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RISK-BASED ASSESSMENT AND MAPPING OF MALARIA DISTRIBUTION IN RURAL KWARA STATE

Oluwasogo A. OLALUBI, PhD

March, 2017

RISK-BASED ASSESSMENT AND MAPPING OF MALARIA DISTRIBUTION IN RURAL KWARA STATE

Final Report

By

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Principal Investigator
Adeyemi Mufutau AJAO, PhD
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Prepared Under Grant from
Tertiary Education Trust Fund (TETFUND)

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MARCH, 2017

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Our huge appreciation also goes to the Community Team Leaders at Elemere, Gbugudu, Apodu and Asomu for co-ordinating effective communication between the research team and the community members.

To the whole community members, we say thank you for support, solidarity, acceptance, prompt uptake and ownership of the intervention activities launched at all study settlements.

To the Director, Centre for Community Development, in person of Mr Lawal OLORUNGBEBE, for initial release of some of his community field work staff that was eventually co-opted into the Malaria Research Group, we appreciate your support sir.

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mobilization, participation and logistics administration, supplies at the rural settlements under studied.
Lastly, to the Tertiary Education Trust Fund (TETFUND) for providing institutional support in form of capability strengthening grant for this work. We are immensely grateful.

TABLE OF CONTENTS **Page**

Acknowledgments **iii**

Executive Summary **v**

Chapter One: **1**

Institution Based Research (IBR) Final Template

Chapter Two: **5**

Community Diagnosis of Acute Uncomplicated *Plasmodium Falciparum* Malaria

Chapter Three: **21**

Predicting Malaria Risk Vulnerability with Geographical Information System (GIS) Mapping

Chapter Four: **34**

Intervention Strategies and Capability Development

Chapter Five: **49**

Final Expenditure

Chapter Six: **55**

Conclusions and Recommendations

Chapter Seven: **57**

References

EXECUTIVE SUMMARY

Despite the possibility of being preventable, malaria has a high level of mortality and morbidity and is the world's most prevalent parasitic disease. It is caused by infection with single-celled parasites of the genus *Plasmodium*, which is transmitted by the bite of female *Anopheles* mosquitoes. In Nigeria, statistics shows that malaria accounts for 25% of the under-five mortality, 30% of childhood mortality and 11% of maternal mortality (Okonko *et al*., 2009). All Nigerians are at risk of malaria and the problem is compounded by the increasing resistance of malaria to hitherto cost-effective drugs and insecticides (Okonko *et al*., 2009). Describing in detail the spatial and temporal variation in transmission and disease risk is fundamental to epidemiological understanding and control of malaria. Risk maps are, by definition, outcomes of models of disease transmission based on spatial and temporal data. These models incorporate, by varying degrees, epidemiological, entomological, climate and environmental information. Decades of experience confirm that successful malaria control depends on accurate identification and geographical reconnaissance of high-risk areas (Carter *et al*., 2000). In the past, malaria risk maps at different geographical levels were largely based on expert opinion based on limited data, crude climate isolines with no clear and reproducible numerical definition. In recent years, the availability of new data sources such as remote sensing (RS) and mapping tools, such as computerized geographic information systems (GIS) for quantitative analysis of spatial data, have provided an unprecedented amount of information and increased capability to describe, predict and communicate risk and outcome of interventions (Berquist, 2001). Measures that might be mapped include categories of endemicity (*e.g.* unstable, mesoendemic or holoendemic), vector density and capacity, entomological inoculation rate (EIR) and incidence of disease. However, although malaria endemicity can vary widely over only short distances, most of these measures have only been studied in a few, widely separated localities. In general, results from different sites differ.

Our corporate effort in this research work focuses on utilization of Geographic Information Systems (GIS) hardware, software and training to map the incidence/prevalence of malaria over some geographic area. The GIS map incorporate physical environmental risk variables such as vegetation covers, rivers, pond and streams, housing and drainage pattern, ecological and topographical lay-out, built up status of the settlements and vectorial interphase and interactions with potential host communities could serve as an environmental model to predict Malaria distribution in selected settlements neighbourhood of Kwara State University, Malete, Nigeria. In this study, Apodu settlement showed a high vulnerability index due its dense vegetation and the presence of impounded water in the dam. Apodu and Elemere had the highest malaria vulnerability index within 300m radius. That is, the vulnerability index increases as one moves away from the center of the settlement. Futhermore, the Fulani who stay some few meters away from the centre of settlements were more at risk. However, Gbugudu was at highest risk at 100 *m* buffer (60%) but the vulnerability index decreases as one move away from the settlement centre. The absence of thick vegetation and presence numerous cultivated farmlands on the eastern part could have been possible explanation for this reduction in vulnerability index (Appendix 2).

Over the years, one of the challenges in malaria management, particularly among children, is inaccurate diagnosis of the condition (Olukosi *et al*., 2015). Clinical diagnosis of malaria without laboratory support may lead to malaria misdiagnosis and maltreatment (Oladosu and Oyibo, 2013). The focus here is to examine past trends through available medical records, as well as the present situation with the possibility of correlating current malaria incidence / prevalence among the population in order to calculate populations at risk, malaria parasite stage distribution by settlement, age-group and occupation. The goal with these studies is to see if any obvious patterns exist, but the study neither found evidence of existing interventions nor medical records. We conducted routine

screening to scale-up malaria diagnosis comparing Rapid Diagnostic Tests (RDTs) and Giemsa Microscopy techniques. The RDT results revealed a 37% malaria prevalance in all three communities combined while Light microscopy recorded 48% positivity rate. However, with Light microscopy, Apodu community had a higher infected to non-infected persons ratio at 58.7% to 41.3% than Gbugudu and Elemere, both of which showed lower prevalence rates at 30.3% and 46.2% respectively (Appendix 1; Table2 & 7). Rings and trophozoite stages were the two most pronounced stages detected under the light microscope. Most (56.9%) of the malaria cases were found to have parasites at the "Ring Stage", while the others (43.1%) had progressed to the "Trophozoite Stage". Out of One hundred and thirty five (135) individual that were screened and diagnosed for Malaria, (44/135) 32.6% Yoruba and (21/135) 15.6% Fulani were positive respectively (Appendix1). We therefore infer that both techniques could be employed to detect malaria infection, however, Giemsa microscopy method demonstrated higher sensitivity and effectiveness over RDT for being able to resolve and detect low parasitaemia, symptomatic and asymptomatic cases. Results obtained from this study confirm that the microscopy method remains the reference standard and a better diagnostic tool for malaria diagnosis in the laboratory than the RDTs in limited resources endemic zones.

Results from this study indicate that the degree of malaria parasitaemia in the three settlement correlates directly with the remote sensing data (Appendix 1&2).

We recommend more appropriate land utilization and engagement, environmental sanitation and consistent re-training of household leaders (fathers, mothers and grandparents) and caregivers on causal factors and prevention of malaria in the rural communities under studied to be able to effectively assess the effect of intervention program provided. The essence would be for the villagers to take responsibility for ownership and be able to self-apply and manage these approaches.

CHAPTER ONE
ANNEX 1
INSTITUTION BASED RESEARCH (IBR)
FINAL TEMPLATE

Title of Research Project:
Risk-Based Assessment and Mapping of Malaria Distribution in Rural Kwara State.

Name and Address of Institution:
Kwara State University, Malete. PMB 1530, Ilorin, Kwara State.

