laborers 14/207 (6.8%) and formally employed 13/207(6.3%). Others were children up to 3 years 9/207 (4.3%). Self-employment included operating small business, subsistence farming, skilled labor (carpenter, tailor), and “boda-boda”(cyclists ferrying passengers over short distances).

4.2 Types and Characteristics of the Biting Animal

Dogs were the most commonly involved in the bites; 148/207 (71.5% 95% CI 64.8-77.5%) followed by humans; 34/207 (16.4% 95% CI 11.7-22.2%) snakes 14/207 (6.8 % 95% CI 3.7-11.1%), cats were 7/207 (3.4% 95% CI 1.4-6.8%), rodent 1/207 (0.5%) and others (chameleon, lizard and turkey) 3/207 (4.0%)

Dogs and cats of known ownership more often inflicted the bites (79.4%). These either belonged to the family or a neighbor. Regarding the status of the dogs and cats involved in the bites, 138/155 (89%) was alive and normal at the time patient reported at the hospital, 11/155 (8%) unknown and 6/155 (3%) dead.

4.3 Characteristics of the Bite

4.3.1 Anatomical Site and Time of Bite

Most dog bites were inflicted on the lower extremities (thigh, leg, foot or kneecap) 124/148 (83.8%) followed by the upper extremities (shoulder, arm, forearm or wrist) 15/148 (10.1%), thorax 7/148 (4.7%), and head/neck 2/148 (1.4%).

Human bites were mainly inflicted on the upper extremities; 20/34 (58.8%) followed by head/neck 12/34 (35.2%), thorax 1/34 (2.9%) and 1/34 (2.9%) on the lower extremities.

Snakebites commonly involved the lower extremities 11/14 (78.6%) and 3/14 (21.4%)

were on the upper extremities. All the cat bites occurred on the extremities with 3/7 (42.9%) affecting the upper extremities and 4/7 (57.1%) the lower extremities.

The rodent and chameleon bites were inflicted on the upper extremities while the lizard and turkey bites were on the head/neck.

4.3.2 Time of Occurrence of Bite

Most human bites occurred at night 15/34 (44.1%). Bites inflicted by dogs mainly occurred in the morning 66/148 (44.6%), and evening 43/148 (29.1%). Most snake bites occurred in the evening 5/14 (35.7%) and night 4/14 (28.6%) (Table 4.2)

Table 4.2: Time of Occurrence of the Bites Reported to Kakamega Provincial General Hospital

Time of bite	Vertebrate Type				
	Dog n=148	Human n=34	Snake n=14	Cat n=7	Others n=4
Morning 6.00am- 12noon Afternoon	66 (44.6%)	12 (35.3%)	2 (14.3%)	1 (14.3%)	2 (50.0%)
1.00 pm- 3.00pm	23 (15.5%)	2 (5.9%)	3 (21.4%)	1 (14.3%)	2 (50.0%)
Evening 4.00pm- 6.00pm	43 (29.1%)	5 (14.7%)	5 (35.7%)	3 (42.9%)	-
Night 7.00pm- 5.00am	16 (10.8%)	15 (44.1%)	4 (28.6%)	2 (28.6%)	-
Total	148	34	14	7	4

4.3.3 Place of Occurrence and Exposure Circumstances of Bites

Bites inflicted by dogs mainly occurred along the pathway 70/148 (47.3%) while human bites occurred more often at home either in the house or within the compound as shown in Table 4.3.

Table 4.3: Place of Occurrence of Animal Bite Injuries Reported to Kakamega Provincial General Hospital

Place of Bite	Animal Type				
	Dog n=148	Human n=34	Snake n=14	Cat n=7	Others n=4
Along the road, path or public place	70 (47.3%)	14 (41.2%)	-	-	-
At home	26 (17.6%)	16 (47.1%)	8 (57.1%)	7 (100%)	1 (25.0%)
Forest/bush	1 (0.7%)	-	6 (42.9%)	-	2 (50.0%)
Someone's home	51 (34.5%)	4 (11.2%)	-	-	1(25.0%)
Total	148	34	14	7	4

Table 4.4 depicts exposure circumstances by animal type. Most dog bites were unprovoked 125/148 (84.4%).

Table 4.4: Exposure Circumstances of Animal Bite Injuries among the Patients Reporting to Kakamega Provincial General Hospital

Exposure circumstance	Dog n=148	Human n= 34	Snake n=14	Cat n=7	Others n=4
No provocation	125 (84.4%)	-	12(85.7%)	2 (28.6%)	3
Ordinary interaction(feeding, grooming)	2 (1.4%)	-		1 (14.3%)	
*Provoked	5 (2.7%)	-	2(14.3%)	4 (57.1%)	1(rodent)
Commanded to attack	3(2%)	-		-	
Moved close to young ones	11(7.4%)	N/A		-	
Playing/petting	2(1.4%)	N/A		-	
Fight/separating fight	N/A	34 (100%)	N/A	-	
Total	148	34	14	7	4

*N/A- Not applicable

*Provoked was defined as the animal having been kicked, hit or struck by a person with an object or part of the person's body or any part of the animal's body having been squeezed.

