FACTORS ASSOCIATED WITH SNAKE BITE AND HEALTH SEEKING BEHAVIOR AMONG RESIDENTS OF KALTUNGO LGA, GOMBE STATE, NIGERIA

BY

ISMAILA HABILA
(MPH/MED/13507/2011-2012)

A THESIS SUBMITTED TO THE
SCHOOL OF POSTGRADUATE STUDIES,
AHMADU BELLO UNIVERSITY, ZARIA

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE AWARD OF
MASTER OF PUBLIC HEALTH (FIELD EPIDEMIOLOGY)

DEPARTMENT OF COMMUNITY MEDICINE,
FACULTY OF MEDICINE
AHMADU BELLO UNIVERSITY, ZARIA, NIGERIA

DECEMBER, 2014

ATTESTATION

I declare that the work in the dissertation entitled “Factors associated with Snakebite and the Health-seeking behavior of Snakebite victims in Kaltungo LGA, Gombe state, Nigeria” was carried out by me in the Department of Community Medicine.

The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this thesis was previously presented for another degree or diploma at this or any other Institution.

Ismaila Habila _____ _____

Signature **Date**

CERTIFICATION

The thesis entitled "Factors associated with Snakebite and the Health-seeking behavior of Snakebite victims in Kaltungo LGA" by Ismaila Habila meets the regulations governing the award of Master Degree in Public Health (Field Epidemiology) of the Ahmadu Bello University, Zaria and was approved for its contribution to knowledge and literary presentation.

Dr. A.U. Shehu MBBS, DTM&H, FWACP Chairman, Supervisory Committee	_____ Signature	_____ Date
Prof. K. Sabitu MBBS, FWACP Member, Supervisory Committee	_____ Signature	_____ Date
Dr. M.N. Sambo MBBS, MIAD, FWACP Head of Department	_____ Signature	_____ Date
Prof. Adebayo Joshua Dean, Postgraduate School	_____ Signature	_____ Date

DEDICATION

To God, the creator of all

To my adorable and wonderful wife and children

To all that had fallen victims of snakebites

To all that sacrificed their time and energy to seek and advance knowledge about this condition of public health importance, and

To all that committed their resources to relieve humanity from the burden it poses.

Good Lord, help us all!

ACKNOWLEDGEMENTS

I thank God Almighty for his mercies and grace upon me and my entire family and giving me the enablement to carry out this study. My kind appreciation goes to my parent, who sacrificed so much to set my path upon this journey.

My gratitude goes to my supervisors Dr. A.U. Shehu and Prof K. Sabitu whose efforts contributed immensely to the completion of this thesis. I also wish to acknowledge the unrelenting efforts and inputs of my program supervisors Dr. N.Patrick and Dr. E.N. Waziri.

Am highly indebted to the amiable and exceptional mentorship of Dr. Patrick Nguku, Resident Advisor of the Nigeria FELTP; Dr Frank Mahorney (CDC Atlanta), Dr. Chima Ohuabunwo (NSTOP) who gave me numerous opportunities to acquire practical skills and competence.

I also appreciate AFENET and CDC Atlanta for their support during my training and this research work. Also Gombe state Government and Ministry of Health (MOH) Gombe.

I cannot forget to also appreciate the Principal, School of Health Technology, Kaltungo and the final year students of Community Health Extension Workers (CHEW), for supporting me through data collection.

Finally, special thanks to my loving and caring wife and our children, for their moral support, encouragement and sacrifice during the period of my training as Field Epidemiologist. I thank God for blessing me with you people. I could not have made it without you! My siblings and their love ones, thank you all.

TABLE OF CONTENTS

Title page - - - - - - - - - - i

Attestation - - - - - - - - - - ii

Certification - - - - - - - - - - iii

Dedication - - - - - - - - - - iv

Acknowledgement - - - - - - - - - v

Table of content - - - - - - - - - vi

List of tables - - - - - - - - - ix

List of figures - - - - - - - - - xi

List of Appendices - - - - - - - - - xii

List of acronyms - - - - - - - - - xiii

Summary - - - - - - - - - xv

Chapter One – Introduction

1.1 Background - - - - - - - - - 1

1.2 Problem Statement - - - - - - - - 2

1.3 Justification / Rationale - - - - - - - - 5

1.4 Research Questions - - - - - - - - 5

1.5 General and Specific Objectives - - - - - - - 6

1.5.1 General Objective - - - - - - - - 6

1.5.2 Specific Objectives - - - - - - - - 6

Chapter Two – Literature Review

2.1 Historical background - - - - - - - - 7

2.2 Classification of snakes - - - - - - - - 8

2.3 Snake Venom - - - - - - - - - 9

2.4 Treatment of Snakebite - - - - - - - - 11

2.4.1 Anti-Snake Venom - - - - - - - - 11

2.4.2 Other treatment modalities - - - - - - - 14

2.5 Socio-demographic factors - - - - - - - 16

2.6 Environmental factors - - - - - - - 18

2.7 Treatment-seeking behavior - - - - - - - 19

2.8 Prevention of snakebite - - - - - - - 22

Chapter Three – Methodology

3.1 Background of Study Area - - - - - - - 24

3.2 Study Design - - - - - - - - - 26

3.3 Study Population - - - - - - - - - 26

3.3.1 Inclusion Criteria - - - - - - - - 26

3.3.2 Exclusion Criteria - - - - - - - - 27

3.4 Sample Size Determination - - - - - - - 27

3.5 Sampling Technique - - - - - - - - 28

3.6 Study Instruments - - - - - - - - 28

3.7 Data Collection Methods - - - - - - - - 29

3.8 Data Management - - - - - - - - 30

3.8.1 Measurement of Variables - - - - - - - 30

3.8.2 Statistical Analysis - - - - - - - - 30

3.9 Ethical Considerations - - - - - - - - 31

3.10 Limitations - - - - - - - - - 31

Chapter Four – Results

Result - - - - - - - - - - 33

Chapter Five – Discussion

Discussion - - - - - - - - - - 60

Chapter Six – Conclusion and Recommendations

6.1 Conclusion - - - - - - - - - 67

6.2 Recommendations - - - - - - - - - 68

References - - - - - - - - - - 69

Appendices - - - - - - - - - - 76

LIST OF TABLES

Table 1: Socio-demographic profile of the respondents from the selected households in Kaltungo LGA - - - - - - - - 33

Table 2. Distribution of respondents bytheir knowledge about places where snakebite can be treated - - - - - - - - 35

Table 3. Distribution of the snakebite victims at the time of bite by Age and Sex- 36

Table 4: Distribution of the respondents by their duration of stay in their places of abode in Kaltungo LGA - - - - - - - 37

Table 5: Distribution of the snakebite victms by places where the reported snakebites took place in Kaltungo - - - - - - - 40

Table 6: Distribution of the victims bythe activities involved with at the time of bite in Kaltungo - - - - - - - - - 41

Table 7: Distribution of the respondents by places where Palmyra palm was processed in Kaltungo - - - - - - - - 43

Table 8: Distribution of respondents by their general health seeking behavior - - 44

Table 9: Distribution of the victims by types of first aid care given to the snakebite victims in Kaltungo - - - - - - - 45

Table 10: Distribution of the snakebite victims by their distance from the General Hospital Kaltungo and Traditional healer- - - - - 46

Table 11: Distribution of the snakebite victims by Time interval before treatment was accessed - - - - - - - - - 47

Table 12: Distribution of the victims by the venue where snakebite victims received further care and treatment - - - - - - 49

Table 13: Distribution of the victims by the reasons for their choice of treatment venue in Kaltungo - - - - - - - - 50

Table 14: Distribution of the victims by their sources of information about treatment venue in Kaltungo - - - - - - - 51

Table 15: Distribution of the snakebite victims by duration of Illness due to the snakebite - - - - - - - - - 52

Table 16: Distribution of the victims by the Cost to treat the illness due to snakebite in Kaltungo - - - - - - - - - 53

Table 17: Distribution of the victims by the outcome of the overall care and treatment 53

Table 18: Distribution of the victims' rating of their Satisfaction with the overall outcome of treatment - - - - - - - 55

Table 19: Socio-demographic factors related to snakebite among the victims in Kaltungo - - - - - - - - - 56

Table 20: Respondents' Personal practices that were related to snakebite in Kaltungo LGA - - - - - - - - - 57

Table 21: Unconditional logistic regression for variables found to be statistically significant at Bivariate analysis - - - - - - 59

LIST OF FIGURES

Figure 1: Distribution of snakebite cases by months of occurrence in Kaltungo - 38

Figure 2: Distribution of snakebite victims by the species of snakes involved in Kaltungo LGA - - - - - - - - 39

Figure 3: Distribution of the victims by sites affected during the snakebite in Kaltungo 42

Figure 4: Distribution of the victims by places where victims first sought care following snakebites - - - - - - - 48

LIST OF APPENDICES

Appendix 1: Ethical Approval - - - - - - - 76

Appendix 2: Map of Study Area - - - - - - - 77

Appendix 3: Consent form - - - - - - - - 78

Appendix 4: Study Instrument - - - - - - - 80

LIST OF ACRONYMS

AFENET	-	African Field Epidemiology Network
ASV	-	Anti-snake venom
B.C.	-	Before Christ
CAM	-	Contemporary and Alternative Medicine
CDC	-	Centers for Disease Control and Prevention
CFR	-	Case Fatality rate
CHEW	-	Community Health Extension Workers
CI	-	Confidence Interval
Fab	-	Monovalent immunoglobulin fragment from proteolytic digestion of immunoglobulin by papain
$F(ab'')_2$	-	Bivalent immunoglobulin fragment from proteolytic digestion of immunoglobulin by pepsin
FGD	-	Focus Group Discussion
FMOH	-	Federal Ministry of Health
HH	-	Head of Household
IDI	-	In-depth Interview
IgG	-	Immunoglobulin G
IgM	-	Immunoglobulin M
LGA	-	Local Government Area
MPH	-	Masters in Public Health
M_r	-	Relative Molecular mass
NFELTP	-	Nigerian Field Epidemiology and Laboratory Training Program
NHIS	-	National Health Insurance Scheme
NSTOP	-	National Stop Transmission of Polio

NTD	-	Neglected Tropical Disease
OR	-	Odds Ratio
PHC	-	Primary Health Care
PTF	-	Petroleum Trust Fund
SES	-	Socio-Economic Status
SIM	-	Sudan Interior Mission
TV	-	Television
WHA	-	World Health Assembly
WHO	-	World Health Organization
χ^2	-	Chi-square

SUMMARY

Snakebite is a significant cause of morbidity and mortality, with an annual incidence of about 497 cases per 100,000 populations, in Nigeria. Studies revealed that only about 8.5% Nigerian snakebite victims sought treatment in hospitals. The aim is to identify the factors associated with snakebite and assess the health seeking behavior among residents of Kaltungo LGA.

This Cross sectional study used structured questionnaire to elicit relevant information from adult victims of snakebite, heads of households (or next most senior member) in households with history of snakebites involving someone below the age of 18 years, and in households without history of snakebite. A multi-stage sampling technique was used.

A total of 422 households were visited. Majority of the respondents had either secondary or post secondary education [169 (40.0%) and 162 (38.4%) respectively]. From those 422 households visited (containing 961 people), a total of 191 snakebites were reported (Prevalence of 19.9%). However, only 142 snakebite victims were traced and interviewed. Of the 142 snakebite victims interviewed, 78 (54.9%) were males. About 40.8% snakebites occurred on farms and farming was the commonly engaged activity, 50 (35.2%), at the times of bites. Those who processed palmyra palm were 310 (73.5%). Males were 1.6 times more at risk. People with educational level below secondary school were 1.8 times at risk of snakebite. Similarly, people who processed Palmyra palm fruits were about two times more likely to be bitten by snakes. Generally, 47.2% of respondents first patronized local medicine vendors when sick, while 29.6% ignored it until it became very severe. However, among the snakebite victims, 64.3% accessed health-care within 2 hours after the bite.

Snakebite is still a public health problem in Kaltungo LGA. Significant associated factors found were; Male sex, Not attaining educational level up to secondary school level, and Processing Palmyra palm fruits. About 60% of the snakebite victims sought treatment in Hospital.

KEY WORDS: Snakebite, Community-based study, Factors associated, Health-seeking behavior, Gombe-Nigeria

CHAPTER ONE

INTRODUCTION

1.1 Background

Bites and stings are a common occurrence worldwide, and especially in the tropical and sub-tropical regions. While stings are associated more with pains, for instance, scorpion sting and sting by bees, bites on the other hand are especially more important when it is associated with either inoculation of highly virulent pathogens, as in the case of bites from rabid dogs or when there is injection of a lethal poisonous substances, as is the case with bite of poisonous snakes. Some snakebite may be associated with both severe pains as well as the systemic effects from the presence of poisonous venom in the circulation. However, victims of snakebites are perhaps often more concerned with the perception of sudden imminent death than with pain or other symptoms.[1]

Snakes are cold blooded reptiles belonging to the Phylum *Chordata*, sub-phylum *Vertebrata*. They are widely distributed in the world, although, certain species are more common in some regions than others. For example, while a place like Lithuania has the common adder (*Vipera berus*) as the only venomous specie of snake, Nigeria on the other hand, has 4 venomous species of snakes (Carpet viper, black-necked spitting cobra, puff adder and Actraspididae).[2] In fact, Nigerian Echis was described as the world most dangerous snake.[3] The incidence of snakebite appears to correlate (in addition to other factors) with the number of venomous snake species present in the given area, the anti-predatory behavior of the snake species found in the given area, population density of rural dwellers engaging in farming and other activities that increases contact with snakes (such as hunting), and the seasonal pattern of such activities.[4] Thus, Nigeria has an estimated annual incidence of snakebites of 497 per 100,000 populations, with a 10 – 20

% natural mortality[2], while in Europe, only one-person die of snakebite envenomation every 3 years.

Majority of snakebite victims are rural dwellers, found where social amenities, including hospitals are often lacking, thus, many of the cases go unreported and undocumented. Their plight is made worse by their lack of control over how resources are shared, thus, denied access to quality care and treatment. These, among other reasons, made snakebite lack the needed attention given to other health conditions such as Hypertension and diabetes (which is sometimes associated with affluence). However, with the inclusion of snakebite in the World Health Organization (WHO) classification of Neglected tropical diseases in April 2009, more and more attention is being drawn to snakebite, a condition with very high mortality and morbidity, if not managed appropriately.[5]

1.2 Problem Statement

Snake bite is a significant cause of morbidity and mortality, especially in tropical and sub-Saharan Africa.[6] In places where snake bites are endemic, such as Kaltungo, it is a major public health concern. The medical doctor in charge of the snakebite treatment unit of General Hospital Kaltungo reported that the hospital admits about 12 snakebite victim daily, on the average. In other parts of Nigeria, it was reported that snakebite victims may occupy more than 10% of hospital beds.[7] Other states in Nigeria where snakebites are also common include Taraba, Adamawa, Borno, Plateau, Jigawa, Niger, Kogi, Oyo and Enugu states.

The annual incidence of snake bite in Nigeria is about 497 cases per 100,000 populations with a 10 - 20% natural mortality. Most studies on snake bite were essentially hospital-based studies. These may be understatements where documentation is poor and/or significant proportions of

victims seek treatment elsewhere[3]. Studies revealed that only about 8.5% Nigerian, 27% Kenyan and 3% Bangladesh snake bite victims sought treatment in hospitals.[9,59,60] Other studies revealed that majority of snake bite victims first seek treatment at traditional healers, and only visit hospitals when condition worsen or there are complications.[10] The problem of under-reporting and poor documentation is not peculiar to Nigeria. In the year 2000, Nepal Ministry of Health reported a total of 480 snakebites, with 22 deaths. However, a community-based study conducted in only the Eastern part of Nepal in that same year 2000, reported a total of 4078 snakebites, with 396 deaths.[61]

Snakebite is prevalent in Kaltungo LGA especially during the rainy season, when farming activities increase contact between humans and snakes. Most of the cases occur outside the home environment. Snakebite occur more among rural dwellers in Kaltungo LGA. The only hospital equipped to manage snakebite victims is situated in Kaltungo town (several kilometers away from most wards). The cost of anti-snake venom plus other medications required in the management of snakebite is sometimes prohibitively high to such affected peasant families, who in most instances often have other competing basic needs to contend with. Consequently, morbidity and mortality due to snake bite is often high in such settings. Similarly, a significant proportion of hospital beds and resources are used to manage snake bites, thus consuming much of hospital resources.