Tetfund Reference No:
KWASU/CSP/062215/VOL3/TETF/0030

Name and Address of Principal Researcher:
Dr. Oluwasogo A. OLALUBI
Head, Department of Public Health
School of Basic Medical Sciences
College of Pure and Applied Sciences
Kwara State University, Malete
PMB 1530, Ilorin, Kwara State

Tenure of the Project:
12 Months

Total Amount Approved:
₦1,370,875.00

Total Amount Received:
₦ 1,370,875.00

Final Expenditure (give details on a separate sheet):
(Appendix 4)

Objective(s) of the Project and whether objectives achieved (give details):

1. To scale-up of routine screening through Rapid Diagnostic Tests (RDTs) and Giemsa Microscopy techniques for community diagnosis of acute uncomplicated *Plasmodium falciparum* malaria episode. The RDT results revealed a 37% malaria prevalance in all three communities combined while Light microscopy recorded 48% positivity rate.

However, with Light microscopy, Apodu community had a higher infected to non-infected persons ratio at 58.7% to 41.3% than Gbugudu and Elemere, both of which showed lower prevalence rates at 30.3% and 46.2% respectively (Appendix 1; Table2 & 7). Rings and trophozoite stages were the two most pronounced stages detected under the light microscope. Most (56.9%) of the malaria cases were found to have parasites at the "Ring Stage", while the others (43.1%) had progressed to the "Trophozoite Stage". Out of One hundred and thirty five (135) individual that were screened and diagnosed for Malaria, (44/135) 32.6% Yoruba and (21/135) 15.6% Fulani were positive respectively (Appendix1). We therefore infer that both techniques could be employed to detect malaria infection, however, Giemsa microscopy method demonstrated higher sensitivity and effectiveness over RDT for being able to resolve and detect low parasitaemia, symptomatic and asymptomatic cases. Results obtained from this study confirm that the microscopy method remains the reference standard and a better diagnostic tool for malaria diagnosis in the laboratory than the RDTs in limited resources endemic zones. This view is supported by Wilson, 2013 who posited that the sensitivity of microscopy is not 100% but varies from region to region and depends to some extent on the skill of the microscopist (Olukosi *et al*., 2015) and the degree of parasitaemia in a given specimen (Appendix1).

2. Evaluation of the effectiveness of current interventions at reducing morbidity and mortality due to malaria with RDTs as markers and available medical records. The study neither found evidence of existing interventions nor medical records.

3. Development of Geographic Information System (GIS) maps

incorporating environmental risk variables such as vector/parasite habitat distribution, dispersal dynamics, and interactions with potential host communities. The vulnerability index utilised was mainly defined by vegetation cover and built-up status of the environment. Apodu showed a high vulnerability index due its dense vegetation and the presence of impounded water in the dam. Apodu and Elemere had the highest malaria vulnerability index within 300m radius. That is, the vulnerability index increases as one moves away from the center of the settlement. Futhermore, the Fulani who stay some few meters away from the centre of settlements were more at risk. However, Gbugudu was at highest risk at 100 *m* buffer (60%) but the vulnerability index decreases as one move away from the settlement centre. The absence of thick vegetation and presence numerous cultivated farmlands on the eastern part could have been possible explanation for this reduction in vulnerability index (Appendix 2)

4. Determination of the associations of malaria infection in specific rural communities with environmental variables using remote sensed (GIS) and laboratory (RDT and Giemsa Microscopy) data. This is as infered in Objective 3 above. (Appendix 1&2)

5. Conduct of awareness training of household leaders (fathers, mothers and grandparents) and caregivers on causal factors and prevention of malaria in the rural communities to be studied. Members of all three communities were educated about the hazard status of malaria and the vulnerability risk possed by the conditions of their proximal environment. Long lasting insectide treated nets (LLITNs) were also distributed to the community members with medication provided to infected persons (Appendix 3)

6. Monitoring and evaluation of the possession and universal coverage of the tool so as to achieve sound and sustainable malaria control programme: Intervention deployed are Long Lasting Insecticide Treated BedNets (LLITNs), Pain Medications and Antimalarial Drugs. The first line brand of Artemisinin Based Combination Therapy (ACT), a fixed two doses daily over three days of Artemether / lumefantrine combination therapy were administered by the medical personnel for all malaria positive cases (Appendix 3).

Implementation of Intervention: Target Individuals ranging from children under ten, adolescent youth, Middle and Old aged men and women and pregnant women were divided into groups called strata using stratification method of sampling. The total number in each groups were made to be proportionate to the available resources for the intervention. Post-Intervention diagnosis and screening was conducted to determine current malaria status or burden in the three settlements so as to assess the success and effectiveness of the intervention tool and programme.

Summary of the findings of the study (Use separate sheet):

(Find attached Appendix 1 &2)

Value added to knowledge

(Find attached Appendix 1 &2)

Challenges/difficulties if any, experienced in implementing the project:

The study could not find reliable secondary data (medical health records) of members of the three communities under study.

Dissemination of the findings (publications of the results in journals, monographs, etc; Presentation in conferences & seminars, etc)

Manuscript is being developed for presentation at the forthcoming Vectors, Pathogens and Diseases: Current Trends and Emerging Challenges: Keystone Symposia coming up September 10-14, 2017; Venue: Southern Sun Elangeni & Maharani Durban, KwaZulu-Natal, South Africa.

Signature of Principal Researcher: Signature of Chairman IRC:



23-03-2017

Signature of Head of Department: Signature of Head of Institution:



23-03-2017

CHAPTER TWO
APPENDIX1:
COMMUNITY DIAGNOSIS OF ACUTE UNCOMPLICATED *PLASMODIUM FALCIPARUM* MALARIA EPISODE WITH RAPID DIAGNOSTIC TESTS (RDTS) AND GIEMSA MICROSCOPY TECHNIQUES

Background: Malaria exerts an unacceptably high toll on children in Africa, where 80% of estimated malaria cases and 90% of deaths occur, especially in Nigeria (WHO, 2015a). Early diagnosis and prompt, effective treatment are recommended in malaria control guidelines (WHO, 2015b). However, most cases of malaria in Africa are still diagnosed presumptively (WHO, 2015c), with consequent over-diagnosis of malaria because the symptoms and signs of malaria are generally nonspecific (Falade *et al.,* 2016). WHO recommends that all malaria case management be based on parasitological diagnosis (Drakeley *et al.,* 2009), a policy that was adopted by the Nigerian National Malaria Programme in 2011 (FMOH, 2011). The recommended parasitological tests are light microscopy and immunochromatographic rapid diagnostic tests (RDTs). Microscopy of Giemsa-stained blood smears remains the gold standard for confirmation of malaria diagnosis. Microscopy has numerous advantages. It allows identification and quantitation of the causative organism. It is also cheap and excellent in competent hands. However, light microscopy is not a feasible option in most parts of sub-Saharan Africa most especially Nigeria, because of irregular electricity to power microscopes that are in short supply. In addition, suitably trained laboratory technicians are not generally available Malaria RDTs are more practical at the point of care in communities where community health workers (CHWs) can be trained in their use, as they do not require electricity or special equipment. RDTs may also detect *Plasmodium* infection even when the parasites are sequestered in the deep vascular compartments and thus undetectable by microscopic examination of a peripheral blood smear. High-quality RDTs have become available (WHO, 2015c) and are now the preferred option for programmatic deployment by many national

malaria control programs, including Nigeria (FMOH, 2011), because of their simplicity and speed in yielding reliable results. Histidine-rich protein II (HRP2)–based RDTs are the preferred options for tropical areas, where *Plasmodium falciparum* is responsible for >95% of malaria infections. In addition, HRP2-based RDTs can withstand better than the enzyme-based RDTs the heat and temperature fluctuations of tropical Africa, where refrigeration and air conditioning are not always feasible. Many have demonstrated their sensitivity, specificity, ease of performance, and reading (Hendriksen, 2011).