About 3% of the cat and dog bites were reported to the Veterinary office.

4.3.4 Types of Bites sustained by the Patients

About 77% of the bites were classified as Category III (Table 4.5).

Table 4.5: Bite wound categories: frequency and Percent Occurrence.

Bite sustained	Frequency	Percent	95%CI
Category II (Nibbling of uncovered skin, minor scratches or abrasions without bleeding. Licks on broken skin)	48	23.2	17.6-29.5
Category III (Single or multiple trans-dermal bites or scratches. Contamination of mucous membranes with saliva)	158	76.9	64.6-90.7
Mauling	1	0.5	
Total	207	100.0	

4.5 Types and Characteristics of Bites Reported at Kakamega Provincial General Hospital 2006 - 2008

Animal bites in the three years reviewed was 808/92,553 constituting (0.87%) of the hospital caseload. The number of cases registered were 2006, 162/808 (20.0%) 2007, 298/808 (36.9%) 2008, 348 (increased over time the highest being 2008 348/808 (43.1%). Analysis for linear trend in proportions yielded p- value 0.005.

Animal bites were inflicted more by dogs in the three years with an average of 600/808 (74.3%) followed by human bites 110/808 (13.6%), snakebites 74/808 (9.1%), cat bites 9/808 (1.1%), rodents 8/808 (0.99%) and others 8/808 (0.99%).

More male patients were involved in the animal bite incidents with an average of 54.5%. A majority of dog bites occurred in individuals under 10 years 210/808 (26%) while human and snake bites mainly affected persons in 21-30 years age-group with an average of 47/110 (43%) and 35/74 (47%) , respectively.

4.6 Trends of Animal Bites Reported at Kakamega Provincial General Hospital Between 2006 to 2008

Animal bite trends are as shown in figure 4.2 with peaks in March and August.

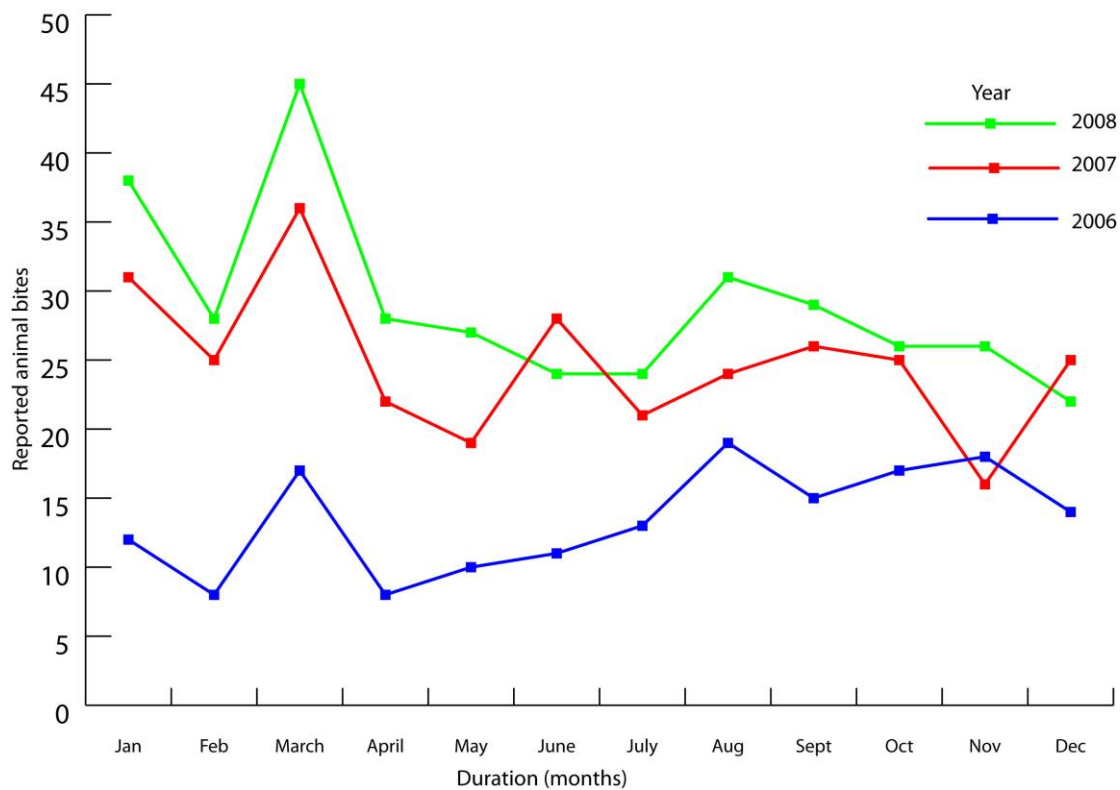


Figure 4.2: Temporal Trends of Animal bites at Kakamega Provincial General Hospital 2006-2008