Besides farming and hunting, other risk factors include professional snake handlers, sleeping outside, fetching fire-wood, storage of food materials in homes (local silos). Apart from those factors that are associated with risk of getting bitten by snake, some other factors tend to influence the severity and or outcome of the illness due to the snakebite. Distance to health

facility, cost of anti snake venom and ignorance are some of such factors that modify the outcome of snake bite. Although both sexes are affected, studies revealed that male are about two times more likely to be affected than females. Young adults are mostly affected.

In its effort to reduce the sufferings snakebite victims go through, the Gombe state Government has up-graded the General hospital in Kaltungo town into a snakebite treatment centre and supplies anti-snake venom free to victims. That step taken by the government has shortened the distance snakebite victims cover before they access quality care and treatment. Reducing the distance to treatment centre has shortened the time interval between snakebite to when treatment is commenced, for some wards. Similarly, provision of free anti snake venom by the government also reduces the financial burden on victims.

However, one treatment centre is still far for many victims living in wards located far from Kaltungo town (where the General Hospital is located), where the distance from the hospital is over 15 km. Consequently, snakebite victims from such far wards still present late at the General hospital or even patronize other alternative treatment options. Furthermore, the General hospital Kaltungo occasionally experience stock-outs of anti snake venom. During periods of stock-outs, snakebite victims that managed to make it to the General hospital were asked to procure anti-snake venom from patent medicine stores, whose anti-snake venom is often times very expensive for the victims to afford, and sometimes the potency could not be guaranteed. Those may be some of the contributing factors that make some snakebite victims seek care and treatment in other places.

1.3. Justification/Rationale

There is need to conduct a Community-based study in Kaltungo LGA, to possibly identify other possible risk factors for snake bites, and to assess the health-seeking behavior of the snake bite victims in Kaltungo LGA. Community-based study provides a more reliable information on the burden of snake bite and the risk factors associated with it.[11] It is hoped that this study will generate information about other factors that are still predisposing inhabitants of Kaltungo LGA at higher risk of snake bites, despite all efforts made in the past.

Furthermore, factors determining choice of treatment for snake bite and outcomes from those other treatment options would be identified. Identification of the risk factors for snake bite would help develop more effective prevention and control strategies. Also, knowing the factors that influences the decision on where to go for treatment would inform policies on management, both at the state and LGA levels and eventually improve outcome.

1.4. Research Questions

Do environmental factors, such as vegetation, flood, topography, and the likes, increase the incidence of snakebite in Kaltungo LGA?

What are the factors that predispose to snake bite?

What factors determine the decision on where to seek treatment for snakebite in Kaltungo LGA?

1.5. General and Specific Objectives

1.5.1 General Objective

To identify factors associated with snakebite and assess the health seeking behavior among residents of Kaltungo LGA, Gombe state.

1.5.2 Specific Objectives

1. To determine the socio-demographic characteristics of snakebite victims in Kaltungo LGA, Gombe state.
2. To identify the factors that are associated with snakebite in Kaltungo LGA, Gombe state, and
3. To assess the health-seeking behavior of snakebite victims in Kaltungo LGA, Gombe state.

CHAPTER TWO

LITERATURE REVIEW

2.1 Historical Background

Snakes probably existed for as long as mankind exists. This reptile was equipped with venom in order for it to fend for food and to ensure its continual existence. Most snakes are defensive, often prefer to avoid coming in close contact with man. They occasionally come close to man in search for food or when men go near to their hiding places.[8] However, man with his curious nature, made efforts to tame snakes, with some degree of success. In fact, even the most poisonous snake known to man can be seen displayed and used for entertainment purposes, as seen with snake charmers, or tamed for other purposes by snake experts.[12,13] While some snake experts and charmers were able to get their pet snakes to obey some commands, others were able to get their snakes dance to certain musical notes.[14] Unfortunately, some snake experts and charmers had fallen victims to snakebites in the course of their professional practice.[15,16,14] Snakebites that occur during snake handling or a caged snake kept in captivity is termed "illegitimate" snakebite (or "Intentional" snakebite). On the other hand, "hazardous snakebite" (or "Unintentional" snakebite) refers to bite that occur when humans encountered snakes while working in the fields.[8,13] A bite that does not result into systemic envenomation is often referred to as a "dry bite".[10]

Snakebites no doubt, have been happening for many years. However, the first documented case of snakebite was said to be in 1550 B.C. It was documented in Arrian's Indica (fourth century BC) that Alexander the Great expressed satisfaction with the ability of Indian doctors to cure his troops' snakebites, especially where his own Greek physicians failed.[17,62] The first assessment of

global snakebite incidence and mortality in the world was perhaps the work undertaken in 1954, in the research on snakebite mortality in the world. That study revealed that a total of 500,000 cases of snakebites and 30,000 – 40,000 deaths occurs per year.[18] The current global burden of snakebites was estimated at about 5 million each year, with about 125,000 deaths and probably more than 100,000 suffer serious complications.[8]

Snakebite ranks high among the most neglected global health problem, especially in sub-Saharan Africa and Asia.[19] Majority of the cases of snakebites occur among rural communities of the Savannah region of West Africa, particularly in countries like Republic of Benin, Burkina Faso, Ghana, Nigeria and Togo. In West African region, the incidence of snakebites envenoming is 8.9 – 93.3 per 100,000 population, with a mortality rate of 0.5 – 5.9 per 100,000 persons per year.[19] Snakebite was considered as a "Neglected Public Issue". In fact, in 2007, WHO recognized snakebite as a Neglected Tropical Disease (NTD). However, as more and more research (including meta-analyses) and publications are made in this subject area, some experts are no longer looking at snakebite as a "Neglected" public issues".[20]

The burden of snakebite goes beyond the numeric number of persons it affects, to the financial lost incurred during its treatment, to man-hour loss at places of work, to pain and disabilities, and to even lost of breadwinner or potential breadwinner.[7] In fact, the burden of snakebite is sometimes difficult to quantify and often times, underestimated.[17]

2.2 Classification of Snakes

There are many ways to classify snakes.[11] Some few of the classifications include:

(A) Based on the location and type of the fangs; *Opithoglyphs* have rear fangs (example include mangrove snakes, boomslangs), *Proteroglyphs* have small non-movable front

fangs and are among the deadliest snakes in the world (examples are Cobras, Kraits, Mambas and Coral snakes), and Solenoglyphs which have movable front fangs that can be extended to about 180^{o} angle (examples include vipers).[15]

(B) Based on the type and action of the venom; Neurotoxic snakes (example Cobra) and Haemorrhagic snakes (example Viper).[11]

(B) Based on the snake's capability to cause death or serious disability; Class I are those that commonly cause death or serious disability. Class II involves those that uncommonly cause bites but are recorded to cause serious effects (death or local necrosis). And Class III are those that commonly cause bites but serious effects are very uncommon.[21]

2.3 Snake Venom

Contrary to the belief that snake venoms are modification of the salivary or pancreatic proteins, recent advances suggests that most snake venoms evolved through a process by which genes encoding for normal body proteins are duplicated, and the copy is selectively expressed in the venom gland. Repeated duplications resulted in the diversity and variability in the composition and properties of toxins in snake venoms.[22] Snake venom is a complex mixture of enzymatic and non-enzymatic compounds. In fact some authority considered snake venom as the most complex of all poisons.[23] Some examples of the compounds and their mechanism of toxicity includes; Hyaluronidase (aiding in the spread of the venom), Vasodilators (causing hypotension), Coagulopathic compounds (causing consumptive coagulopathy due to activation of Factors V, X and Pro-thrombin), Haemolysin (leading to bleeding from fang site), Haemorrhagins (causing bleeding from fang site via inhibition of platelet activation and increasing vessel wall permeability), Neurotoxins (causing muscular paralysis and respiratory failure) and Cardiotoxins

(causing local tissue necrosis).[24,63] Beside the toxin inside the venom, snakebite may be complicated by inoculation of some exogenous pathogenic bacteria flora.

Some snake venom characteristically affects the nervous system, causing weakness, paralysis and even death, when the paralysis extended to the respiratory system leading to asphyxiation. It is thus, referred to as neurotoxic. An example of such neurotoxic snakes is Cobra (Elapidae). On the other hand, other snakes produce venom that interferes with the blood clotting mechanism, leading to excessive blood loss, and if severe, shock and even death. Such venom is classified as Haemotoxic. Viper is an example of such Haemotoxic snakes.[17,24] However, recent studies suggest that the composition of snake venom differ slightly from region to region, and in some instances even overlaped, such that in some instances, a bite by Viper may produce symptoms of neurotoxicity.

Man has evolved several modalities to treat snakebites. From ancient times to modern era, the treatment of snakebite has evolved considerably. The ancient Ayurvedic practices commonly used herbal remedies to treat snakebites. Their herbal preparations ranged from simple preparation involving single herb, to complex preparation involving several herbs, depending on the stage of envenomation, and at times, the specie of snake involved. In fact, in some instances, the Ayurvedic practice combined herbal formulation with the use of tourniquets, cauterization, and even mantras.[17] A study done in Haryana, India in 2010 reported that about 19 different types of medicinal plants belonging to 13 families were used for the treatment of snakebites by 'Nath' community of India.[25]

In Kenya, Africa, a study reported that both herbal and non-herbal remedies were used, in which mystical therapies and herbal plants, and at times the treatment combines different methods

including cuts, sucks, and bind methods followed by application of plant leaf and root poultices strap with strips of cloth or bark.[26]

2.4 Treatment of Snakebite

2.4.1 Anti-Snake Venom

Generally speaking, antivenoms are bio-pharmacological products, produced from hyper-immunized animals. They found applications in human medicine in the treatment of potentially severe patho-physiological complications resulting from bites and stings of various animals such as snakes, scorpions, spiders, or fishes, as well as from intoxications with plants.[64] While the role of antivenom in the management of sting of scorpions and other arachnids is controversial, anti-snake venoms, on the other hand, are recognized as the only specific gold-standard treatment for envenomation by snakebites.

The first anti-snake venom (called 'Anti-ophidic serum') was developed against the Indian Cobra (Naja naja) by a French scientist called Albert Calmette in the year 1895. In the past, antivenoms were made up of serum gotten from hyper-immunized horses, hence were called "Anti-snakebite serum" or "Antiserum". Present day antivenoms are produced by the fractionation of plasma (plasmapheresis) usually obtained from domestic animals hyper-immunized against relevant snake venoms, hence are nowadays called "Snake antivenom immunoglobulin".[11] Currently, the 4 most widely used methods for antivenom production are: Ammonium sulfate precipitation of $F(ab)_2$ fragments, Ammonium sulphate precipitation of whole immunoglobulin G (IgG), Caprylic acid precipitation of $F(ab)_2$ fragments, and Caprylic acid precipitation of whole IgG.(20)

Although there is no documented incident of viral transmission to humans from the use of antivenom, the possibility of transmission of zoonotic disease pathogens, called for the need for

antivenom manufacturers to continue to adopt steps that guarantees safety of antivenoms against all zoonotic diseases. Among the various steps to ensure viral safety of antivenoms, Caprylic acid and low pH treatments are believed to assure higher viral safety.[27]

"Recurrent envenomation" is a phenomenon whereby an envenomed patient starts to re-manifest symptoms of envenomation after initial improvement following administration of antivenom.[24] This phenomenon results from rapid elimination of the antivenom, especially when Fab fragments were used. Antivenoms containing large relative molecular mass (M_r) bivalent antibodies (IgG and $F(ab')_2$ are more effective for the complete and prolonged neutralization of intravascular toxins (e.g. Procoagulant enzymes) which have a long half-life in envenomed patients. On the other hand, low relative molecular mass (M_r) monovalent IgG fragments such as Fab may be more appropriate against low-molecular mass neurotoxins which are rapidly distributed to their targets and are rapidly eliminated from the patient. [11] Studies showed that Case Fatality Rate (CFR) for snakebite envenomation can be as high as 45-50% or even more, in the absence of treatment. However, timely and appropriate use of anti-snake venom can reduce the CFR to less than 5%.[3,65,66]

Venoms used for the manufacture of anti-snake venoms should be representative of the snake population living in the area where the anti-snake venom is to be used.[11] EchiTab-Plus-ICP antivenom was produced by immunizing horses with a mixture of the venom of *Echis ocellatus, Bitis arietans, and Naja nigricollis* from Nigeria. Thus, it is suitable and effective in the treatment of snakebites in Nigeria, especially in bites involving snakes belonging to such species. It was also shown to be effective against other species.[3]

One critical challenge with anti- snake venoms production is the variability in the venom composition within individual snake species which could range from 32 – 34. Thus, to account for such variability in the venom composition, it is recommended that between 20 – 50 venom specimens be collected from snakes from the same geographical location.[11]

At the WHO meeting in January 2007, it was suggested that production of adequate higher-quality anti-snake venom is key in reducing snakebite mortality.[20] Shortly after that, in March 2007, Anti-snake venom immunoglobulins were included in the WHO Model List of Essential Medicines.

Snake envenomation have been classified into 4 grades.[22] The grading is to guide in determining the quantity of anti-snake venom required by the victim. The grading is as follows:

- Grade 0: No envenomation
- Grade 1: Mild envenomation (local swelling and pain without progression)
- Grade 2: Moderate envenomation (swelling, pain or ecchymosis progreeing beyond site of injury, mild systemic or laboratory manifestations)
- Grade 3: Severe envenomation (marked local response, severe systemic findings and significant alteration in laboratory findings)

For mild envenomation 50mls of anti-snake venom in required, for moderate envenomation 100mls, while for severe envenomation 150mls of anti-snake venom. The dose is usually the same for both adults and paediatrics.[22]

2.4.2 Other treatment modalities

Neutralization of snake venom has been achieved through different approaches. In the late 1980s, "electric shock for snakebites" was introduced as an alternative approach to treat snakebite. It entails local application of high-voltage low-amperage direct electric current (dc) from a portable device called "Stun-gun". The current is able to neutralize the venom phospholipase A2 and metalloproteases.[28] Other alternative treatment options used for snakebites involved the use of folk and traditional medicines. Herbs and plants have been used in an effort to treat various ailments and disease since primitive era.

A study conducted among the Hause-Fulani communities of Sokoto, North-western Nigeria, revealed that plants were used either as repellants, prophylaxis or for treatment of snakebites. They used dried leaves, roots or stem back from two or more plants mixed together in sour milk (acidic medium). Some commonly used plants by those Hausa-Fulani communities include 'Tunfafiya' (*Calotrolis procera*), 'Marke' (*Anogeissus leiocarpus*), 'Magarya' (*Zizipus mauritiana*), 'Tafarnuwa' (*Allium sativum*), 'Chibra' (*Randia nilotica*), 'Danya' (*Spondias spp.*), 'Gwanda' (*Carica papaya*), 'Kanya' (*Diospyros mispilifomis*), 'Tsada' (*Ximenia Americana*), and 'Taura' (*Detarium senegalence*).[29] In other settings, the parts of plant or extracts from plants are applied directly onto site of bite, chewed or ingested with the hope of counteracting the effects of the snake venom.