Deployment of sound diagnostic deliverables remains a crucial component of malaria control and prevention programme in Nigeria. One of the challenges in malaria management, particularly among children, is inaccurate diagnosis of the condition (Olukosi *et al*., 2015). Clinical diagnosis of malaria in a region with many tropical infectious diseases has limited reliability since signs and symptoms are similar for many of these diseases. Clinical diagnosis of malaria without laboratory support may lead to malaria misdiagnosis and maltreatment (Oladosu and Oyibo, 2013).

Methods

Study Sites: The studies were conducted in rural communities of Apodu, Gbugudu, Elemere, all situated at the axis or at the outskirts or neighbourhood of Kwara State University, Malete, Moro Local Government, Area of Kwara State, Nigeria. A total of One hundred and thirty five (135) individual were screened and diagnosed for Malaria with light microscope and rapid diagnostic kits (Care Start™, Malaria HRP2 (Pf) between October 2015 till December 2016. The inhabitants are mostly peasant Yoruba farmers, Fulani herdsmen, students and few civil servants and traders. A few significant proportions of inhabitants have at least primary school education. Of the 8 rural settlements / wards, with an estimated total population of 1,317 and 20 were children <5 years of age, 18 adolescent youth of between 6-15 years, 56 married adults of between 16-50 years, 41 aged individuals of above 50 years were selected for this study. The climate is that of a tropical rainforest with a warm dry season from

November to April and a rainy season from May to October. Malaria transmission occurs year round, with a peak during the rainy-season months and a nadir during the dry-season months. Children between the ages of 3 and 60 months who presented to CHWs (usually with fever or a recent history of fever suggesting
malaria), irrespective of the degree of severity of the illness, were enrolled. 5mls of venous blood was collected from all subjects for thin and thick blood film preparation for Giemsa microscopy and Rapid Diagnotics test (RDT).

Rapid Diagnostic Test

CareStart™ Malaria HRP2 (Pf) Cat No: G0141, for in vitro diagnostic use, store at 1°-40°C Access Bio, Inc. 65 Clyde Road, Suite A, Somerset NJ, 08873 U.S.A. www.accessbio.net. A rapid test for the detection of malaria histidine rich protein2 (HRP2) in human blood, an HRP2-based immunochromatographic test which detects HRP2 antigen that is specific for P. falciparum detection was used in this study. This RDT has very high performance as reported in the most recent annual RDT evaluation program [3] and is approved for public sector procurement by the National Malaria Program of Nigeria [13]. All enrollees were screened for malaria using RDT following the manufacturer's instructions. The Malaria RDT was considered negative when only the control line was visible, positive when both control and test lines were visible, and invalid when a control line was not seen, irrespective of whether a test line was visible. Test lines were considered present whether faint or deep. Used RDT cassettes were collected at least once in 2 weeks from the CHWs and re-read by a trained research staff with >6 years' experience reading RDT cassettes. The study cassettes were re-read by the same clinical research assistant and by a senior investigator when necessary. All RDTs were from a single batch, stored at the recommended temperature of 4°C–30°C, and were used within shelf life.

Giemsa-Stained Microscopic Diagnosis

All enrollees in the study had thick and thin blood smears prepared on microscope slides from both the same finger prick used for RDTs and

5 mls venous blood collected in EDTA bottles. Dried blood smears were stained with fresh Giemsa stain at pH 7.2 using standard procedures (Ajumobi *et al.,* 2015). Stained blood smears were screened in the Microbiology laboratory, College of Pure and Applied Sciences, for the presence and quantification of malaria parasites using bifocal Olympus light microscopy at a magnification of ×1000. All blood smears were double-read by 2 experienced malaria microscopists blind to the result of RDTs. Diagnosis of malaria was based on identification of asexual stages (ring and trophozoite) of *Plasmodium* on thick blood smears. Parasite density was determined by counting the number of asexual parasites against approximately 200 leukocytes on the thick blood film and converted to parasites per microliter using an assumed total white blood cell count of 8000 cells/μL (WHOc, 2015). Blood films were declared negative if no parasite was seen after viewing 200 high power field.

Data Management

Data were entered into EpiData and transferred to Stata software for analysis. With results of microscopy taken as the gold standard, the sensitivity and specificity of the RDT were calculated.

Ethical Approval

All aspects of the study were approved by Kwara State University Research Committee and Ethical Review Board. Verbal and written Informed consent was obtained from all the community leaders /respondents in the three major settlement screened. They were assured of voluntary participation, confidentiality of their test results and responses and the opportunity to withdraw at any time without prejudice in line with the Helsinki Declaration was emphasized (World Medical Association, 2001). The history, demographic data of presenting clients or respondents were obtained and entered into the case report form (CRF) and study register.

Result of Malaria Diagnosis

Table 1: Microscopic Distribution of Malaria by Tribe					
		Parasite Count / Stage			Total
		Ring Stage	Trophozoite Stage	Negative	
Tribe	Yoruba	27	17	53	97
	Fulani	10	11	17	38
Total		37	28	70	135

Out of One hundred and thirty five (135) individual that were screened and diagnosed for Malaria, (44/135) 32.6% Yoruba and (21/135) 15.6% Fulani were positive respectively (Appendix1).

Figure 1 Microscopic Distribution of Malaria by Tribe

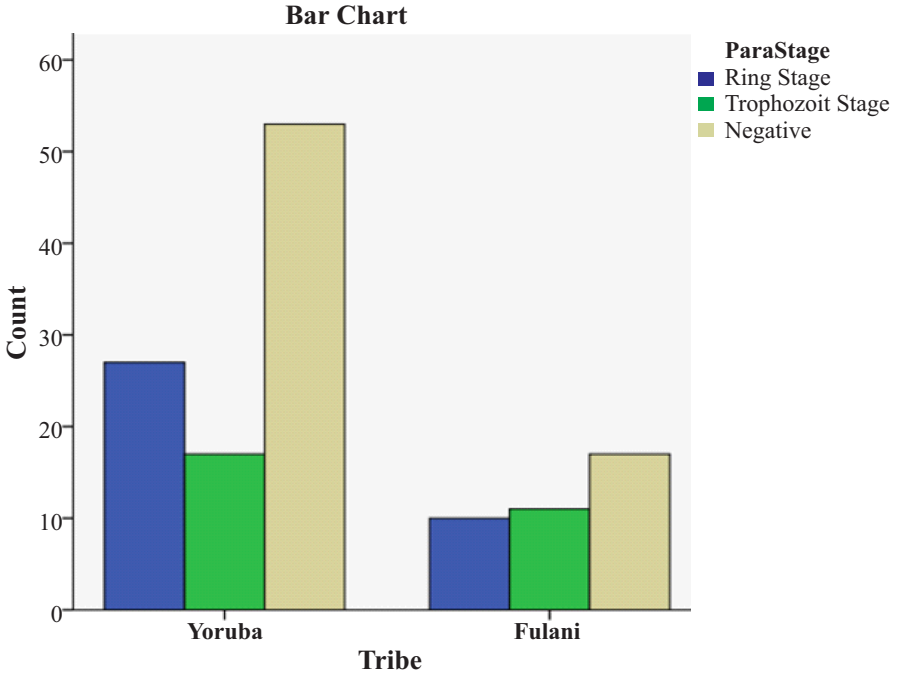


Table 2: Microscopic Evaluation of Malaria Burden among the Three Settlements under Studies