4.7 Animal Bite Management Practices

4.7.1 Animal bite Management practices at home

About 9% of the patients had the bite wounds washed with water and soap while 5% reported taking either antibiotics or analgesics. Sixty six percent of the patients applied traditional first aid methods such as cleaning wound with paraffin, topical application of potassium permanganate and application of some blood from the biting dog to the wound. Of all the snakebite patients, 1/14 (7%) reported to a traditional healer. About

93% reported to the hospital with tourniquets while 7% reported in a sling.

4.7.2 Clinical Management of Animal Bite Patients Reporting to Kakamega

Provincial General Hospital.

Of all the patients, 125/207 (60.4%) received antibiotic treatment. The antibiotics included Amoxicillin, Floxapen, Penicillin and Ampiclox. Tetanus toxoid was administered in 121/207 (58.5%) while two patients were put on anti-retroviral therapy. One of these patients had a pre-exposure history of a cat bite which had bitten a person known to be Human immunodeficiency virus positive within ten minutes.

Anti-rabies vaccine was prescribed to 150 of the patients. The number of doses prescribed per patient ranged between 1-7 doses and were dependent on animal's ownership, status and rabies vaccination history. Three doses were prescribed in 89/150 (59.3%; 95% CI of 51.0-67.3%). About 27% of the patients completed the prescribed dose. Period of delay from injury to receiving the first anti-rabies dose ranged from 0-232 days with a mode of 2 days. Regarding the source of anti-rabies vaccine, 85/120 (70.85) of the patients bought from the dispensing chemists while 35/120 obtained from the Kenya Expanded program for Immunization. During the study period, 2/155 (1.3%) dog and cat bites resulted in rabies.

4.7.3 Factors Associated with Anti-rabies Vaccine Completion among Patients

Reporting to Kakamega General Hospital

Sourcing vaccine from KEPI, age group 5-12 years and sustaining a bite on the upper extremities were found to be significantly associated with anti-rabies vaccine completion on bivariate analysis (Table 4.7).

Table 4.6: Bivariate Analysis of Factors Associated with Completion of Prescribed Anti-rabies Doses in Dog and Cat Bite Patients

Characteristics	Yes	No	TOTAL	COR	95%CI	P-Value
	n (%)	n (%)	n (%)			
1. Non-employment						
Yes	28	73	101	1.15	0.52-2.60	0.726
No	12	36	48			
2. Self employment						
Yes	7	19	26	1.00	0.39-2.61	0.990
No	33	90	123			
3. Person known to patient owns animal						
Yes	28	79	107	0.89	0.40-1.96	0.720
No	12	30	42			
4. KEPI as vaccine source						
Yes	15	19	34	2.84	1.21-6.38	*0.018
No	25	90	115			
5. Unknown animal ownership						
Yes	4	7	11	1.62	0.45-5.86	0.335
No	36	102	138			
6. Bite on the lower extremities						
Yes	20	68	88	0.60	0.30-1.25	0.240
No	20	41	61			
7. Age 5-12 years						
Yes	17	24	41	2.65	1.21-5.67	*0.023
No	23	85	42			
8. Bite on upper extremities						
Yes	9	9	18	3.22	0.30-1.25	*0.022
No	31	100	131			
9. Dispensing chemists as source of vaccine						
Yes	28	57	85	2.13	0.98-4.61	0.080
No	12	52	64			