Ayurvedic medicine utilize different plants, believed to have anti-snake venom activities.[23] In fact, Ayurvedic medicine used specific plants to treat bites of specific snake species. For instance, root extract of *Abrus precatorius* is used against Krait bite, leaf paste of *Azadirachta indica* with rock salt is used against Viper bites, *Aristolochia indica* as decoction for snakebite,

juice of *Origanum dictamnus* is consumed in wine to cure snakebite, while leaves and bark of *Casearia sylvestris* used as standard Ayurvedic drug to treat snakebite in India and Columbia.[23] Herbal remedies may consist of a single herb taken as a decoction, or a complex herbal formulas comprising of many ingredients.[17]

The first scientific investigation regarding antivenom activity of herbs was done by Knowles.[23,67] A study conducted in Yemen in 2010 to ascertain the anti-snake venom activity of *Hibiscus aethiopicus L*. against Echis ocellatus and Naja n. nigricollis, revealed that the *Hibiscus aethiopicus* completely blocked the haemorrhagic activity of Echis ocellatus in egg embryo and also inhibited the cytotoxic effects of Echis ocellatus venom. Thus, suggested that *Hibiscus aethiopicus* may contain an endogenous inhibitor of venom-induced haemorrhage.[30] Similarly, leaf extract from *Guiera senegalensis* was shown to possess some in vitro detoxification activity against Echis carinatus and Naja nigricollis venom.[68]

Several other experiments on animal models demonstrated the antivenom activity of several herbs. The haemorrhage caused by venom of *Bothrops atrox* was completely neutralized by extracts form barks of *Brownea rosademonte, Tabebuia rosea*; plants of *Pleopeltis percussa, Trichomanes elegans*, rhizomes of *Heliconia curtispatha*; leaves and branches of *Bixa orellena, Phylodendrum tripartitum, Gozalagunia panamensis*; ripe fruit of *Citrus limon;* leaves, branches and stems of *Ficus nymphaeifolia.*[69] Water-methanol extract of *Parkia biglobosa* stem bark could neutralize venoms of Naja nigricollis and Echis ocellatus in several experimental models.[70] *Mimosa pudica* was reported to demonstrate anti-hyaluronidase activity against Naja naja, Vipera russelli and Echis carinatus venom.[71]

Among the various plants used as snake remedy, the "snakeroot" plant was preferred by many because of its long twisted "snaking" root. However, apart from plant roots, herbal medicine used leaves, bark of stems, fruits and seeds or combination of such. A study done in Luo, western Kenyain 2005 reported that 73% used leaf preparations, 19% used root preparations and 8% used bark.[26] Even in herbal medicine, combination treatment is recognized. Ayurveda combine medicinal plants with other plants and spices, to achieve greater effects.[23] In fact, the ancient Ayurvedic compendia, though mostly used herbal remedies, at times it was combined with the use of tourniquets, cauterization, and even mantras.[17] The study conducted in Luo, Kenya revealed that traditional treatment for snakebite combined application of plant, application of tourniquet above and below bite site, incision across the wound, sucking of the wound in an effort to drain out the poison, and then cauterizing the wound.[26] In other practices, the snakebite victim is given infusions or decoctions orally, in addition to topical application.

Given the challenges and limitations of anti-snake venom, some proponents of herbal medicine believed that the natural herbal remedies may be a better alternative. Some advantages of herbal compounds includes cheapness, availability, stability at room temperature and their ability to neutralize a wide range of venom

2.5 Socio-demographic Risk Factors

Unlike in developed countries where snakebite typically occurs during recreational activities, in developing countries it is an occupational hazard, affecting young agricultural workers. A study conducted in USA in 1997 reported that majority (67%) of snakebites in the study area, resulted from intentional exposures to snakes during recreational setting, while 35% occurred in occupational setting.[13] The high case-fatality ratio of snakebite envenomation observed in

developing countries were attributed to scarcity and delay of administration of anti snake venom, poor health services, further worsen by difficulties with transportation from rural areas to health centers.[31] Tropical regions of Asia and Africa suffer highest levels of snakebite-induced mortality. Studies demonstrated a strong association between snakebite-induced mortality and poverty.[32]

Snake bite is a daily occupational and domestic hazard to subsistence farmers and cattle herders.[1,33] Farmers and children are at higher risk of snake bite in sub-Saharan Africa. Males (of productive age group) are twice more likely to be affected than female.[34,35] Non-mechanized farming techniques, which is often the setting in Nigeria, place farmers at higher risk of snake bite, especially in rainy season.[18] Similarly, location of houses near farms / grain stores increases domestic exposure to snake bite. Storage of seed and crops in houses attracts rodents, which in turn attract snakes. Feet, legs and hands are the frequent anatomical sites for snake bite in Africa. Other occupations that are associated with risk of snakebite include fishing, catching and handling snakes for food (in snake restaurants), snake charmers, manufacturing leather made from snake (especially sea snakes) and Chinese medicine preparation.[12,36,31,37]

Frequent shortage of anti snake venom places more burdens on snakebite victims and their families. A study conducted in 2012 that analyzed the sub-Saharan African anti-snake venom market and the global context, reported that between 1-12 vials of anti-snake venom is required to effectively neutralize a moderate envenomation, while for severe envenomation, a patient may require a lot more.[38] With the cost of a vial of anti-snake venom ranging between $18 - $200, depending on the quality and location,[38] a victim requiring 10 or more vials of anti-snake venom would spend a good fortune before getting treated. The rising cost of living makes some

snakebite victims unable to afford anti snake venom sold by patent pharmaceutical companies. Even where the victim could afford the cost, the reliability and effectiveness of some of the anti snake venom bought from local pharmacy shops are questionable. The consequence of those issues above is an increase in morbidity and mortality rate due to snakebite in such settings.[10]

The 58th WHA held in Geneva, Switzerland, in May 2005, drew the attention of both developed and developing countries towards ensuring universal access and coverage in health services provision. However, in many developing countries, there is still great disparity in the allocation of resources, health facilities and other social amenities between the urban and the rural communities.[72,73] Many at times, people access health services through out-of-pocket payment. In settings where people could not afford healthcare services through out-of-pocket payment, morbidity and mortality rates are ultimately high. The study to describe the relationship between healthcare financing and health outcomes in Nigeria, demonstrated that, out-of-pocket payment and the wide disparity and inequality in income distribution were associated with high morbidity and mortality. Furthermore, the concentration of health facilities at urban areas, relative to rural areas, contributed to the poor service demand.[39] Even with the introduction of National Health Insurance Scheme (NHIS), household socio-economic status (SES) still influences the choice of health services.[40]

2.6 Environmental risk factors

Reports indicated that cases of snakebites tend to occur more in certain places than others. One wonders then whether there are factors in the environment that contributes to that. By nature, snakes are cold blooded animals. As such, one expects to see more cases of snakebites in environments that are cold. The study conducted in 1954 showed that poisonous snakes are not

found in the climates that are extremely cold.[18] Snakebites tend to be more common during the hot and dry season (during which snakes move around in search for water) and during the rainy season. Among the Kamba and Luo tribes of South Africa, traditional healers were the first point of call following snakebite and even with other illnesses.[41]

Climate change and flooding also increase contact between humans and snakes.[35] Other studies reported that the incidence of snakebites tends to increase in places affected by flood.

Even though most snakes would rather avoid coming close to man, they sometimes gets close or even enter houses in search of food or temporal hiding places. Storage of food materials may attract rodents and snakes into houses and thus, the risk of snakebites.[12]

2.7 Treatment seeking behavior

WHO defined Traditional medicine as "diverse health practices, approaches, knowledge and beliefs incorporating plant, animal, and/or mineral based medicines, spiritual therapies, manual techniques and exercises applied singularly or in combination to maintain well-being, as well as to treat, diagnose or prevent illness." Furthermore, WHO estimated that about 60% of world's population uses herbal medicine to treat their sickness, and up to 80% of Africans depends on traditional medicine for some aspects of primary health care (PHC).[74] Recent global trend, even in advanced countries with most sophisticated orthodox medicine system, is towards contemporary and alternative medicine (CAM) with many countries making headway in traditional medicine to cater for their health care requirements. Other terms used to describe CAM include 'Natural medicine', Non-conventional medicine', and 'Holistic medicine.

Traditional medicine and its practitioners were officially recognized by the Alma Ata Declaration in 1978 as important resources for achieving Health for All. In May 2002, the WHO launched the first ever WHO strategy on Traditional medicine 2002-2005. The African Summit of Heads of States and Government held in July 2003 in Maputo endorsed the plan of action for implementation of the Decade of African Traditional Medicine and the institution of the African Traditional Medicine Day in Member States to be celebrated on 31 August of every year, with effect from 2003.[75] In addition, the World Health Assembly (WHA) drew attention to the potentials and the efficacy of herbal medicine in the national health care systems, and urged member countries to utilize those medicines.[76]

In Nigeria, self diagnosis and self medication is a common practice. A study conducted in four LGAs in South-east Nigeria, revealed that self-diagnosis was by far the commonest form of diagnosis and that patent medicine dealers were often the first point of call for treatment, while significant proportion of the patients visited private health facilities. It was reported that poorer households resorted to self diagnosis and tend to visit patent medicine dealers more. The least poor groups showed higher probability of patronizing hospitals and private clinics.[33]

In another study conducted in Anyigba, North-Central, Nigeria, to assess the Healthcare-seeking behavior, in 2009, delay in seeking treatment was reported by 56.9% of the respondents, and the thought of getting over the illness was the major reason for the delay. That same study revealed that majority of the low income patronized drug sellers.[42] The study to determine the socio-cultural determinants of health-seeking behavior on the Kenyan Coast showed that traditional healers were consulted when there was need to attribute the cause of the illness to supernatural sources, when dealing with chronic illness that modern medicine could not cure, and for

prevention of possible ill-health, among others.[43] The study further revealed that parent were the ultimate decision makers in deciding where to take their children for treatment, even though they sometime yield to elders' advice, especially when it involved patronizing traditional healers.

Among the elderly age group, a study conducted in Edo, Nigeria in 2013 revealed that 73.7% of the elderly patronized health centers whenever they fell sick and more elderly males resorted to self-medication (both orthodox and herbal remedies). Most of the ailments affecting the elderly people are chronic conditions with insidious onsets. However, even with acute and infectious conditions such as Tuberculosis, It was also found that the patients still first patronize patent medicine vendors. A study done to determine healthcare-seeking behavior and treatment delay among pulmonary tuberculosis patients in rural Nigeria in 2013 nearly 80% first visited drug shops, 10% visited traditional healers, while the remaining 10% visited private hospital.[44] Even among youths, the males tend to seek treatment from traditional healers compared to females. The study on STI treatment-seeking behavior among youth in Nigeria revealed that while 60% of the females sought treatment from formal sources (clinics and hospitals), 54% of the males sought treatment from informal sources (commonly, traditional healers).[45]

In terms of snakebite, perhaps the perception of an immediate imminent death following snakebite, calls for an urgent and immediate need to commence treatment as soon as possible, even right from the vicinity of the incident. The study done in Luo, Kenya, reported that traditional treatment began right in the field, immediately after the bite.[1] The traditional healers were held with high regards, given their reputation in treating difficult snakebites, while recording few deaths (less than 3%).[41]

In Hlabisa sub-district, KwaZulu Natal, a study conducted in 2007 among snakebite victims, to assess their healthcare-seeking behavior and use of traditional healers after snakebite, revealed that 80% of the victims used traditional medicine before presenting at the hospital. About 62% of them consulted traditional health practitioner.[46] Studies revealed that only about 8.5% Nigerian (and 27% Kenyan) snake bite victims sought treatment in hospitals.[9] Other studies revealed that majority of snake bite victims first seek treatment at traditional healers, and only visit hospitals when condition worsen or there are complications.[10]

The study conducted to examine the trends and challenges of traditional medicine in Africa in 2011 reported that Colonialism, Western religion and education as well as globalization phenomenon, to some extent, have negatively affected the perception about traditional medicine in Africa, especially among the elites.[77] Nevertheless, the current growing demand for and use of traditional medicine across the world (including many African countries) is down-regulating that negative effect. In fact, there is increasing collaboration between orthodox health practitioners and traditional health practitioners. A study conducted in 2005 reported that 50% of traditional healers referred patients, at least once, to modern health facilities for further treatment.[78]

2.8 Prevention of snakebite

Man has gone beyond efforts to treat snakebites, to efforts at preventing snakebites. Such efforts too, had evolved over time. Knowing the kind of snakes and their habits is very important in prevention.[12] In their work on Control methods for snakes, Brock and Howard classified the control methods into three broad groups (general methods, repellents, and miscellaneous) and seven different specific categories; snake-proofing, removal of food and cover, searching and

killing, traps, chemicals, repellents, miscellaneous (use of domestic animals such as geese, ducks, cats, dogs, and hogs).[47]

In India, the worship of nāgas (serpent deities) is associated with rain magic and fertility than with curing of snakebite. Occasionally, there were mantras, worship, and offerings addressed to the nāgas for protection against snakebite[17]

CHAPTER THREE

METHODOLOGY

3.1 Study Area

Kaltungo, a Local Government Area (LGA) in Gombe state, is located along latitude 9° 49' N and longitude 11° 19' E in the Savannah belt of northeastern Nigeria. It has an estimated population of 44,519 (2006 census), mostly subsistent farmers and scattered nomads. It has 11 political wards. The wards were further subdivided into settlements. The LGA has vast fertile land for cultivation, with rainy season spanning from May and extends to late October. Some parts of the LGA are mountainous and rocky and in such areas, the inhabitants practice terrace farming methods. There are many types of vegetation, notable among which is the Palmyra palm trees (*Borassus aethiopum C. Martius*) or "Giginya / Kanje" (in Hausa) said to have originated from Ethiopia (but also found in India, Asia and other regions), which is of many economic values. For instance, the trunk and leaves of the Palmyra palm is used in roofing houses, the fruit is eaten fresh (because it is juicy and sweet), while the seed is further left to germinate into a type of root tuber called "Muruchi" (in Hausa) and eaten as a delicacy or even as a meal. Thus, many households are utilizing Palmyra palm in one way or another. To many inhabitants of Kaltungo LGA, the Palmyra palm tree is a means of livelihood, as such, they often move around, especially at night, gathering the Palmyra palm fruits. It was reported that snakes are often found around Palmyra palm fruits

The whole of Kaltungo LGA has only one Secondary health facility and 55 Primary health care (PHC) facilities, distributed across the 11 political wards. People from different parts of the LGA access health care services from the General hospital and the PHCs. However, some people at

times resorted to traditional methods of treatment, depending on the nature of the illness. The Snakebite treatment and Research centre in the General Hospital Kaltungo was started by a Missionary organization called Sudan Interior Mission (SIM) over 30years ago, in their effort to bring succor to the people. However, in 1994, the Federal Government, through the Federal Ministry of Health (FMOH), took over the centre from the SIM. Shortly after that, services in the centre deteriorated drastically. In 1998, services at the Snakebite treatment centre were revived through the Petroleum Trust Fund (PTF). Presently, it is the Gombe state government that supplies Anti-snake venom to the hospital. In fact, in 2013, the Gombe state Government awarded a contract to expand the Snakebite treatment unit of the General hospital Kaltungo, in order to cater for more victims. The Snakebite treatment centre not only caters for victims from the state alone, but even from neighboring states. Because of the number of snakebite victims accessing care in the hospital, there are periods of stock outs of anti-snake venom.

There was a legend in parts of Kaltungo about certain species of snakes. This specie of snake was described as being very big and at times creeps into houses. They were considered harmless, thus, left alone. In fact, they were believed to offer some sort of protection to households. That specie of snakes is hardly seen these days. Prior to the inauguration of the snake unit of the General hospital, snakebites were treated traditionally, by traditional healers. Though most victims of snakebite are presently treated at the General hospital, some victims still patronize the traditional healers, especially those living far from the hospital.

Kaltungo has a School of health technology which trains Community health extension workers. There are five secondary schools, and many primary schools (both public and private schools),

within Kaltungo town. There is a major market that attracts people from different parts of Gombe state on Fridays.

3.2 Study Design

The study is a Cross sectional study. Interviewer-administered Structured questionnaire was used to elicit relevant information from respondents in the community. General characteristic of households (HH) was noted and the home environment was also observed for factors that could be associated with snakebites.