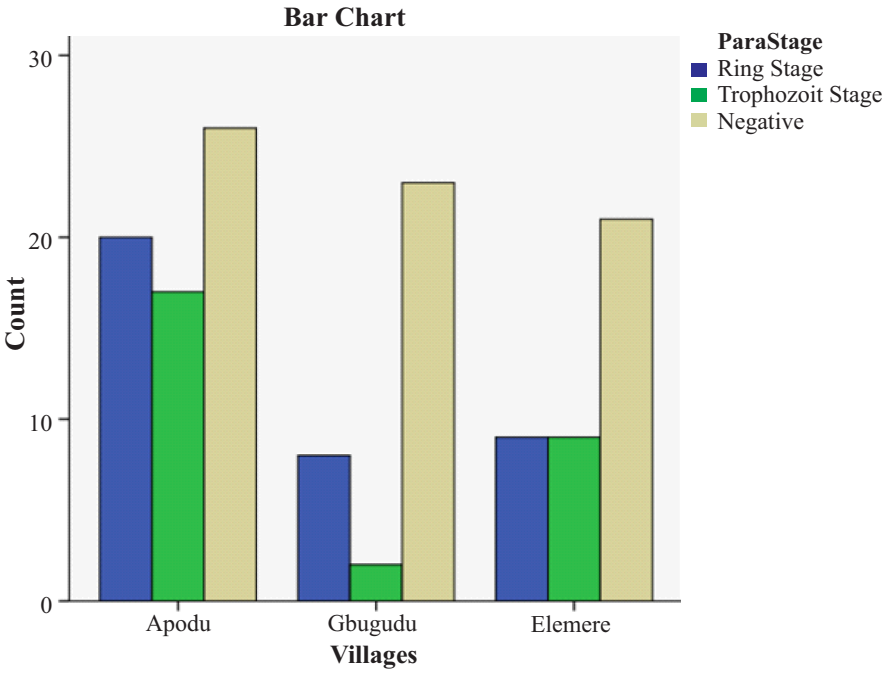
		Parasite Count / Stage			Total
		Ring Stage	Trophozoite Stage	Negative	
Villages	Apodu	20	17	26	63
	Gbugudu	8	2	23	33
	Elemere	9	9	21	39
Total		37	28	70	135

Out of One hundred and thirty five (135) individual screened and diagnosed for Malaria with light microscope, (37/63) 58.7%, 30.3% and 46.2% prevalent rate were recorded for Apodu, Gbugudu and Elemere settlement respectively.

Figure 2: Malaria Parasite Stage Distribution by Settlement

Rings and trophozoite stages were the two most pronounced stages detected under the light microscope. Most (56.9%) of the malaria cases were found to have parasites at the "Ring Stage", while the others (43.1%) had progressed to the "Trophozoite Stage".

Table 3: Malaria Parasite Stage Distribution by Age Group



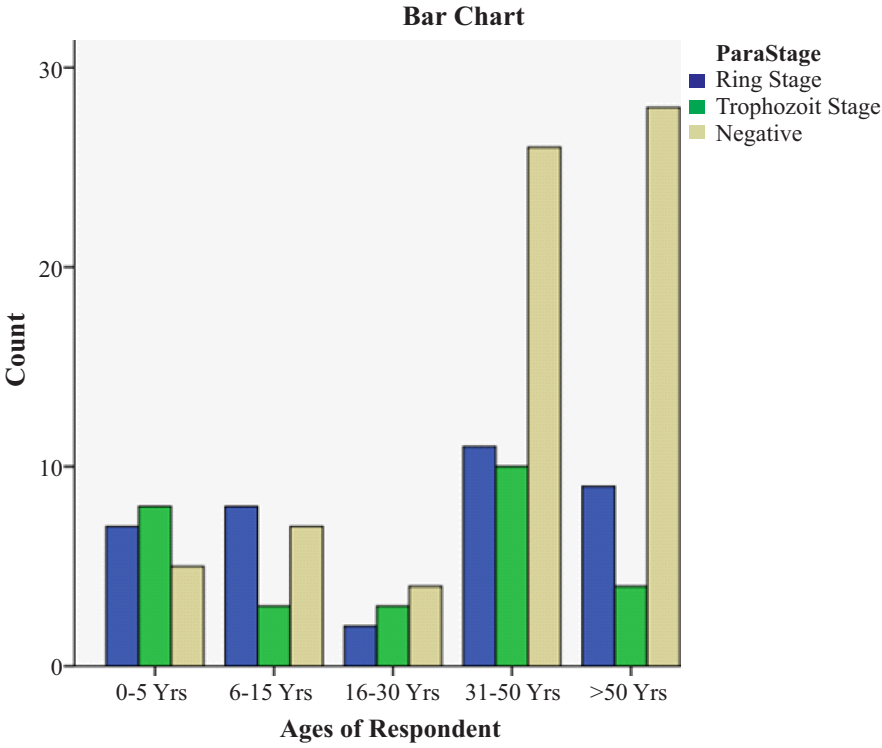
Rings and trophozoite stages were the two most pronounced stages detected under the light microscope. Most (56.9%) of the malaria cases were found to have parasites at the "Ring Stage", while the others (43.1%) had progressed to the "Trophozoite Stage".

Table 3: Malaria Parasite Stage Distribution by Age Group

Ages of Respondent (Years)	Parasite Count / Stage			Total	% Malaria Distribution
	Ring Stage	Trophozoite Stage	Negative		
0-5	7	8	5	20	11.1
6-15	8	3	7	18	8.2
16-30	2	3	4	9	3.7
31-50	11	10	26	47	15.6
>50	9	4	28	41	9.6
Total	37	28	70	135	51.8

Malaria distribution trend follow the order 31-50, > 0-5, > above 50, >6-15, >16-30.
Highest malaria parasite distribution was among individual of age range 31-50 followed by children under five while lowest parasite distribution was detected among age range 16-30 years.

Figure 3: **Malaria Parasite Stage Distribution by Age Group**



Out of One hundred and thirty five (135) individuals screened and diagnosed for Malaria, (35/135) 25.9% and (30/135) 22.2% were positive male and female respectively as demonstrated in table 4 below

Table 4: Malaria Distribution by Gender

Count					
		Parasite Stage			Total
		Ring Stage	Trophozoite Stage	Negative	
Gender of Respondent	Male	21	14	28	63
	Female	16	14	42	72
Total		37	28	70	135