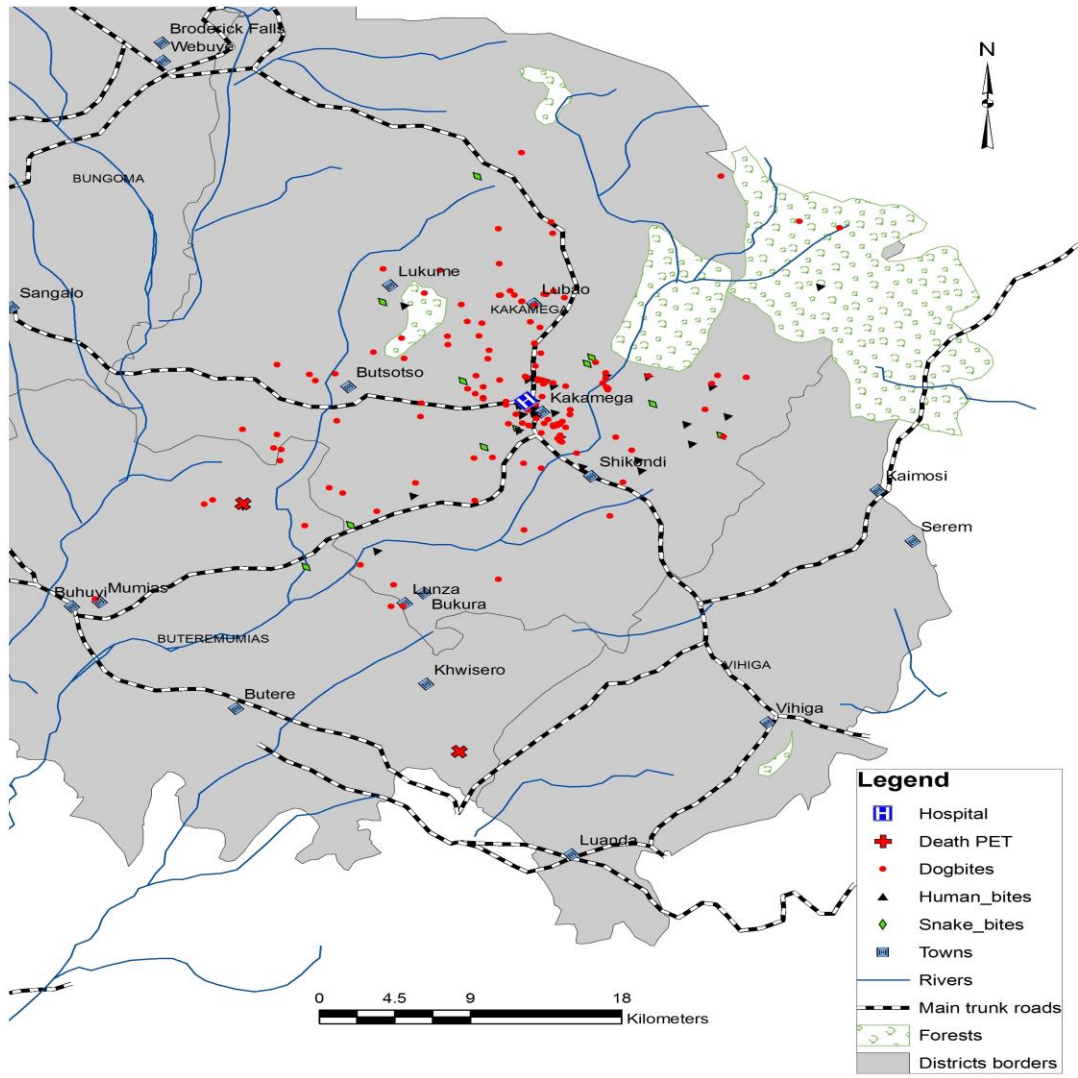
*Characteristics with $p < 0.05$ are significantly associated with anti-rabies vaccine completion.

Table 4.7: Independent Factors Associated with Anti-rabies Dose Completion in Patients reporting at Kakamega PGH 2009

Exposure Characteristics	Odds Ratio	95%C.I.	P-Value
Age group 5-12 years	2.72	1.20-6.16	0.016
Upper extremity bite	3.65	1.25-10.67	0.018
KEPI as source	2.67	1.14-6.23	0.023

4.6 Geographical Distribution of Animal Bites

The number of animal bites was high within Kakamega Municipality area. Dog bites were also concentrated around the Local market, Lubao (Figure 4.3).



*One symbol represents one vertebrate animal bite

Figure 4.3: Spatial Distribution of Bites of Dogs, Humans and Snakes Reported to Kakamega Provincial General Hospital

4.6.1 Distribution of Animal Bites Injuries in Kakamega Provincial General Hospital by Division.

Municipality division reported higher bites than other areas (Figure 4.4)

Bites were high in Lurambi and Kabras which are sugar-cane growing zones and Shinyalu which is partly covered by the Kakamega forest.