3.3 Study Population

The study populations were people who have been residing in Kaltungo LGA for at least one year. Although, it is possible for an individual arriving Kaltungo to be bitten by snake the next day or few days later, for the purpose of this study it was assumed that for one to be sufficiently exposed to some of the factors associated with snakebite, the individual should have been residing within Kaltungo for about one year. Respondents were categorized into three groups: Victims of snakebites (18 years and above), in households with history of snakebites; Heads of households (or next most senior members), in households with history of snakebites in which the victims were below 18 years of age; and thirdly, Heads of households (or next most senior members), in households without history of snakebite. From those selected respondents, relevant information were obtained.

3.3.1 Inclusion Criteria

Victims of snakebite, 18 years and above, resident in Kaltungo LGA, and whose incidents occurred within Kaltungo LGA.

Heads of households (or next most senior members) in households where the snakebite victims were less than 18 years of age.

Heads of households (or next most senior members) in households with no history of snakebite but living in Kaltungo LGA for at least a year and who consented to participate in the study.

3.3.2 Exclusion Criteria

Snakebites that occurred outside Kaltungo LGA were excluded from the study.

3.4 Sample Size Determination

Sample size was calculated using the formula as bellow:

$$n = \frac{Z_{\alpha}^{2} pq}{d^2}$$

Where:

n = Minimum sample size required

Z_{α} = Standard normal deviate corresponding to a 2 sided level of significance of 95% = 1.96

p = Prevalence of snakebite was assumed to be 50% =0.5

q = 1-p = 0.5

d^2 = Desired level of precision of 5 % = 0.05

Thus,

- $n = \frac{Z_{\alpha}^{2} \times p \times q}{d^2}$

$= [\frac{1.96^{2} \times 0.5 \times 0.5]}{0.05^{2}}$

$= 384.16$

$= 384$

* Non-response rate = (n / 1-10%) = n / 0.9

$= 384/0.9$

$= 426.67 \approx 427$

* Total sample size = 427

3.5 Sampling Technique

A multi-stage sampling technique was used, whereby; at the 1st stage, 4 wards were randomly selected out of the 11 wards in the LGA. At the 2nd stage, 40 settlements were selected by simple random sampling from a total of 116 settlements in the 4 wards. Certain numbers of households were allocated to each of the 40 selected settlements, in proportion to their sizes. At the 3rd stage, households were selected systematically from each of the 40 selected settlements at intervals determined by dividing the total number of households in each settlement by the number of households allocated to that settlement. At each selected settlement, questionnaire administration started from household determined by the neck of a bottle spun at the center of each selected settlement.

At each selected household, history of snakebite was enquired. Where there was history of snakebite, the snakebite victim (that were 18 years and above) were interviewed directly. In households with history of snakebites but the victims were below 18 years, the Heads of those households or next most senior members (where the heads were not present) were interviewed. Where there were more than one snakebite incidents, the interview was restricted to the most recent incident. In households without history of snakebite, the Heads of such households or next most senior member, where the head of the household was absent were also interviewed.

3.6 Study Instruments

A structured questionnaire was administered. The questionnaire was made up of 5 sections as follows; Socio-demographic characteristics, Knowledge about snakebite, Factors associated with snake bite, Health-seeking behavior, Prevention and control. Some of the questions asked, were generally for both snakebite victims and non-victims. While some questions were specific for

only those that fall victims of snakebites and such questions were meant to identify specific information related to the snakebite. For instance, activities at the time of bite, what was done immediately as first aid care and subsequent management, where victim was treated and what informed that choice? Another key component of the questionnaire is the aspect that required the interviewer to observe the home environment and record findings based on the checklist designed to identify some likely factors in and around the home environment that could be endangering the occupants of such houses. The aspect that entailed observing the home environment was applicable to all households visited (with or without incident of snakebite). The last section of the questionnaire was an open-ended format where each of the respondents was asked to state their opinions on how best they think snakebites burden could be reduced and also what they feel the Government could do in order to reduce the burden of snakebites in Kaltungo. See appendix 3 for the complete questionnaire.

3.7 Data Collection Methods

Research assistants recruited were final year students of the School of Health technology, Kaltungo. All the research assistants were carefully selected, such that all of them could speak both “Hausa” and “Tangale” (the local dialects commonly used in the communities selected) in addition to English language. They were then trained extensively on the data tool. The questionnaire was pre-tested in Shongom LGA (bordering Kaltungo LGA). Grey areas and ambiguous questions were subsequently re-phrased and re-designed before final administration and data collection was done in the study area.

Data was collected within the months of January and February 2014.

3.8 Data Management

Data was cleaned and coded, then entered into Epi-info version 3.5.4, then exported into Excel and double checked for consistencies.

Frequencies and proportions were run to describe characteristics of the respondents. Prevalence Odds ratios at 95% CI and Chi-square (χ^2) was also run to determine association between exposure factors and outcome of interest. Factors that were found to be statistically significant were further subjected to unconditional logistic regression, while Confounders and Effect modifiers identified.

3.8.1 Measurement of Variables

The outcome variables (dependent variable) are history of snakebite and non-snakebite. The exposure variables (independent variable) includes Age, Sex, Educational level, Occupation, Processing Palmyra palm, Working on the farm bare footed, Working on the farm till is dark, Storage of crops inside the house, Using light source at night, Preference of open shoes to cover shoes, Refuse dumping in or near house, Keeping Palmyra palm fruits within or near house, Fencing of compound, Fencing of compound with wall and Rearing chickens within or near house.

3.8.2 Statistical Analyses

Data was analyzed using Epi info version 3.5.4, and Open Epi. Univariate analysis was done to arrive at frequencies and proportions of variables, Bivariate analysis for association of exposure (Independent) factors with outcome of interest (Snakebite status). Independent factors that were found to be statistically significant were further subjected to Unconditional logistic regression in order to rule out Effect modifiers and Confounders. Where appropriate, data were segregated and

analysis for snakebite victims was run separately, in order to assess some specific Health-seeking behavior.

3.9 Ethical Considerations

Clearance was obtained from Medical Research and Ethical committee, Ministry of Health, Gombe state, as well as from A.B.U Zaria. Permission was also sought from the traditional rulers and the local authority in the LGA and selected wards and settlements.

Informed consent (both verbal and written) was obtained from each respondent prior to questionnaire administration. Those unwilling to participate in the study were respectfully excused.

Although respondents were not given any monetary benefit during the study, fresh snakebite victims met during data collection, who were yet to receive appropriate treatment, were supported with transportation to get to the Hospital and access treatment.

Confidentiality was maintained all through.

3.10 Limitations

1. In some households, the snakebite incident occurred several years ago. Consequently, recall bias was an issue of concern. To minimize the effect of recall bias, questions were carefully designed to elicit information that respondents were likely able to recall even when the event occurred several years ago.
2. Not all the snakebite victims reported from all the households visited were interviewed. Some had moved to distant locations and could not be reached during the period of data

collection, others had died. But all those present at the time of data collection and those within reach were interviewed.

3. Willful misstatements could not be independently verified.

CHAPTER FOUR

RESULTS

Table 1: Socio-demographic profile of the respondents from the selected households in Kaltungo LGA

Variable	Frequency (n=422)	Percentage (%)
Age group (yrs)		
<20	10	2.4
20-29	120	28.4
30-39	125	29.6
40-49	80	19.0
50-59	47	11.1
60+	40	9.5
Sex		
Male	264	62.6
Female	158	37.4
Tribe		
Tangale	307	72.7
Hausa	56	13.3
Fulani	24	5.7
Others†	35	8.3
Highest educational level		
Secondary	169	40.0
Post secondary	162	38.4
None	55	13.0
Primary	32	7.6
Quranic	4	0.9
Occupation		
Business	129	30.6
Government employee	92	21.8
Farmer	83	19.7
Students	76	18.0
Herdsman	11	2.6
Others††	31	7.3

†= Tula, Waja, Awak, Pero, Dadiya

††= Applicants, House wife, Security personnel,

Over 50% of the respondents were in the age range of 20-39years. Two hundred and sixty four (62.6%) respondents were males, while the remaining 158 (37.4%) were females. The predominant ethnic group of the respondents was 'Tangale' 307 (72.7%), followed by Hausa 56 (13.3%). Majority of the respondents had either secondary or post secondary education [169 (40.0%) and 162 (38.4%) respectively]. The occupations of the respondents are also shown in Table1.above. Business people are the majority 129 (30.6%), followed by government employees 92 (21.8%). Farmers were 83 (19.7%).

Table 2: Distribution of respondents by knowledge on places to seek for treatment of snakebite

Place to treat snakebites	Frequency	Percent (%)
Hospital	368	87.2
At home	23	5.5
Traditional healer	22	5.2
Chemist	6	1.4
Spiritual healer	1	0.2
Don't know	2	0.5
Total	422	100

Although majority of the respondents, 368 (87.2%), reported that snakebites should be treated in hospital, over 10% of the respondents reported that snakebites should be treated either at home or by a traditional healer (Table2. above).

A total of 392 (92.9%) reported that snakes are common in their environment. Out of that, 359 (85.1%) reported that snakes had entered their houses in the past.

Table 3. Distribution of the snakebite victims at the time of bite by Age and Sex.

Age groups (yrs)	Female n (%)	Male n (%)
<10	4 (6.3)	4 (5.1)
10-19	21 (32.8)	35 (44.9)
20-29	26 (40.6)	24 (30.8)
30-39	6 (9.4)	5 (6.4)
40-49	3 (4.7)	3 (3.8)
50-59	3 (4.7)	3 (3.8)
≥60	1 (1.6)	4 (5.1)
Total	64 (100)	78 (100)

Overall, a total of 191 snakebites were reported during the data collection. However, we were only able to trace and interviewed 142 snakebite victims in 142 households containing 961 people (Prevalence was 19.9%). Among the 142 snakebite victims interviewed, 78 (54.9%) were males while the remaining 64 (45.1) were females. Among the females, those in the age groups 20-29 were more affected(40.6%), followed by age group 10-19 (32.8%). The reverse was the case for the males; the age group 10-19 were more affected (44.9%) followed by 20-29 (30.8%). Combined, snakebite affected people in the age range 10-29 years.

The mean age of the snakebite victims was 38.4 years, while the median age was 35.0 years.

Table 4: Distribution of the respondents by their duration of stay in their places of abode in Kaltungo LGA

Duration of stay (yrs)	Snakebite Victims (%)	Non-victims (%)
<11	52 (36.6)	144 (51.4)
11-20	29 (20.4)	68 (24.3)
21-30	29 (20.4)	35 (12.5)
31-40	17 (12.0)	16 (5.7)
≥41	15 (10.6)	17 (6.1)
Total	142 (100)	280 (100)

Generally, majority of the snakebite victims (36.6%) as well as the non-victims (51.4%) spent, at most, a decade in their places of abode.

The mean duration of stay for the victims was 20.7 while that for the non-victims was 15.3. The median duration of stay for the victims was 20.0 while that for the non-victims was 10.0

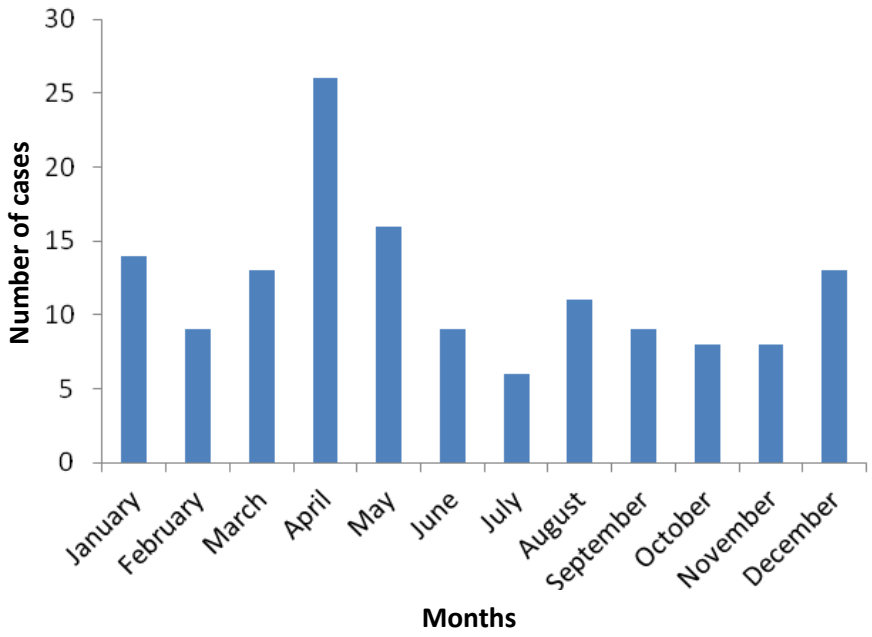


Figure 1: Distribution of snakebite cases by months of occurrence in Kaltungo

More cases of snakebites occurred in the months of April and May (18.3% and 11.3%, respectively). Fewer snakebite cases were reported in the month of July, see Figure1. above.

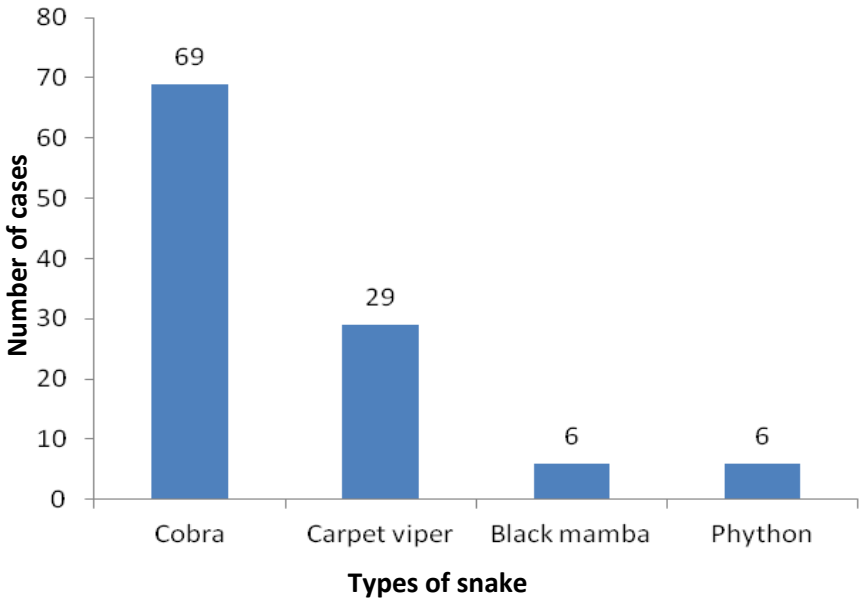


Figure 2: Distribution of snakebite victims by the species of snakes involved in Kaltungo LGA

Out of the 142 snakebite victims, 110 (77.5%) victims were able to identify the snake involved. In 28 (19.7%) cases, the snakes were not identified, while the remaining 4 could not remember. Information provided by the respondents showed that Cobra was the most commonly implicated specie of snake, 69 (62.6%), followed by Carpet viper, 29 (26.4%), figure2 above.

Table 5: Distribution of the snakebite victms by places where the reported snakebites took place in Kaltungo

Place of snakebite	Frequency	Percent (%)
On the Farm	58	40.8
Outside, within the compound	37	26.1
Outside, near the compound	15	10.6
In the bush	13	9.2
Inside a Room	12	8.4
Along Foot-path	7	4.9
Total	142	100

Majority of the snakebites, 58 (40.8%), occurred on the farm, followed by those cases that took place outside but within the house compound. The least number of cases were those that occurred along foot path, table 5 above. Out of the 142 cases, 12 (8.4%) took place inside rooms.