Figure 4: Malaria Distribution by Gender

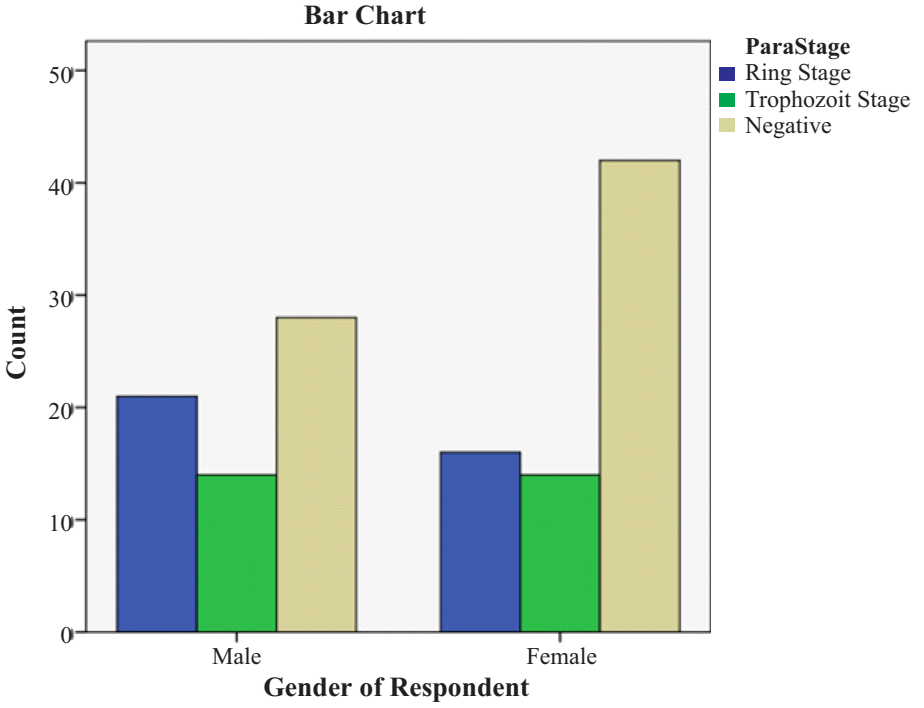


Table 5: Malaria Distribution by Occupation

Respondent's Occupation	Parasite Stage			Total
	Ring Stage	Trophozoite Stage	Negative	
Farming	8	4	22	34
Herdsman	1	0	1	2
Students	12	1	11	34
Trading	10	10	33	53
Housewife	4	1	3	8
Civil servant	2	2	0	4
Total	**37**	**28**	**70**	**135**

Out of One hundred and thirty five (135) individual screened, (12/135) 8.9% (farmers), (1/135) 0.7% (herdsman), (23/135) 17.0% (students), (20/135) 14.8% (traders), (5/135) 3.7% (housewife) and (4/135) 3.0% civil servants were positive for acute uncomplicated malaria respectively.

Table 6: Evaluation of Malaria Burden among the Three Settlements under Studies with Rapid Diagnosis Test kits

Count					
		RDT			Total
		Ring Stage	Negative	Non-Compliance	
Villages	Apodu	29	34	0	63
	Gbugudu	5	28	0	33
	Elemere	16	22	1	39
Total		50	84	1	135

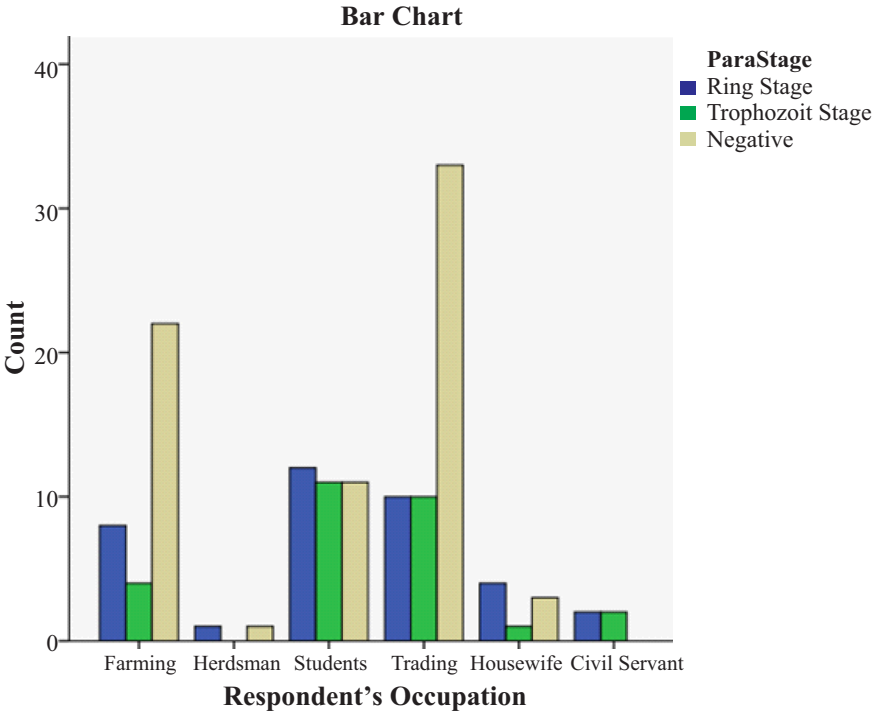


Table 6: Evaluation of Malaria Burden among the Three Settlements under Studies with Rapid Diagnosis Test kits

Count					
		RDT			Total
		Ring Stage	Negative	Non-Compliance	
Villages	Apodu	29	34	0	63
	Gbugudu	5	28	0	33
	Elemere	16	22	1	39
Total		50	84	1	135

Out of total One hundred and thirty five (135) individual diagnosed for Malaria with RDT kits in the three settlement, (29/63) 46%, (5/33) 15.2% and (16/39) 41% were positive to malaria at Apodu, Gbugudu and Elemere settlement respectively.

Figure 6: Evaluation of Malaria Burden among the Three Settlements under Studies with Rapid Diagnosis Test kits

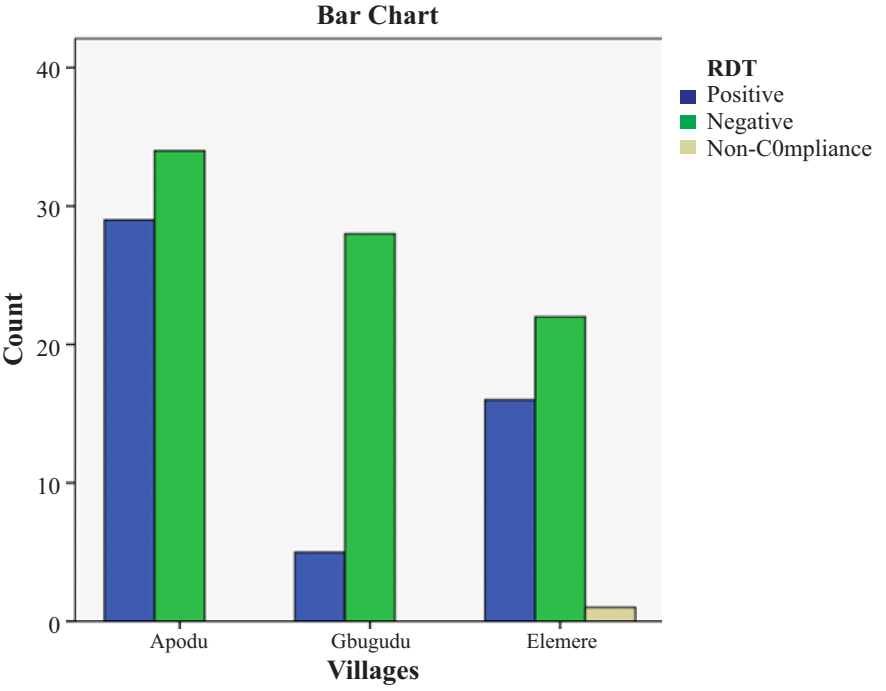


Table 7: Comparative assessment of RDT and Giemsa Microscopic Techniques for Malaria Diagnosis

RDT		Light Microscopy	
Settlement	Malaria Burden (%)	Settlement	Malaria Burden (%)
Apodu	(29/63) 46	Apodu	(37/63) 58.7
Gbugudu	(5/33) 15.2	Gbugudu	(10/33) 30.3
Elemere	(16/39) 41	Elemere	(17/39) 43.5