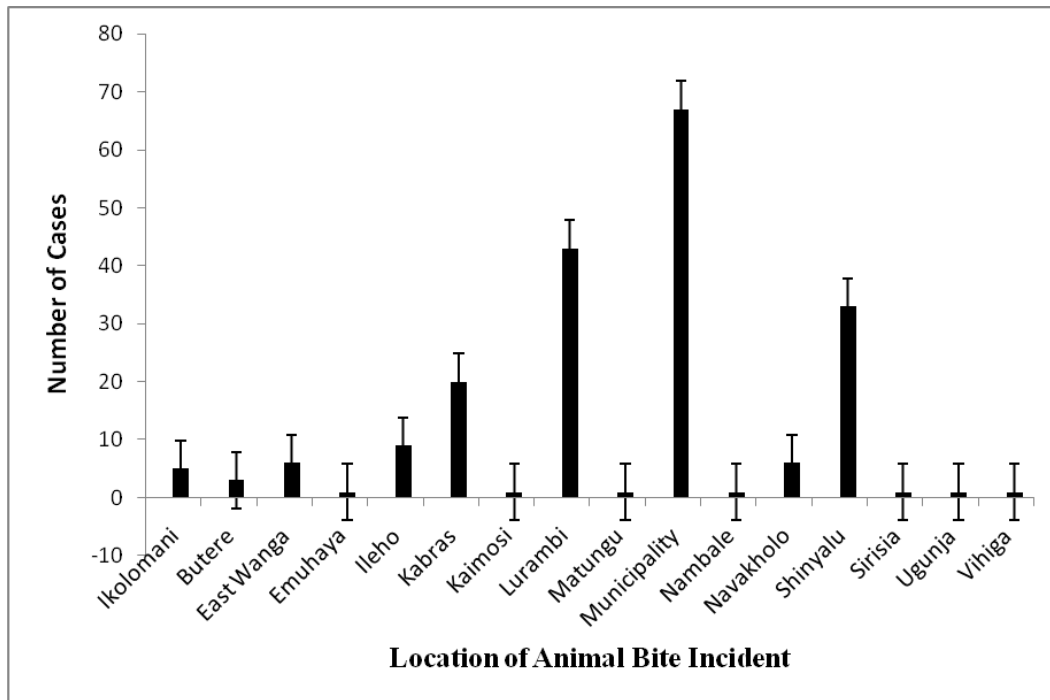


Figure 4.4: Distribution of animal bites reported to Kakamega Provincial General Hospital by Division

CHAPTER FIVE

5.0 DISCUSSION

In this study, dogs were found to be the main animals biting humans in the area and like in many other studies; children were at higher risk of dog bites (Ostanello *et al.*, 2004; Steele *et al.*, 2007). Children aged 5-10 years are at a considerable behavioral risk because of their mobility, curiosity, lack of knowledge on animal behavior, their short stature and frequent association with animals. Children in this age group were mainly bitten on the lower extremities unlike studies done in the developed countries that showed that children were commonly bitten on the head/neck and arms more than any age group. The highest percentage of dog bites in a city in the United States of America (US.A) was from the German shepherd dog (Gail and O'Rourke, 1998) and this being a large breed is more likely to bite the head/neck of a child, as these are the closest to its mouths. In Kakamega, most dogs owned are the local small breeds ("basenji") which are unlikely to reach the head/ neck. Most children were bitten in the event of running away from the biting animal increasing the chance of bite occurring on the lower extremities.

Dogs classified as unknown to the patient accounted for only 8.1%. Although these are important causes of injury and rabies, the most significant source of dog bites in this study was those with known ownership as reported elsewhere (Karla and Abiodun, 2008). Majority of the bites occurred away from the owner's compound and in the morning when children were going to school. Dog owners unaware of their

responsibility in safeguarding the public from injury, let the dogs roam freely in search of food. Addressing responsible ownership and animal control law enforcement will greatly reduce the incidence of dog bites in Kakamega.

In the study, majority of the bite were unprovoked . Dogs resent being disturbed while eating, dislike being threatened or feeling like their territory is being invaded and can be jealous of attention given to other family members (Morgan and Palmer, 2007). It is recommended that the biting animal be isolated and observed for 10 days by a Veterinarian to determine whether the animal has rabies. This is mainly to conserve vaccine and to ensure that those bitten by rabid animals receive sufficient doses to protect them (WHO 1992). Despite this only (3.2%) cat and dog bites were reported to the Veterinary office.

Human bites were second in prevalence to dog bites in this study. Other studies in the developed countries place human bites third following dog and cat bites (Sinclair and Zhou, 1995, Pretty *et al.*, 1999).

In this study, human bites were significantly high and common in female. The victims and aggressors were mainly females. These results compare well with other studies done in Tanzania and Nigeria (Shubi *et al.*, 2008, Obukwe, 2002) which also established that women were at higher risk than males. Human oral flora contains multiple species of bacteria and can result in serious infections. This coupled with the possible transmission of blood-borne viral diseases through human bites makes it necessary for the ministry of

Public Health and Sanitation to set guidelines on proper management of human bites in the health facilities at all levels. There may be need to educate the community and especially females on the dangers of human bites. It is possible that women prefer using teeth instead of fists with a hope of inflicting maximum harm especially disfigurement of the face.

The bites were common in individuals aged 21-30 years and were frequent at night. Human bites are expected to be high in this age group due to the social activities they engage in which most often end up in conflicts that are settled through fights. The bites were common at night when people are more likely to be engaged in these social activities like alcohol drinking.