Of the 142 snakebites reported, 52 (36.4%) occurred in the evening, 46 (32.4%) occurred at night while the remaining 44 (31.0%) in the morning

Table 6: Distribution of the victims bythe activities involved with at the time of bite in Kaltungo

Activity at time of bite	Frequency	Percent (%)
Farming	50	35.2
Walking at night	25	17.6
Handling Palmyra palm	21	14.8
Rearing animals	9	6.3
Sleeping inside a room	9	6.3
Sleeping outside a room	7	4.9
Fetching firewood	7	4.9
Climbing trees	4	2.8
Playing	4	2.8
Fetching water	3	2.1
Gathering blocks	2	1.4
Hunting	1	0.7
Total	142	100

Farming was the commonly engaged activity, 50 (35.2%), at the times of bites. The study showed that hunting was associated with fewer incidents of snakebites.

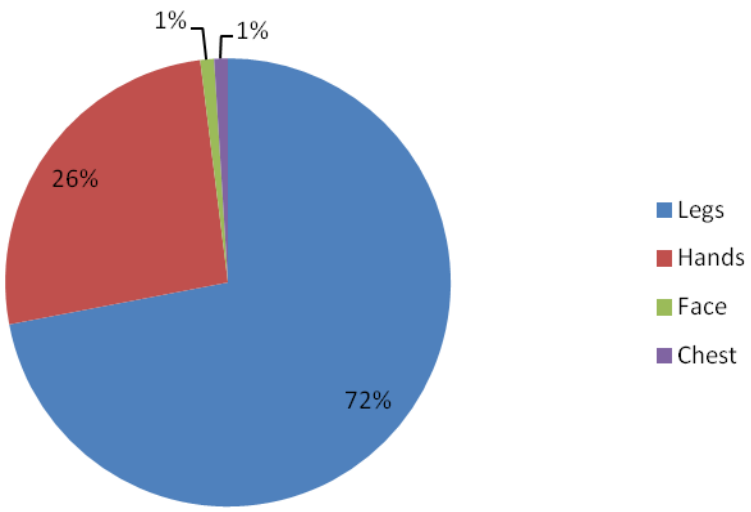


Figure 3: Distribution of the victims by sites affected during the snakebite in Kaltungo

Over 70% of the snakebites involved the lower limbs, followed by the hands, 26%. In two cases (1%) the face was affected.

Table 7: Distribution of the respondents by places where Palmyra palm was processed in Kaltungo

Where Palmyra was processed	Frequency	Percent (%)
Just outside the house compound	154	49.7
Within the house compound	93	30.0
On the farm	63	20.3
Total	310	100

Of the 422 respondents interviewed, 310 (73.5%)%) do process Palmyra palm (either regularly or occasionally) while the remaining 112 (26.5%) do not process Palmyra palm.

Out of the 310 respondents that process palmyra palm, 154 (49.7%) process it just outside their house compounds, 93 (30.0%) process it within their house compounds, while 63 (20.3%) process it on their farms.

Table 8: Distribution of respondents by their general health seeking behavior in Kaltungo LGA

Health seeking behavior when sick	Frequency (n=422)	Percent (%)
Patronize local medicine vendor	199	47.2
Ignored till became very severe	125	29.6
Pray or go for spiritual healing	181	43.0
First visit Chemist	307	72.7
Hospital	360	85.9
Total	1172	278.4

Out of the 422 respondents, 360 (85.9%) sought treatment at hospital when sick. Significant proportion of the respondents, 199 (47.2%) first patronized local medicine vendor when sick.

Table 9: Distribution of the victims by types of first aid care given to the snakebite victims in Kaltungo (n=142)

First aid care given to vicitms	Frequency	Percent (%)
Black stone	65	45.8
Traditional concoction applied	48	33.8
Incisions at bite site	30	21.1
Traditional concoction ingested	28	19.7
Tourniquet applied	28	19.7
Nothing was done	28	19.7
Total	227	100

Following snakebite, 65 (45.8%) out of the 142 victims, used black stone as a form of first aid care. Similarly, 48 (33.8%) out of the 142 victims applied traditional concoction to the bite site.

Table 10: Distribution of the snakebite victims by their distance from the General Hospital Kaltungo and Traditional healer

Distance (Km)	General hospital	Traditional lealer
<5	86 (60.6)	89 (65.0)
5-9	41 (28.9)	12 (8.8)
10-14	9 (6.3)	12 (8.8)
≥15	6 (4.2)	23 (17.4)
Total	142 (100)	137 (100)

About 60% of the victims reside within 5 Km radius from the General Hospital Kaltungo while about 10% of the victims reside 10 Km and over from the General Hospital Kaltungo.

About 65% of the snakebite victims reside within 5 Km distance from the traditional healer.

The mean distance to traditional healers' was 4.7 Km while median was 2.0 Km.

Table 11: Distribution of the snakebite victims by Time interval before treatment was accessed

Time interval (hrs)	Frequency	Percent (%)
<3	90	64.3
3-6	21	15.0
7-10	1	0.7
≥11	28	20.0
Total	140	100

In 90 (64.3%) cases of the snakebites, the victims were able to access treatment within 2 hours after the bite. On the other hand, significant proportion of the victims, 28 (20.0%) only accessed treatment after the first 10 hours following the bite.

Mean duration of delay was 12.2 hours while the median was 2.0 hours for the victims.

The figure below shows the places where the snakebite victims first sought care and treatment.

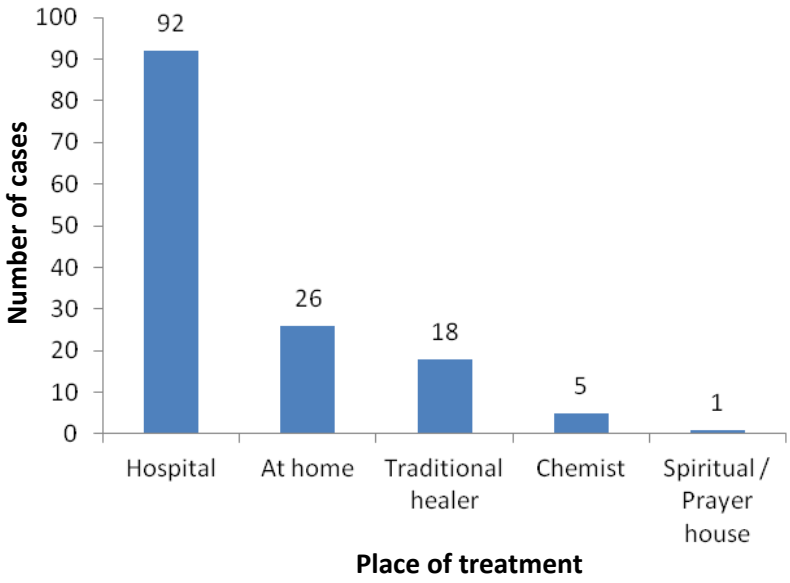


Figure 4: Distribution of the victims by places where victims first sought care following snakebites

In 92 (64.8%) of the cases, the victims were first taken to the Hospital for care and treatment. On the other hand, the remaining 50 (35.2%) victims first presented at other places for care and treatment.

Table 12: Distribution of the victims by the venue where snakebite victims received further care and treatment

Place of further treatment	Frequency	Percent (%)
No further treatment required	95	66.9
Hospital	40	28.2
Traditional healer	6	4.2
Home	1	0.7
Total	142	100

Responding to whether the victim required further care and treatment and where such additional care and treatments were given, 95 (66.9%) did not require further care, 40 (28.2%) victims that first received care elsewhere had to go to the hospital for further care and treatment, 6 victims (4.2%) said they received further care at traditional healer.

Table 13: Distribution of the victims by the reasons for their choice of treatment venue in Kaltungo

Reason for choice of treatment venue	Frequency	Percent (%)
Faster healing	39	27.5
Effectiveness of treatment	30	21.1
Cheapness of treatment	26	18.3
Closeness to victim's house	23	16.2
Possibility for free treatment	17	12.0
Most victims prefer there	6	4.2
Fewer death records	1	0.7
Total	142	100

The need for faster healing, 39 (27.5%), was the strongest reason why snakebite victims chose their treatment venue. Another strong reason was the effectiveness of the treatment (Table 13 above).

Out of the 132 snakebite victims that ended up at the General hospital Kaltungo, 115 (81.0%) received anti-snake venom, while the rest did not receive anti-snake venom or were not sure if anti-snake venom was administered. Of the 132 snakebite victims that received anti-snake venom, only 67 (47.2%) were ant-snake venom free of charge. Fifty one (35.9%) paid out of pocket, while the rest were not sure.

Table 14: Distribution of the victims by their sources of information about treatment venue in Kaltungo

Source of information	Frequency	Percent (%)
Relations	50	35.7
Friends	46	32.9
Another victim	35	25.0
Radio / TV	5	3.6
No prior knowledge	5	3.6
Papers / pamphlets	1	0.7
Total	142	100

Responding to their source of information about the treatment place, relations of the snakebite victims played a major role in the decision making, 50 (35.7%), followed by friends, 46 (32.9%). Five (3.6%) had no prior knowledge about the treatment place

Table 15: Distribution of the snakebite victims by duration of Illness due to the snakebite

Duration (days)	Frequency	Percent (%)
<11	43	30.3
11-20	46	32.4
21-30	34	23.9
31-40	2	1.4
41-50	6	4.2
≥51	11	7.7
Total	142	100

Following the snakebite, 46 (32.4%) of the victims received care for 11-20 days, while 43 (30.3%) received care for 1-10 days. On the other hand, 11 victims continued to receive care for at least 50 days.

The mean duration of the illness was 21.3 days, while median was 14.0 days.

Table 16: Distribution of the victims by the Cost of treatment for snakebite in Kaltungo

Cost (n × ₦1,000)	Frequency	Percent (%)
<10	21	31.8
10-19	17	25.8
20-29	11	16.7
30-39	7	6.1
≥40	13	19.7
Total	66	100

Out of the 142 victims, 75 (52.8%) were treated free of charge, 66 (46.5%) paid for anti-snake venom out of their pockets. Almost 20% of those that paid out of pocket spent over NGN 40,000 on treatment. The average cost spent by those that paid out of pocket was NGN 21,120,00.

Table 17: Distribution of the victims by the outcome of the overall care and treatment

Outcome of overall treatment	Frequency	Percent (%)
Completely healed	106	74.6
Felt better but had complication	26	18.3
Had to go to another place	5	3.5
Still on treatment	5	3.5
Total	142	100

Majority of the victims, 106 (74.6%), recovered completely from the illness due to the snakebite. Five snakebite victims were met still on admission at the General hospital Kaltungo at the time of data collection.

Table 18: Distribution of the victims' rating of their satisfaction with the overall outcome of treatment

Rating	Frequency	Percent (%)
Very dissatisfied	3	2.1
Dissatisfied	13	9.2
Satisfied	52	36.6
Very satisfied	74	52.1
Total	142	100

Over 50% were very satisfied with the outcome of the treatment, while 2.1% were very dissatisfied. In line with that, 133 (93.7%) said they will recommend the same venue they received care and treatment, while the remaining 9 (6.3%) said they will not recommend that same treatment venue.

Table 19: Socio-demographic factors related to snakebite among the respondents in Kaltungo

Socio-demographic Variables	Respondents' Snakebite status		OR (95% CI)	p-value
	Victims' n (%)	Non-victims n (%)		
Age (yrs)				
<18	2 (1.4)	1 (0.4)	3.99	0.26†
≥18	140 (98.6)	279 (99.6)	(0.2-235.9)†	
Sex				
Female	46 (32.4)	112 (40.0)	0.72	0.15
Male	96 (67.6)	168 (60.0)	(0.47-1.10)	
Educational level				
At least secondary	103 (72.5)	228 (81.4)	0.60	0.04
Below secondary	39 (27.5)	52 (18.6)	(0.37-0.96)	
Duration of stay in environment				
<2	4 (2.8)	6 (2.1)	1.32	0.45†
≥2	138 (97.2)	274 (97.9)	(0.27-5.68)†	

† = Fisher Exact used because one of the cells has expected value <5

Educational level of at least secondary school level was found to be statistically significant (OR=0.60) with P-value of 0.04

Table 20: Respondents' Personal practices that were related to snakebite in Kaltungo LGA

Personal practices	Respondents' Snakebite status		OR (95% CI)	p-value
	Victims' n (%)	Non-victims n (%)		
Palmyra palm fruit processing				
No	32 (22.5)	78 (28.1)	0.75	0.27
Yes	110 (77.5)	200 (71.9)	(0.47-1.19)	
Getting to farm while still dark				
Yes	59 (41.5)	106 (37.9)	1.17	0.53
No	83 (58.5)	174 (62.1)	(0.77-1.76)	
Working on farm barefooted				
Yes	64 (45.1)	145 (51.8)	0.76	0.23
No	78 (54.9)	135 (48.2)	(0.51-1.15)	
Using stick to move grass				
Yes	89 (62.7)	180 (64.3)	0.93	0.83
No	53 (37.3)	100 (35.7)	(0.61-1.42)	
Heaping grasses on the farm				
Yes	71 (50.0)	181 (64.6)	0.51	0.005
No	71 (50.0)	99 (35.4)	(0.36-0.82)	
Working on farm till it is dark				
Yes	60 (42.3)	161 (57.5)	0.54	0.004
No	82 (57.7)	119 (42.5)	(0.36-0.81)	
Storing crops on the farm				
Yes	15 (10.6)	27 (9.6)	1.11	0.90
No	127 (89.4)	253 (90.4)	(0.57-2.15)	
Storing crops outside house				
Yes	39 (27.5)	57 (20.4)	1.48	0.13
No	103 (72.5)	223 (79.6)	(0.93-2.37)	
Storing crops inside house				
Yes	128 (90.1)	251 (89.6)	1.06	0.99
No	14 (9.9)	29 (10.4)	(0.54-2.07)	
No need for light at night when going out				
Yes	29 (20.4)	58 (20.7)	0.98	0.95
No	113 (79.6)	222 (79.3)	(0.60-1.62)	
Always carry a light source at night				
Yes	114 (80.3)	235 (83.9)	0.78	0.42
No	28 (19.7)	45 (16.1)	(0.46-1.31)	
Walking at night barefooted				
Yes	49 (34.5)	80 (28.6)	1.32	0.25
No	93 (65.5)	200 (71.4)	(0.85-2.03)	
Prefer open shoes to cover shoes				
Yes	93 (65.5)	173 (61.8)	1.17	0.52
No	49 (34.5)	107 (38.2)	(0.77-1.79)	
Refuse dumped in or near house				
Yes	93 (65.5)	207 (73.9)	0.67	0.09
No	49 (34.5)	73 (26.1)	(0.43-1.04)	
Drying farm produce in or near house				
Yes	85 (59.9)	183(65.4)	0.79	0.32
No	57 (40.1)	97 (34.6)	(0.52-1.20)	
Farming activities within or near house				
Yes	105 (73.9)	211 (75.4)	0.93	0.84
No	37 (26.1)	69 (24.6)	(0.58-1.47)	
Palmyra fruits stored within or near house				
Yes	81 (57.0)	163 (58.2)	0.95	0.91
No	61 (43.0)	117 (41.8)	(0.63-1.43)	

Personal practices	Respondents' Snakebite status		OR (95% CI)	p-value
	Victims' n (%)	Non-victims n (%)		
Bushes within or around house				
Yes	108 (76.1)	200 (71.4)	1.27	0.37
No	34 (23.9)	80 (28.6)	(0.80-2.02)	
Compound fenced				
Yes	109 (76.8)	234 (83.6)	0.65	0.12
No	33 (23.2)	46 (16.4)	(0.39-1.07)	
Compound fenced with wall				
Yes	68 (54.8)	155 (62.8)	0.72	0.18
No	56 (45.2)	92 (37.2)	(0.47-1.12)	
Rearing chickens within or near house				
Yes	126 (88.7)	235 (83.9)	1.51	0.24
No	16 (11.3)	45 (16.1)	(0.82-2.78)	

The following personal practices were found to be statistically significant at p-value of 0.05

- Heaping grasses on the farm to pack them another day (OR=0.51; p-value=0.005)

- Working on farm till it is dark (OR=0.54; p-value=0.004)

All the factors that found to be statistically significant at P-values of 0.25 and below after bivariate analyses were subjected to unconditional multiple logistic regressions to rule out effect modifiers and confounders.