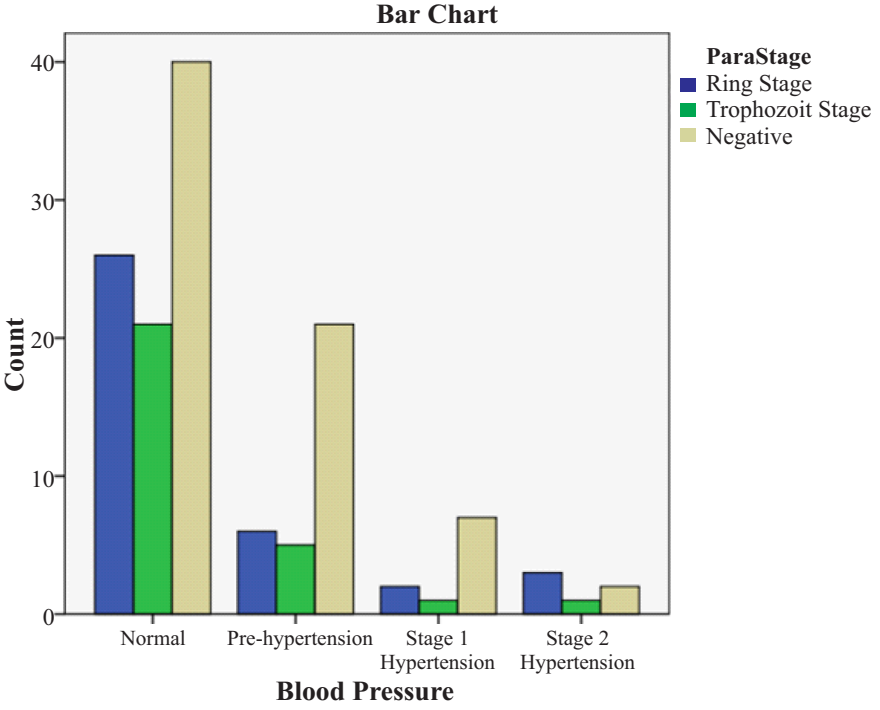
The RDT results revealed a 37% malaria prevalance in all three communities combined while Light microscopy recorded 47.4% positivity rate. However, with Light microscopy, Apodu community had a higher infected to non-infected persons ratio at 58.7% to 41.3% than Gbugudu and Elemere, both of which showed lower prevalence rates at 30.3% and 43.5% respectively (Appendix 1; Table2 & 7). We therefore infer that both techniques could be employed to detect malaria infection, however, Giemsa microscopy method demonstrated higher sensitivity and effectiveness over RDT for being able to resolve and detect low parasitaemia cases. Results obtained from this study confirm that the microscopy method remains the reference standard and a better diagnostic tool for malaria diagnosis in the laboratory than the RDTs in limited resources endemic zones. This view is supported by Wilson, 2013 who posited that the sensitivity of microscopy is not 100% but varies from region to region and depends to some extent on the skill of the microscopist (Olukosi et al., 2015) and the degree of parasitaemia in a given specimen.

Table 8: Malaria Distribution and Blood Pressure Status

Count					
		Parasite Stage			Total
		Ring Stage	Trophozoite Stage	Negative	
Blood Pressure	Normal	26	21	40	87
	Pre-hypertension	6	5	21	32
	Stage 1 Hypertension	2	1	7	10
	Stage 2 Hypertension	3	1	2	6
Total		37	28	70	135

Out of One hundred and thirty five (135) individual diagnosed for Malaria, (11/135) 8.1% positive cases were at pre-hypertension stage while (2/135) 1.5% and (4/135) 3.0% positive cases were at stage 1 and stage 2 hypertension respectively.

Figure 6: Malaria Distribution and Blood Pressure Status



Discussion and Conclusion

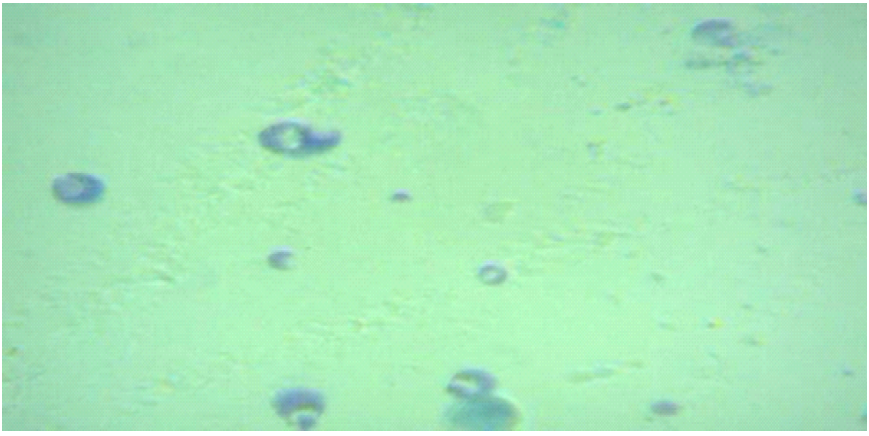
Though, examination of a thick blood smear by Giemsa staining technique remains the preferred method for malaria diagnosis, it is however labour-intensive and time consuming. It requires ability of a trained microscopist to identify malaria parasite even at low parasitaemia level . As reliable as this technique is, a few cases may still be missed. Nonetheless, Giemsa microscopy offers a lot of advantages over other diagnostic techniques. Microscopic examination of blood films for malaria is only feasible in standard laboratory settings which are often unavailable in many rural areas. Consequently, the use of rapid diagnostic technique (RDT) kits for malaria diagnosis is becoming widespread in recent times. For

instance, Ikwuobe *et al*., 2011, advocated the use of RDT at community pharmacies in Nigeria. Continuous influx of imported RDT kits into the Nigerian market with little or no regulation is a cause for concern and has subtle tendency to compromise malaria management and control on a nation-wide scale. The assumption that all RDT kits work pretty alike and exhibit high efficacy is misplaced and has a tendency to worsen efforts aimed at malaria control in Nigeria.

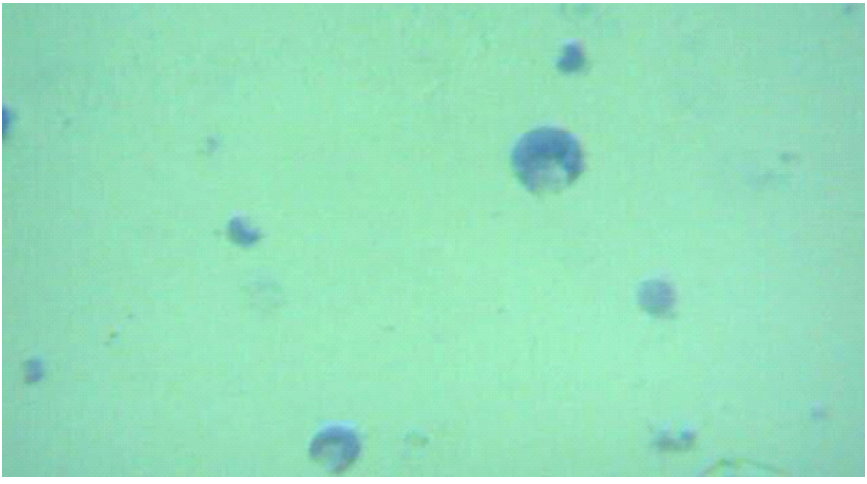
Finally, it is pertinent to mention one important diagnostic advantage in microscopy which RDTs lack - the ability of the analyst to observe the morphological features of the parasite under the microscope. This makes it possible for the microscopist to identify the different parasite forms and stages commonly seen under the microscope, a feature which has a lot of implications for the diagnosis of critical parasite forms like schizonts and gametocytes. The inability of RDTs to detect such parasite forms may scales down the gravity of detection of infection especially during severity, thereby contributing directly or indirectly to morbidity and mortality. Wilson *et al*., (2012) listed several other pitfalls in using RDTs for the diagnosis of malaria to include: possibility of cross reactions of the antigens in the immunochromatographic strip with rheumatoid factor, autoantibodies and certain other non-malarial infections; false positive results for *Plasmodium* species that are absent in blood when *P. falciparum* is in high concentration; the continued presence of *p*HRP-2 antigens in blood several weeks after treatment, even when parasite is already cleared from the blood and inability to fairly assess the degree of parasitaemia, among others.