During the study, a cat that had bitten a patient known to be HIV positive bit a child aged seven years in less than 10 minutes interval. Though a rare phenomenon, this points to the need for further investigations on the role of animals in transmission of non-zoonotic diseases like HIV/AIDS in this area, given that HIV prevalence in Western Province is 5.4 % (KAIS, 2007).

Snakebites mainly occurred at home with a large proportion occurring in the house and within Municipality. These findings differ with a study done in India by (Sharma *et al.*,2005) which indicate that most snakebites occurred in the rural population in agricultural fields This difference may be attributed to the disruption of the ecosystem exposing the snakes to the harsh climate and consequently getting into the houses which

are cooler increasing the human to snake contact.

In this Study, use of tourniquets in snakebite patients was high . This is consistent with findings obtained in a study on treatment seeking behaviors among snakebite patients in Mymensingh, Bangladesh. This too was a hospital based study and showed a frequency of 100% (Miah *et al.*, 2009) which established that application of tourniquets was popular (79%). Use of tourniquets or compression bandages was based on research in Australia, which showed that they slowed venom absorption in animals. More recent studies show that they are not useful (Chandio *et al.*, 2000). This misconception may not have been corrected hence the increased use of tourniquets.

It was also found from the study that only 3% of the snake bite patients sought treatment from a traditional healer prior to reporting to the hospital. This is much lower than 68% estimated by a community based study in Kenya (Snow *et al.*,1994). It is possible that this study underestimated the role of traditional healers since it only captured patients who reported to the hospital excluding those who may have visited traditional healers only.

From the study, low level of education and unemployment were associated with a higher probability of an animal bite. It would therefore be important to design communication messages that target this group of population in the society. This factor may also be a contributory factor on the increased use of poor home management of animal bite wounds.

Only 8% of the study participants washed the bite wound with soap and water as recommended while a majority of patients applied inappropriate first aid techniques. Higher rates (58%) of appropriate wound washing have been reported in Uganda (Fevre *et al.*, 2005). The lower rates observed in this area may be attributed to the low awareness levels on bite wound management and the cultural practices which are more frequently used.

Data from this study showed that clinical management of animal bites was poor and the management of wounds inflicted by dogs best exemplifies this. In the study, inadequate vaccine doses of less than four as per Zhagreb Schedule were prescribed in 62.6% of the patients. Wound washing at the hospital was not a common practice as expected (8.2%). None of the patients received anti-venom treatment and 14% of the snakebite patients were given intravenous fluids. Clinical management of bite wounds is therefore an area that MOPHS needs to strengthen.

Bivariate analysis of a subset of data comprising of all dog and cat bites showed that sourcing anti-rabies vaccine from KEPI, sustaining bite on the upper extremities and belonging to age group 5-12 years were significantly associated with completion of the prescribed anti-rabies vaccination course. Parents give priority to children in treatment with a view that they are at higher risk of infection. This in essence is a proven fact and was observed in the study as the two deaths due to rabies were in children less than 10 years of age. Given the low vaccination coverage of dogs and cats reported by (Perry *et*

al., 1994), all bite exposures represent a potential risk of rabies and all the exposed persons should complete the anti-rabies course. Vaccines from KEPI are either free or subsidized compared to the dispensing chemists and people tend to prefer drugs from Government organizations. This is a pointer that in order to improve anti-rabies completion rates in animal bite patients in Kakamega, KEPI vaccine stocks should be improved to meet the demand. With the many power failures with no alternative power source, the dispensing chemists may not be suitable to stock vaccines that require low temperatures.

The observed seasonal variations in bite related hospital cases reported between 2006 and 2008 were determined by both human-dog density and socioeconomic dynamics. The consistent increase during months of March and August every year is strongly associated with the breeding seasons of dogs hence increased aggressiveness. Annual increase in reporting can be attributed to increased public sensitivity and awareness to rabies through the veterinary department. Improved economic status of the local people led to affordability of Medicare and hence hospital attendance. Ultimately the pragmatic utility of a hospital records provides an avenue for accountability and policy revisions in funding of neglected tropical diseases.

The trend reflects the probable range with the given data, but the true level may actually be even higher because of lack of accurate denominator data due to poor methodologies in capture of quality clinical data, lack of awareness and unreported cases. The finding

of seasonal variation in the dog bites is therefore important to the Ministry of Public Health and Sanitation on projecting vaccine needs for the area. Further studies are required to determine this correlation in other settings.