Table 21: Unconditional logistic regression for variables found to be statistically significant at bivariate analysis

Variables	OR	95% CI	p-value
Heaping grasses on the farm to pack another day (Yes / No)	0.65	0.41-1.04	0.07
Duration of stay in the environment (Yes / No)	0.79	0.20-3.09	0.73
Highest educational level attained (Below secondary / At least secondary)	1.88	1.12-3.18	0.02
Working late on the farm till it is dark (Yes / No)	0.49	0.30-0.80	0.004
House Compound was fenced (Yes / No)	0.79	0.46-1.34	0.38
Processes Palmyra palm fruits (Yes / No)	2.04	1.20-3.45	0.008
Sex of respondents (Male / Female)	1.62	1.02-2.55	0.04

The following 3 variables were found to be statistically significant risk factors for snakebite:

- Male Sex; OR=1.62 and P-value=0.04
- Not attaining Educational level up to secondary school level; OR=1.88 and P-value=0.02
- Processing Palmyra palm fruits; OR=2.04 and P-value=0.008

CHAPTER FIVE

DISCUSSION

Out of the 422 respondents interviewed 142 (33.6%) were victims of snakebites. The high proportion of snakebite in the study area may appear alarming. However, a study done in Asia in 2010 reported that 20% of the respondents or their families suffered from snakebite.[48] Majority (92.9%) of the respondents reported that snakes are common in Kaltungo LGA. Their reports were supported by the finding that, in about 85% of the households visited, snakes had entered their compound at a point in time in the past.

The study showed that males were more affected than females. The Male-to-Female ratio from this study was 1.2: 1. In the national epidemiological survey conducted in rural Bangladesh in 2010, they reported equal male: female ratio.[49] However, the study conducted in Niger Delta, southern Nigeria in 2013, it was reported that although women and teenagers spend less time in the fields, they encountered venomous snakes more than adult males.[4] Similarly, a study conducted in the hills of north India reported that 52.3% of the snakebites affected females.[50, 50] Several other studies reported a Male: Female ratios ranging from 1.5:1 to 2:1.[51,52,34] Some of those studies were hospital-based, while this study was a community-based study. It was reported that in the environment where this study was carried out, females go to farms as much as males, if not more in some settings. Since most snakebite occurs on farms, significant proportions of females are therefore at risk of snakebites. This may account for the slightly low Male: Female ratio in this study, compared to the other studies. Furthermore, findings from this study revealed that the male sex was significantly associated with increased risk of snakebite, with Odds ratio of 1.6. Thus, this study revealed that males are 1.6 times more likely to be at risk of snakebite compared to females.

In the study area, it was found that snakebites commonly affected people within the age range of 10-19 years (39.4%) and those in the age range of 20-29 (35.2%), among both sexes. Similar findings were reported in other studies.[3,49,50] The median age of the snakebite victims was 35 years. These categories of people that were commonly affected by snakebites are the young, active and usually productive age groups. Majority of them may not be Government employees at that age. Thus, they may have been actively engaged in farming and other business activities, in order to support themselves.[49] In fact, this research found out that about 41% of the snakebites took place on the farm, and that in about 35% of the times, the victims were engaged in farming activities at the time of bite. Thus, these findings corroborated other studies where snakebite was found to be an occupational hazard.[3,32] Similarly, the study on Estimate of the burden of snakebites in sub-Saharan Africa: A meta-analysis approach, that snakebite mostly affected the peasant farmers.[10] In the study conducted in Madurai District, Tamilnadu in 2012 people in age group of 31-40 years were affected most.[34]

Analysis revealed that those with educational level below secondary school education were nearly twice more likely to be at risk of snakebite, compared to those with at least secondary education. But since other findings from this study showed that nearly 80% of the respondents had attained at least secondary education, one expected to find fewer cases of snakebites in Kaltungo LGA. This apparent paradoxical finding of high cases of snakebites in Kaltungo, despite the relatively high literacy level, could partly be explained by the fact that only about 22% of the sampled populations are Government employees. Out of the remaining percentage, about 20% were farmers, while about 31% engaged in business or other activities like hunting and animal rearing. Farming, hunting and animal rearing are associated with increased risk of contact with snakes.

This study also revealed that 73.8% of the sampled population processed Palmyra palm either on a regular basis or occasionally. And they processed them mostly just outside their house compound (49.7%) or within the house compound (30.0%). When some of the exposure variables were subjected to unconditional logistic regression, it was found that processing Palmyra palm fruits was significantly associated with risk of snakebite in Kaltungo LGA. This finding suggested that those who process Palmyra palm fruits are at least two times more likely to be bitten by snakes when compared with those that do not process Palmyra palm fruits in Kaltungo LGA.

From this study, Cobra was more commonly implicated in the snakebites, followed by Carpet viper (62.6% and 26.4%), respectively). However, studies done in 2001 reported that Carpet viper was more involved than cobra.[53] Some other similar studies suggested that Carpet viper was associated with more morbidity and mortality than other snake species.[18,54] However, those studies were hospital-based and as such the snakes involved in the bites may have been identified by professional experts. This study was a community-based study. Some of the respondents may not have been able to identify the snakes involved, nor described them accurately. Nevertheless, the disproportion found from this study was quite high to ignore. A study conducted in northern India reported that 90.5% of the snake bites were by non-poisonous snakes.[50]

In terms of timing of the snakebites, it was found that 36.6% of the victims were bitten in the evening, while 32.4% at night. This finding was similar to the study done in 2012.[34] Another study reported that most snakebites occurred at nights, especially those involving Kraits specie.[55]

In this study the incidence of snakebite peaked in April and May (18.3% and 11.3%, respectively), while the lowest number of cases recorded was in July. The incidence then

increased again in December and January. In Nigeria, the traditional farming activities is seasonal, with clear major process like clearing of farmland, harrowing, planting, weeding, harvesting and storage.[79] In Kaltungo, like other parts of Nigeria, rainy season starts around April. Thus, most farmers clear their farmlands around April-May. In the process of clearing farmland, man often times inevitably come in contact with snakes, as the process disrupts and displaces such reptiles. This may be the explanation for the reported peak incidence of snakebites in Kaltungo in the months of April and May. Rainfall usually seizes temporarily around May-June. Before then, most farmers might have planted their farms and thus have some period of break around July. Again, this may logically explain the decline in number of cases of snakebites reported in this study. By November-December, most farmers harvest and process their farm produce for storage. Storage of farm produce in and around home environment attracts rodents, which in turn, attracts snakes.[49] In addition to that, December marks Christmas celebration. Many people travel from cities to their villages in order to celebrate. Such sudden surge of people into rural settings, coupled with presence of 'food for rodents and snakes increases the likelihood of snakebites. This, again, explains the raise in number of cases of snakebites again in the months of December and January.

The above pattern may be found in other parts of Nigeria, and even in some tropical African countries. In the epidemiological survey conducted in Nigeria in 2006, it was reported that snakebites occur mostly in the fertile areas of the country during planting and harvesting periods.[3] However, in that same study, data from General Hospital Kaltungo showed that in 2006, the highest number of cases was recorded in the months of October, followed by July, then August, while January had the least number of cases. A study conducted in Niger Delta, southern Nigeria in 2013 to correlate annual activity and patterns of venomous snakes, reported heighten

above-ground activity for both Elapidae and Viperidae during the wet season, and that Elapidae, in particular, showed significantly higher than expected activity from May to September.[4] The study conducted in the hills of North India reported a peak incidence in the months of August and September, while no bite was recorded in December, January and February.[50] Other studies similarly reported increase in seasonal incidence of snakebites during rainy seasons in other tropical countries, including Bangladesh, Mali, Benin, Ivory Coast, Ghana and Cameroon.[8]

In 71.8% of the snakebites, the lower limbs were involved, while in 26.1%, the upper limbs. That was expected, considering the fact that majority of the victims were bitten during farming activities or walking at nights. This finding corroborated studies done in Tamilnadu in 2012[34] and the one done in rural Bangladesh in 2010.[49]

Although from this study, 60% of the victims resided within 5 km radius to the General Hospital Kaltungo, data showed that the median time interval between snakebite to when the victim accessed treatment was 2.0 hours. About 80% of the victims had some form of first aid care, ranging from use of black stone, applications / ingestions of traditional concoctions, to incisions at the bite sites and applications of tourniquets at home, before presenting at the general hospital Kaltungo. In fact, 31% of the victims were first treated at home by a traditional healer. Though the implication of such delay and the use of harmful first aid care on the outcome and prognosis of the illness is again beyond the scope of this study, other research that correlated such delays and or use of first aid care before presenting for definitive treatment with outcomes showed an increased morbidity and mortality.[46,21] The study conducted in KwaZulu Natal in 2007 reported that 80% of the snakebite victims used traditional medicine, and 62.5% of them consulted a traditional health practitioner. The study further revealed that the median time till admission at a

hospital was 7hours 15min, while that of traditional health practitioner consultation was 15 minutes. It was concluded that traditional health practitioner consultation was associated with bite-to-hospital admission delay of more than 6hours.[46] Similarly, the study conducted in rural Bangladesh in 2010 reported that 86% of the victims had some form of management within 2 hours of the bite, while only 3% presented directly at a hospital for appropriate treatment.[49]

Data revealed that nearly all the victims that were first treated at home and about 2/3 of those first treated at traditional healers' places required further treatment at the hospital. Furthermore, this study revealed that over 60% of the snakebite victims in Kaltungo LGA first sought treatment at the General hospital Kaltungo. However, other studies in Nigeria and Kenya reported that only about 8.5 % of Nigerians and 27% Kenyan snakebite victims sought treatments at Hospitals.[56,59] The presence of the General Hospital Kaltungo for over 30 years in that LGA, and its free anti-snake venom program / scheme, no doubt had created good awareness in those communities in Kaltungo LGA, and thus, the changing pattern in health-seeking behavior of snakebite victims following snakebites.

Top among the reasons for the choice of treatment venues were the Need for faster healing (27.5%), Effectiveness of treatment (21.1%) and Cheapness of treatment (18.3%). The General Hospital Kaltungo is supposed to be providing antivenom free to snakebite victims that needed it. However, 48% of the respondents in this study reported that antivenom was not always available at the General Hospital. In fact, 46.5% of the snakebite victims reported that they paid for the antivenom given to them during their treatment. The average cost of NGN21, 120 ($136) spent by victims is far too expensive for most people in Kaltungo LGA. The findings in this

study corroborate finding reported in the 2012 analysis of African anti-snake venom market and the global context.[38]

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Snakebite is still a public health problem in Kaltungo LGA. Those affected most are the young and productive age group. Majority (41%) of the snakebites occurred on the farms during farming activities. Males were found to be 1.6 times more likely to be bitten by snakebites than females. People with educational level below secondary school were found to be about 1.8 times more likely at risk of snakebite compared with those with at least secondary school education. Those that process Palmyra palm fruits were found to be at least two times more likely to be bitten by snakes compared with those who do not process Palmyra palm fruits. Thus, the factors found to be associated with snakebites included male sex, farming activities, processing of Palmyra palm and lower literacy level.

The median time interval between snakebite to when the victim accessed treatment was 2 hours. During such intervals, about 80% of the victims tried some form of first aid care such as application of black stone, traditional concoctions, incisions and tourniquets. Nevertheless, this study found out that 60% of the snakebite victims sought treatment in Hospital.

6.2 Recommendations

1. Community Health Extension Workers should collaborate with ministry of Agriculture to educate people on how to protect themselves from snakebites during farming activities. Where possible the LGA should provide farmers with protective devices such as long utility hand gloves and long rain boots.
2. The Ministry of Information and Non Governmental Organizations (NGOs) should embark on mass enlightenment campaigns on the danger associated with processing of Palmyra palm fruits. The practice of gathering Palmyra palm fruits at night and storing them in and near house or compounds should be discouraged.
3. The Ministry of Health, Faith Based Organizations (FBOs), and Traditional leaders should continually discouraged the use of harmful first aid care following snakebite, especially, when it contributes in delay presentation at the Hospital.
4. The use of biological agents such as rearing of pigs and keeping cats in houses have been shown to help in preventing snakes coming near houses as well as reducing snake population. Community leaders where snakes are common should encourage such practices in their communities. In households where someone is allergic to cats and or pigs, chemicals known to repel snakes should be sprayed.
5. The Gombe state Government, through the Ministry of Education should work out modality to raise the literacy level, at least in areas mostly affected by snakebites.

REFERENCES

1. Bethwell O. O, Benson A. Mulemi J.O. K. No Title: Indigenous snake bite remedies. Journal of ethnobiology and ethnomedicine. 2005; 25(1):129–41.

2. Habib AG, Gebi UI OG. No Title: Snake bite in Nigeria. African journal of medicine and medical sciences. 30(3):171–8.

3. Nasidi A, Ph D. Snakebite as a serious Public Health problem for Nigeria and Africa The EchiTAb Study Group (ESG). 2007; (January).

4. Akani GC, Ebere N, Franco D, Eniang EA, Petrozzi F, Politano E, et al. Correlation between annual activity patterns of venomous snakes and rural people in the Niger Delta , southern Nigeria. 2013;19(1):1.

5. Hansson E, Cuadra S, Oudin A, De Jong K, Stroh E, Torén K, et al. Mapping snakebite epidemiology in Nicaragua--pitfalls and possible solutions. PLoS neglected tropical diseases [Internet]. 2010 Jan [cited 2013 Jun 19];4(11):e896. Available from: http://www.pubmedcentral.nih.gov/articlerender.

6. Chris GU, Colvin G. Emeritus E. Snakebite: the true disease burden has yet to be determined. T CEYLON Medical Journal. 2013;58(3):93–5.

7. Habib AG. Public health aspects of snakebite care in West Africa: perspectives from Nigeria. The journal of venomous animals and toxins including tropical diseases [Internet]. 2013 Jan [cited 2014 Aug 31];19(1):27. Available from: http://www.pubmedcentral.nih.gov/articlerender.

8. Chippaux J-P. Snake-bite: appraisal of global situation. Bulletin of th World Health Organization,1998. 76 (5): 515–24.

9. Omogbai EKI, Nworgu ZAM, Imhafidon MA, Ikpeme AA, Ojo DO, Nwako CN. Snake bites in Nigeria : A study of the prevalence and treatment in Benin City. 2002;1(June):39–44.

10. Chippaux J-P. Estimate of the burden of snakebites in sub-Saharan Africa: a meta-analytic approach. Toxicon : official journal of the International Society on Toxinology [Internet]. Elsevier Ltd; 2011 Mar 15 [cited 2013 May 22];57(4):586–99. Available from: http://www.ncbi.nlm.nih.gov/pubmed/21223975

11. WHO Expert Committee on Biological Standardization, Guidelines adopted at its 59th meeting in Geneva from 13 to 17 October 2008.

12. Warrell DA. Guidelines on mgt of snake bite. World Health Organization, Regional Office for South-East Asia; 2010

13. Morandi N, Williams J. Snakebite injuries : Contributing factors and intentionality of exposure. Wilderness and Environmental Medicine [Internet]. Elsevier; 1997;8(3):152–5. Available from: http://dx.doi.org/10.1580/1080-6032(1997)008[0152:SICFAI]2.3.CO;2

14. Mirtschin P. The pioneers of venom production for Australian antivenoms. Toxicon : official journal of the International Society on Toxinology [Internet]. 2006 Dec 1 [cited 2014 Aug 31];48(7):899–918. Available from: http://www.ncbi.nlm.nih.gov/pubmed/16938322

15. Haji R. Venomous snakes and snake bite. Prepared for Zoocheck Canada Inc. 2000;(July).

16. Dumavibhat B. A study of epidemiology, risk factors and preventive measures against snake bites. J Med Assoc Thai. [Internet]. 1997;80(9):547–56. Available from: http://www.ncbi.nlm.nih.gov/pubmed/9347666

17. Slouber MJ, Gāruda Medicine: A History of Snakebite and Religious Healing in South Asia Berkeley UC. Electronic Thesis and Dissertations. 2012; Available from:http://escholarship.org/uc/item/8rz8t2w7

18. Swaroop S, Grab B. Snakebite-mortality-in-the-world. Bull. Wld Hlth Org. 1954. 10, 35–76.

19. Kasturiratne A, Wickremasinghe a R, De Silva N, Gunawardena NK, Pathmeswaran A, Premaratna R, et al. The global burden of snakebite: a literature analysis and modelling based on regional estimates of envenoming and deaths. PLoS medicine [Internet]. 2008 Nov 4 [cited 2013 May 28];5(11):e218. Available from: http://www.pubmedcentral.nih.gov/articlerender.