General Inference

Results from this study indicate that the degree of malaria parasitaemia in the three settlement correlates directly with the remote sensing data (Appendix 1&2)



Early Trophozoite Stage of *Plasmodium falciparum* (6-12hours) with red stained chromatin duct, a light blue cytoplasm and clear vacuole under the light microscope



Late Trophozoite (12-18hours) Stage of *Plasmodium falciparum* evidence with red stained chromatin duct, a light blue cytoplasm and clear vacuole under the x100 Objective light microscope.

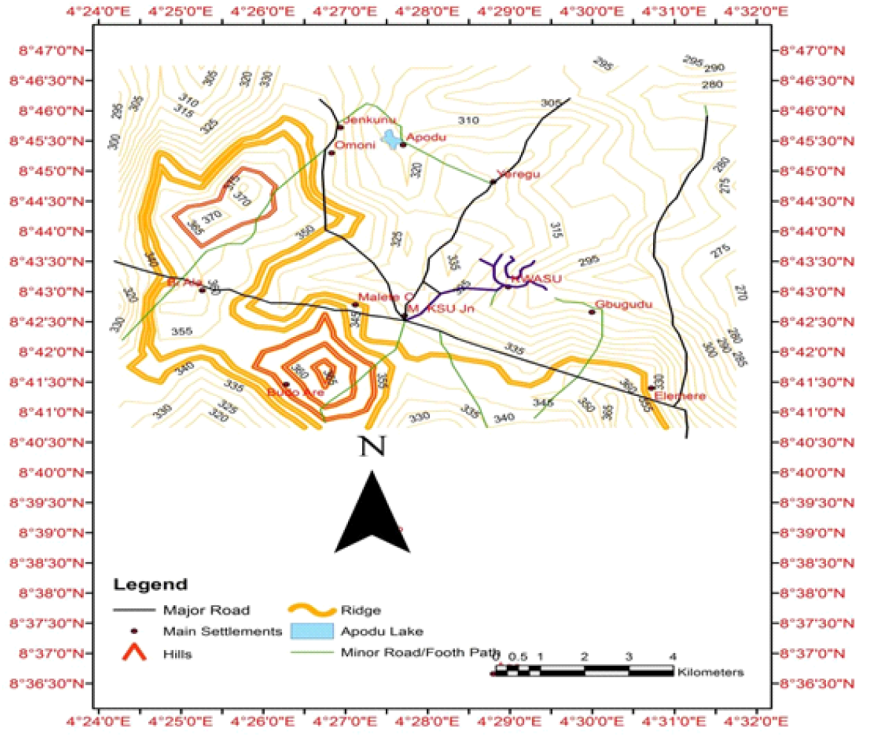
CHAPTER THREE
Appendix 2: Predicting Malaria Risk Vulnerability Through Geographic Information System (GIS) Mapping

Rationale: Development of Geographic Information System (GIS) maps incorporating physical environmental risk variables such as vegetation covers, rivers, pond and streams, housing and drainage pattern, ecological and topographical lay-out, built up status of the settlements and vectorial interphase and interactions with potential host communities could serve as an environmental model to predict Malaria distribution in a settlement.

Objective: To determine the prevalence of malaria infection in some specific rural communities of Apodu, Gbugudu, Elemere and other allied settlements such as Bi-Ala, Budo Are, all located at the outskirt of Kwara State University, Malete, Nigeria.

THE STUDY AREA

The study area is located in Moro Local Government Area of Kwara State and lies within latitudes 8°.6563N to Latitudes 8°.8136N and Longitudes 4°.2359E to longitudes 4°.5410E (Degree Decimals) comprises of Malete, Elemere KWASU and the adjoining communities of Malete, Elemere KWASU among others (Fig. 1) covering an area of about (157,701 Hectares) of land. The study area falls under broad Tropical Savanna climate with seasonal rainfall mostly in the months of June to September. With total annual rainfall of 1200 mm and mean annual temperature of 26°C the vegetation is characterized by deciduous trees and long grass under story. Farming and marketing of agricultural products is the major occupation but the town is fast becoming a trading centre due to its closeness to Ilorin metropolis, the Kwara State capital.



Topographic Map of the study area showing sampled settlements

Settlements	Lon	Lat	Elevation	NDVI	MAT	TAP
Gbugudu	4.5003	8.7131	283	5	26.8	1190
Malete	4.4528	8.7126	351	3	26.4	1197
Apodu	4.4624	8.7576	309	8	26.6	1190
KWASU	4.4838	8.8717	319	4	26.6	1191
Jenkunu	4.4493	8.7637	328	3	26.5	1190
Elemere	4.5108	8.8925	319	4	26.6	1200
Yeregu	4.4803	8.7471	319	3	26.6	1194
BiAla	4.437	8.6904	344	7	26.4	1199

ENVIRONMENTAL DATA OF SAMPLED SETTLEMENTS IN THE STUDY AREA

Introduction

Geographical Information System and Remote Sensing (GIS/RS) has proven to be a very useful for large scale mapping of ecosystem and land cover (Onur Şatır and Süha Berberoğlu, 2006), (Lu and Weng 2007), prevalence rate / risk vulnerability mapping and forecasting. GIS establish relationship or link between vector borne and zoonotic diseases (malaria, filiaris, dengue, meingitis) and associated environmental factors thereby providing explanation for the spatial disribution pattern, possible causes of these diseases outbreak and implication on the community (WHO, 2010)

Vulnerability Mapping: Materials and Methods

Garmin GPS was used to capture the coordinates (Lat/Lon) of 6 selected settlements? (See table) and overlaid with a geo-referenced satellite image in the study area. Bands 1, 2, 3, 4 and 5 of Landsat 7 ETM+ in the study area were obtained from GLCF Earth Spatial Data Interface for vegetation analysis. Bands 1, 2 and 3 are visible bands (0.4 μm – 0.7 μm) Bands 4 and 5 are infrared bands (0.7 μm – 1.1μm. An image bands combination was performed- Band 4 (near infrared) were combined with Band 3 and Band 2 to run Normalised Difference Vegetation Index (NDVI). NDVI is a Remote Sensing /GIS techniques used over the years by scientists to quantitatively and qualitatively evaluate the vegetation covers of an area (Neelima *et al.,* 2013). Vegetation or plant cover is one of the environmental critical factors in assessing malaria vulnerability or risk mapping. Climate data of the study area (the sampled settlements) was extracted from both the WorldClim and FAOClim data base. WorldClim database contains long term (1950- 2000) global climatic database of 19 Bioclimatic variables and monthly temperatures and rainfall of over 30,000 stations spread across the globe with spatial resolution of 0.86 km² (Hijmans *et al.,* 2005).

NDVI as proposed by Rouse, et al., (1974) is mathematically defined as: $NDVI = \frac{NIR-R}{NIR+R}$

Where, NIR and R are the reflectance in the near infrared and red regions respectively. It is the algebraic combination of red and near infrared bands to represent the amount of green vegetation in the image. In the NDVI, the values for a given pixel value is always in a number that ranges from -1 to +1. A zero means no vegetation and close to 1 indicates the highest possibility of green leaves (Biehl., 2010).