In this study a large proportion of bites clustered within Kakamega Municipality area as well as Lubao Market which harbor a large number of stray dogs. The bites were also more concentrated in the sugarcane-growing zone and a few bites occurred from the forest. Spillover transmission of wildlife rabies to domestic animals in proximity to forests and sugarcane plantations therefore remains a public health threat given that rabies prevention in wild life is expensive. The clustering effect of bites as depicted by the maps can provide a basis for establishment of vaccination clinics for dogs and cats in an effort to control rabies.

Semi-permeable barriers like Rivers and roads as depicted in the maps influence reporting. Existence of other health facilities and distance from the referral hospital are main confounders in the irregular dispersal pattern evidence on visual inspection of the maps. Knowledge attitude and practices of urban population will signal higher hospital reporting than rural areas a disparity confirmed as you move away from the township. Traditional healers are preferred in rural areas than urban areas hence underreporting to health facilities.

The space-time analysis is able to be utilized for detecting changes in the pattern of endemic diseases, when population census information is unavailable or irrelevant. The

ability to perform disease surveillance without population-at-risk data is especially important in developing countries such as Kenya, where these data may be hard to obtain.

The analyses presented in this study are descriptive and provide a basis for further investigations in spatio- temporal aspects of animal bites.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

1. Animal bites are a common occurrence in Kakamega with dogs and humans being the main biting species. Dogs frequently inflict injuries on children below 10 years of age.
2. Women aged 21-30 years were at an increased risk of human bites and were often bitten on the upper extremities.
3. Home care and clinical management of bite wounds was inadequate particularly so for bite wounds inflicted by dogs and snakes.
4. There is a seasonal variation of animal bites in Kakamega with peaks in March and August.
5. There are more bites around Kakamega town and Lubao market.

RECOMMENDATIONS

- 1.** There is need for education of the public on responsible dog ownership such as obeying leash laws, timely rabies vaccination and controlled breeding and appropriate first aid techniques in case of an animal bite.
- 2.** Children should be educated on safety around the dogs.
- 3.** The Ministry of Public Health and Sanitation to develop and disseminate animal bite management guidelines to health facilities at all levels.
- 4.** There is need for an improved surveillance of animal bites in humans. Accurate and complete reporting of animal bites is essential for a bite prevention program. Information collected should include demographics of the patient to identify population at risk, thus allowing for targeted education programs. Improved surveillance will necessitate collaboration between animal and human health services.
- 5.** The local authority in collaboration with the Veterinary department should enforce animal control by-laws.
- 6.** There is need for the Ministry of Public Health and Sanitation to control and regulate rabies vaccination in humans and also develop and disseminate animal bite management guidelines to health facilities at all levels.

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Appendix 1: Questionnaire (Continued)

1.4 What is your current employment?

- formal employment
- self employed formal
- self employed informal (.e.g. small scale agriculture, hawker, bodaboda)
- casual employment
- unemployed
- student (specify) lower primary, upper primary, secondary, middle level college, University
- others (specify) _____

2.0 Bite details

2.1 Have you been bitten or scratched by an animal?

- yes**
- no**

2.2 If **yes** to 2.1 above, when were you bitten? (dd/mm/yyyy) ___/___/___

2.3 What time of day were you bitten?

- morning (6.00am-12.00 noon)
- afternoon (1.00 pm-3.00pm)
- evening (4.00pm-6.00pm)
- night (7.00pm- 5.00 am)

Appendix 1: Questionnaire (Continued)

2.4 Where were you bitten from?

- at home (.e.g. shamba, house,)
- someone's home
- along the road
- forest/bush (away from home)
- others (specify) _____

2.5 Which sub-location did the bite occur? _____

2.6 Which part of the body was bitten? (tick all that apply)

- Head/neck
- Arms
- Upper trunk
- lower trunk
- Legs

2.7 What type of bite did you sustain? (Tick most severe category in case of more than one type)

- abrasion (superficial scratch with no bleeding)
- puncture (bite or scratch piercing the skin with bleeding)
- laceration (tear like wound with bleeding)
- tearing away of flesh
- others (specify) _____

Appendix 1: Questionnaire (Continued)

3.0 circumstances of bite

3.1 What were you doing at the time of bite?

- playing or petting the animal
- moved close to animal with young ones
- provoking animal
- ordinarily interacting with animal (e.g. feeding)
- disciplining animal
- animal was commanded to attack
- no interaction
- others (specify) _____

Provoking will be defined as the animal having been kicked hit or struck by a person with any object or part of the person's body or any part of the animal's body having been squeezed.