20. Simpson ID, Norris RL. The global snakebite crisis--a public health issue misunderstood, not neglected. Wilderness & environmental medicine [Internet]. Elsevier; 2009 Jan [cited 2013 Jun 21];20(1):43–56. Available from: http://www.ncbi.nlm.nih.gov/pubmed/19364169

21. Management S. Snakebite Management in Asia & Africa. A guide to snakebite in the key areas for mortality and morbidity. Pakistan Medical Research Council

22. Onyiriuka AN. Snake-bite Poisoning in Childhood; Approach to Diagnosis and Management:Paediatrics Today 2012;8(1):11–21.

23. Gomes A, Das R, Sarkhel S, Mishra R, Mukherjee S. Herbs and herbal constituents active against snake bite. 2010;48(September):865–78.

24. Warrell D a. Snake bite. Lancet [Internet]. Elsevier Ltd; 2010 Jan 2 [cited 2013 May 28];375(9708):77–88. Available from: http://www.ncbi.nlm.nih.gov/pubmed/20109866

25. Panghal M, Arya V, Yadav S, Kumar S, Yadav JP. Indigenous knowledge of medicinal plants used by Saperas community of Khetawas , Jhajjar. 2010;1–11.

26. Owuor BO, Mulemi BA, Kokwaro JO. Indigenous Snake Bite Remedies of the Luo of Western Kenya INDIGENOUS SNAKE BITE REMEDIES OF THE LUO OF WESTERN KENYA. 2005;25(1):129–41.

27. Burnouf T, Griffiths E, Padilla A, Seddik S, Stephano MA, Gutiérrez J-M. Assessment of the viral safety of antivenoms fractionated from equine plasma. Biologicals : journal of the International Association of Biological Standardization [Internet]. 2004 Sep [cited 2013 Jun 14];32(3):115–28. Available from: http://www.ncbi.nlm.nih.gov/pubmed/15536042

28. Panfoli I, Calzia D, Ravera S, Morelli A. Inhibition of Hemorragic Snake Venom Components: Old and New Approaches. 2010;417–27.

29. Ismaila MS, Adamu SA. The impact of traditional methods of managing snake bite in humans and livestock among the Hausa-Fulani communities of Sokoto State (North-western Nigeria). Journal of Medicinal Plants Research [Internet]. 2012 Jul 25 [cited 2013 Jun 18];6(28):4489–93. Available from: http://www.academicjournals.org/jmpr/abstracts/abstracts/abstracts2012/25July/Ismaila and Adamu.htm

30. Hasson SS, Al-Jabri a a, Sallam T a, Al-Balushi MS, Mothana R a a. Antisnake Venom Activity of Hibiscus aethiopicus L. against Echis ocellatus and Naja n. nigricollis. Journal of toxicology [Internet]. 2010 Jan [cited 2013 Jun 15];2010:837864. Available from: http://www.pubmedcentral.nih.gov/articlerender.

31. Lopes A, Cruz LS, Roberto V. Snakebite Envenomation and Death in Developing World. Ethnicity and Disease 2009;19:S1–42.

32. Harrison R a, Hargreaves A, Wagstaff SC, Faragher B, Lalloo DG. Snake envenoming: a disease of poverty. PLoS neglected tropical diseases [Internet]. 2009 Jan [cited 2013 May 22];3(12):e569. Available from: http://www.pubmedcentral.nih.gov/articlerender.

33. Uzochukwu BS, Onwujekwe OE. Socio-economic differences and health seeking behaviour for the diagnosis and treatment of malaria: a case study of four local government areas operating the Bamako initiative programme in south-east Nigeria. International journal for equity in health [Internet]. 2004 Jun 17 [cited 2014 Jul 28];3(1):6. Available from: http://www.pubmedcentral.nih.gov/articlerender.

34. Bayapa RN, Magesh B, Singh RK et al: Factors Affecting the Snake Bite and Health Seeking Behavior of Snake Bitten Individuals of Madurai District, Tamilnadu. Nat.J.Res.Com.Med. 2012;1(2).

35. Papers W, Yangon S. Management of Snakebite and Research. Report and Working Papers of a Seminar 2001 (December) World Health Organization, Regional Office for South-East Asia, New Delhi

36. Few R, Ahern M, Matthies F, Kovats S. Floods , health and climate change : a strategic review Floods , health and climate change :A strategic review. 2004;(November).

37. Mq A, George P, Ks B. Study of Seasonal Variation in Snake Bite Patients Admitted To a Mangalore Based Tertiary Care Hospital. 2014;13(3):72–4.

38. Brown NI. Consequences of neglect: analysis of the sub-Saharan African snake antivenom market and the global context. PLoS neglected tropical diseases [Internet]. 2012 Jan [cited 2013 Jun 12];6(6):e1670. Available from: http://www.pubmedcentral.nih.gov/articlerender.

39. Riman HB, Akpan ES. Healthcare Financing and Health outcomes in Nigeria : A State Level Study using Multivariate Analysis. 2012;2(15):296–309.

40. Kyei-nimakoh M, Arhin D, Aikins M. Socio-economic Differentials in Health Care Seeking Behaviour and Out-Of-Pocket expenditure for OPD Services in Madina Township. 2012;2(4):32–41.

41. Owuor BO, Kisangau DP. Kenyan medicinal plants used as antivenin: a comparison of plant usage. Journal of ethnobiology and ethnomedicine [Internet]. 2006 Jan [cited 2013 Jun 21];2:7. Available from: http://www.pubmedcentral.nih.gov/articlerender.

42. Akande M, Owoyemi JO. Healthcare-Seeking Behaviour in Anyigba , North-Central , Nigeria. 2009;3(2):47–51.

43. Abubakar A, Van Baar A, Fischer R, Bomu G, Gona JK, Newton CR. Socio-cultural determinants of health-seeking behaviour on the Kenyan coast: a qualitative study. PloS one [Internet]. 2013 Jan [cited 2014 Aug 31];8(11):e71998. Available from: http://www.pubmedcentral.nih.gov/articlerender.

44. Ukwaja KN, Alobu I, Nweke CO, Onyenwe EC. Healthcare-seeking behavior, treatment delays and its determinants among pulmonary tuberculosis patients in rural Nigeria: a cross-sectional study. BMC health services research [Internet]. BMC Health Services Research; 2013 Jan [cited 2014 Jul 28];13(1):25. Available from: http://www.pubmedcentral.nih.gov/articlerender.

45. Mmari KN, Oseni O, Fatusi AO. STI treatment-seeking behaviors among youth in Nigeria: are there gender differences? International perspectives on sexual and reproductive health [Internet]. 2010 Jun;36(2):72–9. Available from: http://www.ncbi.nlm.nih.gov/pubmed/20663743

46. Sloan DJ, Dedicoat MJ, Lalloo DG. Healthcare-seeking behaviour and use of traditional healers after snakebite in Hlabisa sub-district, KwaZulu Natal. Tropical medicine & international health□ : TM & IH [Internet]. 2007 Nov [cited 2013 Jun 20];12(11):1386–90. Available from: http://www.ncbi.nlm.nih.gov/pubmed/18045265

47. Brock EM, Howard WE. CONTROL METHODS FOR SNAKES. Vertebrate Pest Conference Proceedings collection 1962;Paper 4;2–6. Available from;http://digitalcommons.unl.edu/vpcone

48. Myanmar S. Snakebite Research Study. Assessing the risks and exploring solutions to the snakebites problem in Magway, Pakkoku and Shwebo; CWS Asia/Pacific

49. Rahman R, Faiz MA, Selim S, Rahman B, Basher A, Jones A, et al. Annual incidence of snake bite in rural bangladesh. PLoS neglected tropical diseases [Internet]. 2010 Jan [cited 2013 Jun 5];4(10):e860. Available from: http://www.pubmedcentral.nih.gov/articlerender.

50. Pandharinath RR. Short reports. Journal of Ayurveda and integrative medicine [Internet]. 2012 Jul;3(3):164–7. Available from: http://www.ncbi.nlm.nih.gov/pubmed/23564900

51. Inamdar IF, Aswar NR, Ubaidulla M, Dalvi SD. O RIGINAL A RTICLES Snakebite□ : Admissions at a tertiary health care centre in. 2010;100(7):456–8.

52. Logaraj M, Thirumavalavan R, Gopalakrishnan S. Epidemiology of snakebite reported in a Medical College Hospital in Tamil Nadu. 2013;2(1):53–5.

53. Habib AG, Gebi UI OG. No Title: Snake bite in Nigeria. African journal of medicine and medical sciences. 2001;30(3):171–8.

54. Chippaux JP. Snakebite-appraisal-of-the-global-situation. Reviews / Analyses. Bulletin of the World Health Organization, 1998. 76 (5) 515-524

55. Ogunfowokan O. Bite-to-hospital time and morbidity in victims of viper bite in a rural hospital in Nigeria. African Journal of Primary Health Care & Family Medicine [Internet]. 2012 Feb 14 [cited 2013 Jun 24];4(1):1–7. Available from: http://www.phcfm.org/index.php/phcfm/article/view/371

56. Eric K.I. Omogbai, Zuleikha A.M. Nworgu, Micheal A. Imhafidon, Anwakang A. Ikpeme, David O. Ojo CNN. Snake bites in Nigeria:A study of the prevalence and treatment in Benin City.

57. Dehesa-Davila M, Alagon A, Possani L. Clinical toxicology of Scorpion stings. In: Meier J, White J, editors. Handbook of Clinical toxicology of animal venoms and poisons. Boca Raton, Florida: CRC Press; 1995. P.221-38

58. Warrell DA. Clinical toxicology of snakebites in Asia. In: Meier J, White J, editors. Handbook of Clinical toxicology of animal venoms. Boca Raton, Florida: CRC Press;1995. P493-594

59. Snow RW, Bronzan R, Roques T, et.al. The Prevalence and Morbidity of snakebite and Treatment-seeking behavior among rural Kenyan population. Annals of Tropical Medicine and Parasitology 1994; 88: 665-71.

60. Rahman R, Faiz MA, Selim S, et.al. Annual Incidence of snakebite in rural Bangladesh. PLoS Neglected Tropical Diseases 2010; 4: e860

61. Sharma SK, et al. Snake bites and Dog bites in Nepal: Community-based studies on snake and dog bites. Toxicon. 2002;

62. MC Crindle JW. Ancient India as Described by Megasthenes and Arrian. Calcutta: Thacker, Spink and Co. 1877: 218-219

63. Holve S. Envenomation: Snakebite: In: Kliegman RM, Behrman RE, Jenson HB, Stanton BF (eds). Nelson Textbook of Paediatrics 18th edn, Philadelphia, Saunders Elsevier 2007:2932-5

64. Lallo DG, Theakston RD. Snake antivenoms. J Toxicol Clin Toxicol 2003; 41:277-90, 317-27

65. Theakston RD, Warrell DA, Griffiths E. Report of a WHO workshop on the standardization and control of antivenoms. Toxicon 2003; 41: 541-57

66. Warrell DA. Clinical toxicology of snakebite in Asia. In: Meier J. White J, editors. Handbook of Clinical toxicology of animal venom and poisons. Boca Raton, Florida: CRC Fress; 1995. P.493-594.

67. Knowles R. The mechanism and treatment of snakebite in India. Trans R Soc Trop Med Hyg. 15 (1921) 72.

68. Abubakar MS, Sule MI, Pateh UU, Abdurrahman EM, et.al. 2000. In vitro snake venom detoxifying action of the leaf extract of Guiera senegalensis. Journal of Ethnopharmacology 69 (3) 253-257

69. Otero R, Fonnegra R, Jimenez SL, et.al. Snake bites and ethnobotany in the northwest region of Colombia: Part I: traditional use of plants, J Ethnopharmacol, 71 (2000) 505.

70. Asuzu IU and Harvey AL. The anti-snake venom activities of *Parkia biglobosa* (Mimosaceae) stem bark extract. Toxicon, 42 (2003) 763

71. Girish KS, Mohanakumari HP, Nagaraju S, et.al. Hyaluronidase and protease activities from Indian snake venom: neutralization by *Mimosa pudica* root extract, Fitoterapia, 75 (2004) 378

72. Olaniyan O, and Lawanson A. (2010). Health Expenditure and Health Status in Northern and Southern Nigeria: A Comparative Analysis Using NHA Framework. Paper presented at the 2010 CSAE conference held at St. Catherine College, University of Oxford, Oxford, UK

73. Ichoku HE, and Fonta WM. (2006) The Distributional Impact of Healthcare Financing in Nigeria: A Case Study of Enugu State. PMMA Working Paper No. 17: 3-22

74. WHO, 2000. General Guidelines for Methodologies on Research and Evaluation of Traditional Medicine

75. WHO 2001. Promoting the Role of Traditional Medicine in Health System: A Strategy for the African Region

76. Akereke O. 1987. The Best of Both Worlds: Bringing Traditional Medicine Up to Data. Social Science and Medicine, 24 (2), 177-181

77. Abdullahi AA. Trends and Challenges of Traditional Medicine in Africa. Afr J Tra.dit Complement Altern Med. 2011; 8 (5 Suppl): 115-123

78. Osowole O, Ajaiyeoba E, Akinboye D, Fawole O, et.al. 'A Survey of Treatment Practices for Febrile Illnesses Among Traditional Healers in the Nigerian Middle-Belt Zone.' Afr J Tradit Complement Altern Med. 2005; 2 (3): 337-344

79. NDES: Environmental and socio-economic characteristics. Vol.1. Abuja: Niger Delta Environmental Survey (NDES); 1998:271

APPENDICES

Appendix 1: Ethical approval

SECRET
GOMBE STATE OF NIGERIA
MINISTRY OF HEALTH HEADQUARTERS

All correspondence to be: -
Addressed to the
Hon. Commissioner

State Secretariat

P.M.B 042 Gombe
Gombe State
072-220244
222988

Our Ref.: MOH/ADM/S/1151/VOL.I **Date: 24th January, 2014.**

Dr. Isma'ila Habila,
Department of Obstetrics and Gynecology,
State Specialist Hospital,
PMB 018,
Gombe State.

RE- APPLICATION FOR ETHICAL CLEARANCE TO DO A RESEARCH.