3.3 Did you report to any government office?

- yes** **no**

3.4 If yes to 3.3 above, where did you report? Choose all that apply.

- Veterinary office
- Administration
- police

others (specify)_____

Appendix 1: Questionnaire (Continued)

4.0 Animal details

4.1 Which animal bit you?

domestic/farm animal (specify) _____

stray domestic animal (specify)_____

wild animal (specify)_____

Human

4.2 Who owns the animal that bit you? (if domestic)

my family a person known to me **DK**

4.3 What is the current state of the biting animal?

alive and normal

alive with strange behavior

Dead

DK

4.4 If animal is a dog or cat, was it vaccinated against rabies?

yes **no** **DK**

4.5 If yes to 4.4 above, indicate date of last vaccination (dd/mm/yyyy)

____/____/____

State number and type of animal bitten by the same animal

Appendix 1: Questionnaire (Continued)

5.6 What treatment did you receive at the health centre? (choose all that apply)

- antibiotics (specify) _____
- painkillers (specify) _____
- washed wound (specify what was used) _____
- vaccination (specify which ones) _____
- anti-inflammatory
- anti-snake venom
- others (specify) _____

5.7 What treatment have you received at this hospital?(choose all that apply)

- antibiotics (specify) _____
- painkillers (specify) _____
- washed wound (specify what was used: water, soap, antiseptic, normal saline)_____
- vaccination (specify which ones) _____
- anti-inflammatory
- anti-snake venom
- others (specify) _____

5.9 Was anti rabies vaccination prescribed?

- yes** **no** **DK**

Appendix 1: Questionnaire (Continued)

5.10 If yes to 5.9 above, state number of doses prescribed? one two three
 four five six

5.11 How many vaccines (anti-rabies) have you received? (tick as appropriate)

day 0 day 3 day 7 day 14 day 28

5.12 What was your source of anti rabies vaccine?

- Pharmacy/Chemist
- KEPI/Public health Department
- Others (specify)_____

6.0 Outcome of bite

6.1 What is the outcome of the bite?

- discharge with follow up
- discharge without follow up
- hospitalization
- death
- others(specify)_____

Appendix 2: Consent Form; Vertebrate Animal Bites and Scratches in Patients

Reporting at Kakamega Provincial General Hospital

My name is _____ from the Ministry of Health Kenya. I am involved in a study on the Epidemiology of vertebrate animal bite and scratch injuries in patients attending Kakamega Provincial Hospital. I am going to ask you questions related to animal bites and personal related questions.

Confidentiality

Your name will not appear on the questionnaire and the information you give will be confidential.

Risks and Benefits

There are no direct benefits if you choose to participate in this study but the information will help us come up with prevention strategies for animal bites and associated conditions.

Consent

You are free to withdraw from the study any time without penalty. If you agree to be recruited into this study, please fill the attached form as evidence of your voluntary participation.

I _____ do willingly wish to participate in this study having fully understood the process, methods and intended purpose of the study. I expect that the information collected will be confidential and utilized for the intended purpose.

Signature of participant _____ Date ___/___/___

Signature of investigator _____ Date ___/___/___

Appendix 3: Fomu ya Kibali; Maambukizi ya Magonjwa Yanayosababishwa na Majeraha na Kukwaruzwa na Wanyama Walio na Uti wa Mgongo Miongoni Mwa Wagonjwa Wanaohudumiwa Katika Hospitali ya mkoa- Kakamega

Mimi kutoka Wizara ya Afya nchini Kenya. Najihusisha na uchunguzi wa maambukizi ya magonjwa yanoyosababishwa na majeraha ya kuumwa na kukwaruzwa na wanyama walio na uti wa mgongo miongoni mwa wagonjwa wanaohudumiwa katika hospitali ya mkoa – Kakamega. Nitawahoji kuhusiana na maswala husika ya kuumwa na wanyama.

Jina lako halitaandikwa kwenye hojaji na habari utakoyopatia itabaki siri.

Hasara na Faida

Hakuna manufaa yoyote ikiwa utaamua kushiriki katika uchunguzi huu, lakini maoni yako yatakuwa msingi bora kuunda mikakati mwafaka ya kuzuia kuumwa na wanyama hawa na hali husika.

Uko huru kujiondoa katika uchunguzi huu wakati wowote bila kuadhibiwa.

Ikiwa umekubali kuchaguliwa kama mshiriki katika uchunguzi huu, tafadhali jaza fomu ya thibitisho ya kushiriki kwa hiari.

FOMU YA KIBALI

Maswala kuhusu maambukizi ya magonjwa yanayosababishwa na kuumwa na kukwaruzwa na wanyama walio na uti wa mgongo miongoni mwa wagonjwa wanaohudumiwa katika hospitali ya mkoa (wa magharibi)

Mimi najitolea kushiriki katika uchunguzi huu baada ya kuelewa utaratibu, mbinu na sababu ya uchunguzi huu. Nataraji utafiti wangu utabaki kuwa siri na kutumiwa katika utatuzi wa uchunguzi huu.

Sahihi

Tarehe/...../.....

Appendix 4: Authorization letter from the National Council for Science and Technology