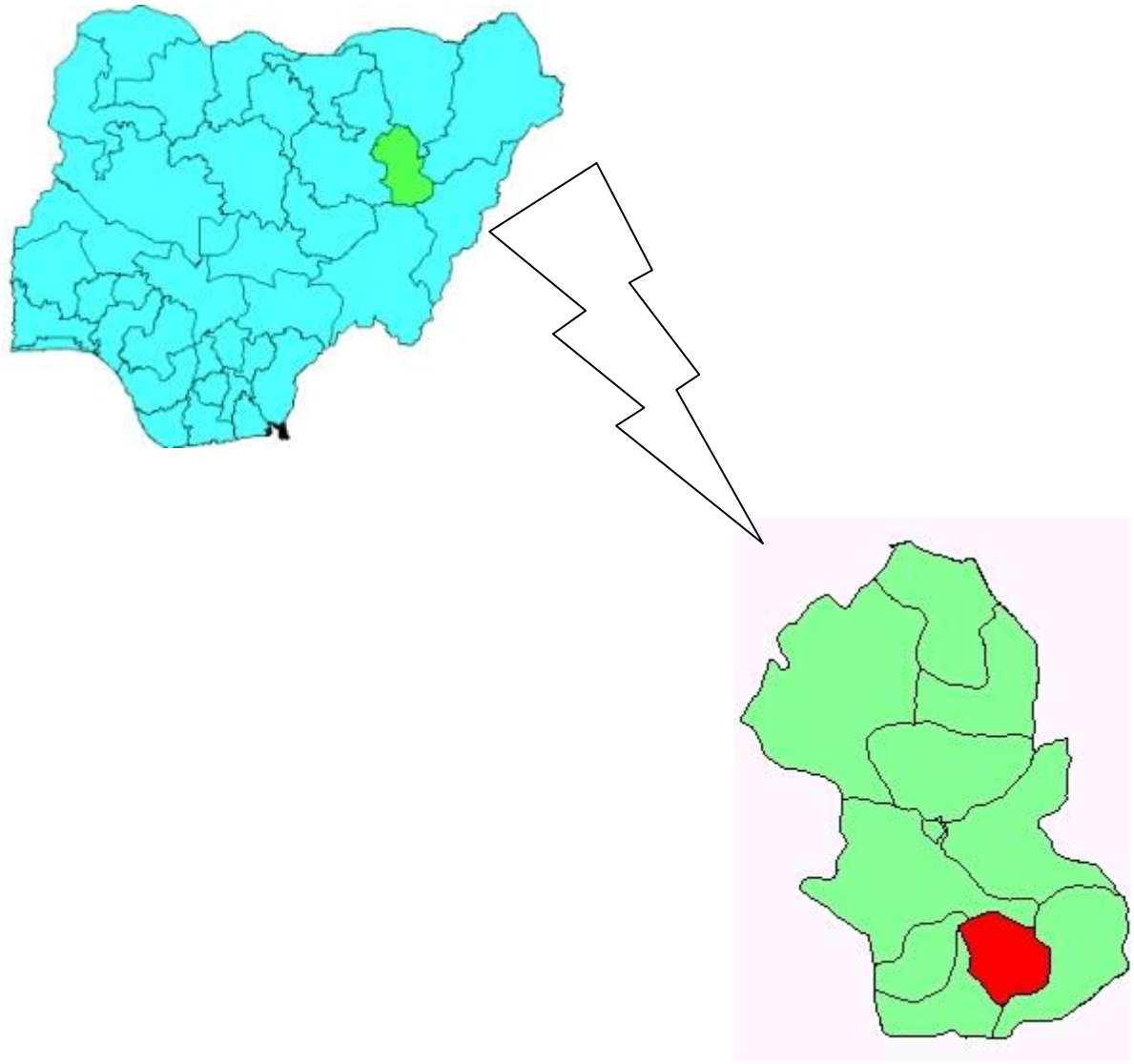
Your letter dated 6th December, 2013 on the above subject matter refers. After due and careful consideration of your request; I have been directed to convey approval of the Medical Research Ethical Committee of the State Ministry of Health to you. This is to enable you carryout a research on factors associated with Snake bite and health seeking behavior of Snake bite victims in Kaltungo, Gombe State.

It is our understanding that patient/clients confidentiality will be observed and maintained throughout your study, and the Ministry of Health will have assess to your findings and recommendation.

Accept the assurances of the Hon. Commissioner's kind regard.

DR. J. M. DILLA
CHAIRMAN MEDICAL RESEARCH
ETHICAL COMMITTEE.

Appendix 2: Map of study area.



Map of study area: Nigeria, Gombe state and Kaltungo LGA

Legend:

Nigeria

Gombe state

Kaltungo LGA

Appendix 3: Consent form

INFORMED CONSENT FORM

Questionnaire No…….

Study Title: Factors associated with Snakebite and Health seeking behavior of snakebite victims in Kaltungo, Gombe state, Nigeria, 2013.

Names and Affiliations of the researcher: This study is being conducted by Dr. Ismaila Habila, a resident of Nigeria Field Epidemiology and Laboratory Training Program (NFELTP) as a requirement for the award of Masters Degree (MPH) in Field Epidemiology.

Purpose of the study: To learn more about the factors associated with snakebite in Kaltungo, Gombe state and to assess the health seeking behavior of snakebite victims in Kaltungo, Gombe state.

Procedure of the research: This study is being conducted in 12 settlements all within 5 political wards in the LGA. Your household has been selected to participate in this study in your settlement. If you agree to participate in this study, you will be interviewed regarding factors associated with snakebite and health seeking behavior of snakebite victims. The interview should take between 10 – 15 minutes. We hope to interview 844 households in this study.

Risk: This is a minimal risk study. Some questions to be asked may seem to be reminding you of a bitter experience you had or you may be slightly uncomfortable with other questions. You are free however, to choose to answer or not answer any of the questions asked.

Benefit: You may not benefit directly from this study. However, many families suffer directly or indirectly from snakebite as a result of complications or mortality associated with snakebite. It is our hope that this study would form a basis for the development of an integrated multifaceted approach that would help reduce the burden of snakebite in Kaltungo, Gombe state and even Nigeria as a country.

Incentives: No material or financial incentive will be given to participants. However, transportation support would be given to new victims of snakebite who need to be transported to health care facility.

Voluntary participation: Your participation in this research is voluntary. However, your involvement would go a long way in alleviating the burden snakebite poses on affected

communities. Your honest response will generate information that will help, among others, unravel some reasons why some snakebite victims prefer to seek treatment in some other places rather than hospital.

Confidentiality: In order to ensure that no one can link your interview responses to you, your name will not appear on the questionnaire or be used in any report or publication. Any information you provide will be treated with utmost confidentiality and be used only for knowledge gain and improving the quality of care given to victims of snakebites.

Statement of person giving consent: Now that the study has been well explained to me and I fully understood the content of the study process, I am willing to take part in this study.

Signature / Thumbprint if participant ……

Date of interview ……

Appendix 4: Study Instrument

FACTORS ASSOCIATED WITH SNAKEBITE AND HEALTH SEEEKING BEHAVIOR OF SNAKEBITE VICTIMS IN KALTUNGO LGA, GOMBE STATE

SECTION 1

Socio-demographic data:

Q1. Age (years): ……

Q2. Sex: (a) Male (b) Female

Q3. Marital status:

(a) Single (b) Married (c) Divorced (d) Widowed

Q4. What is the highest educational level you have attained?

(a) Primary (b) Secondary (c) Post secondary

(d) Quranic (e) None

Q5. Tribe: (a) Tangale (b) Fulani (c) Hausa (d) Others (specify) …….

Q6. Occupation: (a) Student (b) Business (c) Government employee (specify)…….

(d) Herdsman (animal rearing) (e) Farmer (f) Snake charmer (g) Others (specify) ……

Q7. How long have you been living in this place? …….

Q8. Please categorize the number of people in your household using the format below;

Category	Females	Males
(a) <1yr	----------	----------
(b) 1-4yrs	----------	----------
(c) 5-14yrs	----------	----------
(d) 15-24yrs	----------	----------
(e) 25-49yrs	----------	----------
(f) ≥50yrs	----------	----------

Q9. Please estimate how much you earn, roughly, on daily basis. ……

SECTION 2

Background knowledge and Health system practice:

Q10. Have you seen a live snake before? (a) Yes (b) No

Q11. Are snakes common in this environment? (a) Yes (b) No (c) Don't know

Q12. Has snake ever come into your house / compound? (a) Yes (b) No (c) Don't know

Q13. Have you seen anyone bitten by snake before? (a) Yes (b) No

Q14. Do all snakebites present with symptoms? (a) Yes (b) No (c) Don't know

Q15. Is snakebite treatable? (a) Yes (b) No (c) Don't know

Q16. Where are snakebites treated? (Please choose only one option)

(a) At home (b) Traditional healer (c) Spiritual healer

(d) Chemist (e) Hospital (f) Don't know

(g) Other (Please specify) ----------

Q17. Do snake bite victims that go to the place mentioned above get treated free?

(a) Yes (b) No (c) Sometimes (d) Don't know

Q18. Do snake bite victims that go to hospital get treated free?

(a) Yes (b) No (c) Sometimes (d) Don't know

Q19. Does government provide anti-snake venom free at the hospital?

(a) Yes (b) No (c) Don't know

Q20. If Yes, Is it always available?

(a) Yes (b) No (c) S Don't know

Q21. How can snakebite be prevented? (Please choose all that applies)

(a) Stop handling "kanje / Giginya (d)Use light source at night

(b) Wear long boot while farming (e) Health education

(c) Stop sleeping outside (f) Others (please specify) ……

SECTION 3

Factors associated with snake bite:

Q22. Has anyone in your household been bitten by snake before? (a) Yes (b) No

Q23. If response is **No** to Q22 above, please **skip to Q35.**

Q24. If response is **Yes** to Q22 above, how many people were bitten by snake? ……..

Q25. When did the last incident occur? …….

Q26. What month of the year did the incident occurred? ----------

Q27. How old was the snake bite victim when the incident occurred? (Answer in years) ……

Q28. What is the sex of the snake bite victim? (a) Female (b) Male

Q29. Was the snake identified? (a) Yes (b) No (c) Can't remember

Q30. If yes, what type of snake was it?

(a) Carpet Viper (b) Cobra (c) Black mamba (d) Python

(e) Other (Please specify) ----------

Q31. Where did the snake bite occur?

(a) Inside a room (b) Outside, within the compound (c) Outside, near the compound (d) On the farm (e) In the bush (f) Along foot path (e) Other (Please specify) ----------

Q32. What was the snake bite victim doing at the time of the bite?

(a) Farming (b) Rearing animals (c) Climbing trees (d) Handling "Kanje/Giginya"

(e) Walking at night (f) Fetching firewood (g) Sleeping outside (h) Sleeping inside a room (i) Hunting (j) Playing with snake (k) Others (please specify) ----------

Q33. What time of the day did the snakebite occur?

(a) Morning (b) Evening (c) Night

Q34. What part of the body was the site of the snake bite?

(a) Hands (b) Legs (c) Face (d) Others (please specify) ----------

Q35. Do you process Palmyra palm ("Kanje / Giginya")

(a) Yes (b) No (c) Sometimes

Q36. If yes, where do you process it?

(a) On the farm (b) Just outside the house compound (c) Within the house compound (d) Other (Please specify) ----------

Q37. Please choose Yes or No for each option. When you are working on the farm or garden;

(a) You normally get to the farm very early, while it is still dark ……Yes [ ] no [ ]

(b) You are more comfortable working bare footed. ……Yes [ ] No [ ]

(c) You use stick to move grass or leaves before you put hands …….Yes [ ] No [ ]

(d) You heap grasses on the farm and pack them another day …… Yes [ ] No [ ]

(e) You normally work till it is dark before leaving the farm ……..Yes [ ] No [ ]

Q38. Please choose Yes or No for each option. After harvesting crops from your farm;

(a) You immediately transport all to market and sell ……Yes [ ] No [ ]

(b) You store them on the farm ……Yes [ ] No [ ]

(c) You transport them home but store them outside the house ……..Yes [ ] No [ ]

(d) You transport them home and store them inside the house …….Yes [ ] No [ ]

(e) You transport them to a central store for storage …….....Yes [ ] No [ ]

(f) Other (please specify) ----------

Q39. Please choose Yes or No for each option. When going out at night;

(a) You do not need to carry a light source ……Yes [ ] No [ ]

(b) You always carry a light source. …… Yes [ ] No [ ]

(c) You normally walk bare footed ……..Yes [ ] No [ ]

(d) You prefer wearing open shoes to cover shoes ……Yes [ ] No [ ]

Q40. Please observe the home environment and tick accordingly.

(a) Are there refuse dumped in or near the house? …….Yes [ ] No [ ]

(b) Are there farm produce dried in or near the house? …….Yes [ ] No [ ]

(c) Are there evidence of farming activities within or near the house? …..Yes [ ] No [ ]

(d) Are there Palmyra palm fruits ("Kanje / Giginya") within or near the house?. Yes [ ] No [ ]

(e) Are there bushes within or around the house/ . ……Yes [ ] No [ ]

(f) Is the compound fenced? ……Yes [ ] No [ ]

(g) If the compound is fenced, is it with wall? ……Yes [ ] No [ ]

(h) Do they rare chickens within or near the house? …….Yes [ ] No [ ]

SECTION 4

Health seeking behavior:

Q41. . Generally, when you are sick, what do you do? (Please comment on each option)

(a) Immediately buy medicine from medicine vendor / trader ……Yes [ ] No [ ]

(b) Ignore it at first till became very severe …….. Yes [ ] No [ ]

(c) Pray over it / go for spiritual healing …….Yes [ ] No [ ]

(d) Visit Chemist for treatment ……..Yes [ ] No [ ]

(e) Visit Hospital for treatment ……..Yes [ ] No [ ]

(f) Others (Please specify) ----------

NB: Q42 to Q59 is to be filled for victims of snakebite please.

Q42. Was the victim the breadwinner of the family?

(a) Yes (b) No (c) Don't know

Q43. What symptoms of snakebite did you observed in the victim? (Choose all that applies)

(a) Bleeding from different parts of the body (b) Fever (c) difficulty breathing

(d) Weakness / inability to move part of the body (e) Peeling of the skin (f) No symptom at all (g) Others (specify) ……

Q44. What form of first aid treatment was given to the snake bite victim? (Please choose all that applied)

(a) Black stone (b) Traditional concoction applied (c) Traditional concoction ingestion (d) Incisions at bite site (e) Tourniquet applied (f) Nothing was done as first aid (g) Other

Q45. How long after the snakebite before the victim access treatment? ……

Q46. Where was the snakebite victim first treated? (Please choose only one option)

(a) At home (b) Traditional healer (c) Spiritual / Prayer house

(d) Chemist (e) Hospital (f) Other (Please specify) ----------

Q47. Where did the snakebite victim received further treatment? (Please choose only one option)

(a) At home (b) Traditional healer (c) Spiritual / Prayer house

(d) Chemist (e) Hospital (f) No further treatment was required

Q48. If treated at the hospital, was anti-snake venom administered?

(a) Yes (b) No (c) Don't know (d) Not applicable

Q49. If anti-snake venom was administered, was it given free of charge?

(a) Yes (b) No (c) Don't know (d) Not applicable

Q50. What strong reason informed the choice of treatment venue for the victim? (Please choose only one option)

(a) Closeness to victim's house (b) Possibility of getting treated free of charge

(c) Cheapness of treatment (d) Effectiveness of treatment (e) Faster healing

(f) Fewer deaths records (more likely to survive) (g) Most snake bite victims prefer to be treated there (h) Other (Please specify) ----------

Q51. How did the victim / relations get to know about the treatment venue?

(a) Through another snake bite victim (b) Through friends (c) Through relations (d) Over the radio / TV (e) Read about it in papers / pamphlets (f) No prior knowledge (g) Other (Please specify) ----------

Q52. Please estimate, in kilometers, how far is the General hospital from your house? …….

Q53. Please estimate, in kilometers, how far is the Traditional healer from your house?

Q54. How long did the illness due to the snake bite lasted? (Please give answer in weeks or months) …….

Q55. Was the snake bite victim treated free of charge? (a) Yes (b) No (c) Don't know

Q56. If response is No to Q46, please estimate roughly how much is the cost of the treatment. ……

Q57. What was the outcome of the overall treatment?

(a) Completely healed (b) Felt better but had complications (c) Not felt better, had to go to another place (d) Died as a result of the snake bite (e) Other (Please specify) ----------

Q58. How would you rate your satisfaction with the outcome of the treatment?

(a) Very dissatisfied (b) Partly dissatisfied (c) Satisfied (d) Very satisfied

Q59. Would you recommend the same treatment venue to other snake bite victims?

(a) Yes (b) No

SECTION 5

Prevention and Way forward:

Q60. What suggestion (s) do you have that may reduce the burden of snakebite in this community?

……
……
……
……
……
……
……
……

Q61. What do you want the government do to reduce the burden of snakebite in this community?.....
.....
.....
.....
.....
.....

Thank you for your time.