Digital Elevation Model (DEM)

A 90m Digital elevation model (DEM) data from Shuttle Radar Topographic Missions SRTM from NASA/USGS was also procured from Global Land Cover Facility (GCLF). This data was used to create physiographic layer of the study area through the extraction of elevation /altitude , slope and contour data. A 90m Digital Elevation Model (DEM) data from Shuttle Radar Topographic Mission- SRTM for the Africa-West Africa sub-continent was obtained from http://srtm.csi.cgiar.org, with the data sets for the Malete Elemere subset, masked and imported into GIS environment. The elevation data was processed by using the reclass menu in spatial analyst tool in Arc GIS 10.1 version to reclassify the study area into 2 classes.

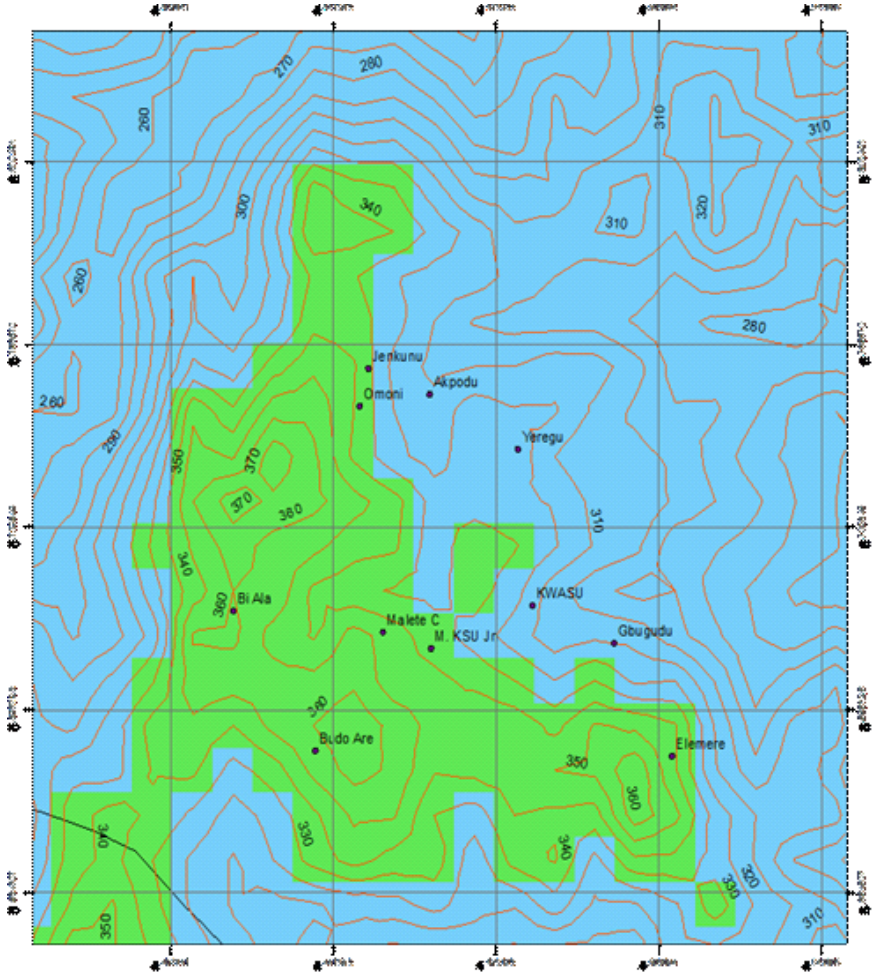
Modeling the vulnerability index

To determine the malaria vulnerability index in the study area we created vegetation layer by reclassing and weighing vegetation index (NDVI), elevation layer from DEM and distance layer by buffering from water points. Urban built up in LULC map was used as surrogate for population and degree of crowdedness. Cluster settlements and heavily built up was ranked high as compared to non-settled area. High population density favoured the creation of stagnant water usually find in adjacent to open bath room which as was observed in most settlements visited. These layers were spatially combined using weighted sum in Arc GIS 10.2 to produce vulnerability map.

Elevation	200- 320 m 320 ->400m	2 1	High Low
Slope	0 – 10 10 – 20 20 – 30 >30	4 3 2 1	Very high Hig h Medium Low
Land cover Land use/NDVI	>0.6 0.3 – 0.6 0.0 – 0.3	3 2 1	Very high Medium Low
Distance from rivers/Ponds	0 -500 m 500 -1000 m 1000 – 1500 m >1500 m	4 3 2 1	Very high High Medium Low
Population density	>400 Persons/ km² 300 – 400 “ 100 – 200 “ 0 – 100 “	1 2 3 4	Very high High Medium Low

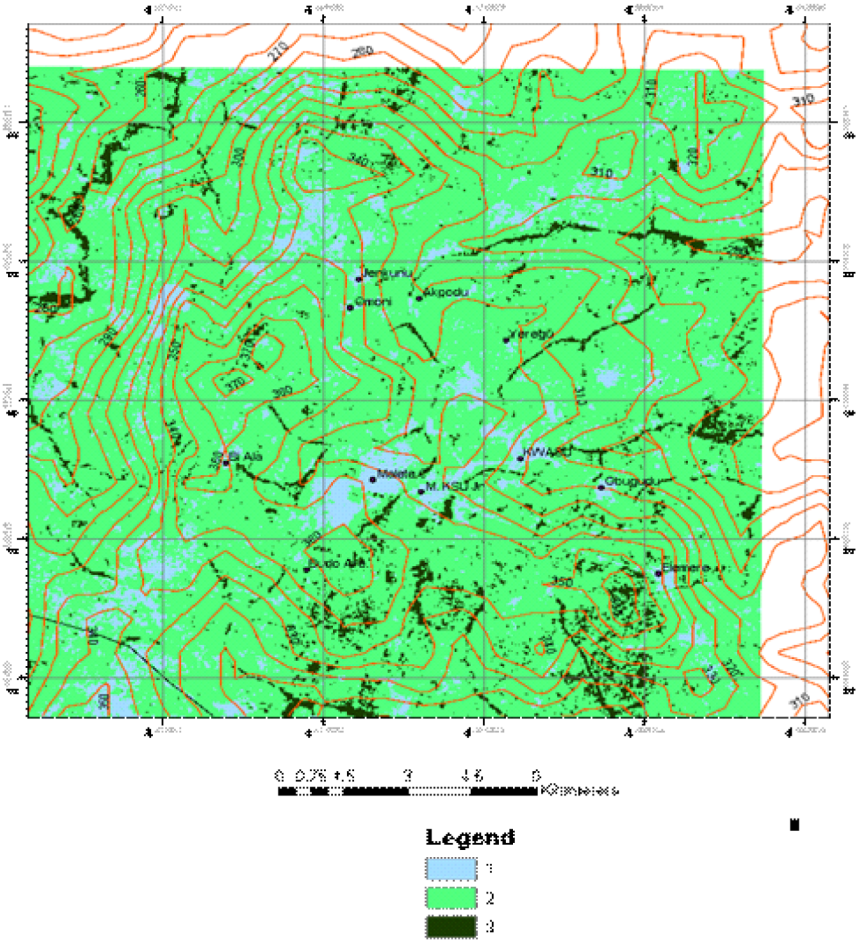
Buffering Analysis

Proximity analysis has been used in recent time to show and expain interelationship among hazardous substances facilites and various land uses and their health impilication and environmental injustice as reflected in the disproportionate exposure and risk among different clasees of people (Chakraboty and Mantaay 2011). Buffering of modeled vulnerabilty index was performed at 100 m, 200 m and 300 m in three experimental settlements – Apodu, Gbigudu and Elemere, An area wegthing techniques was used to determine the propotion (%) of modelled area that falls within different buffer zones of 100m, 200m and 300m



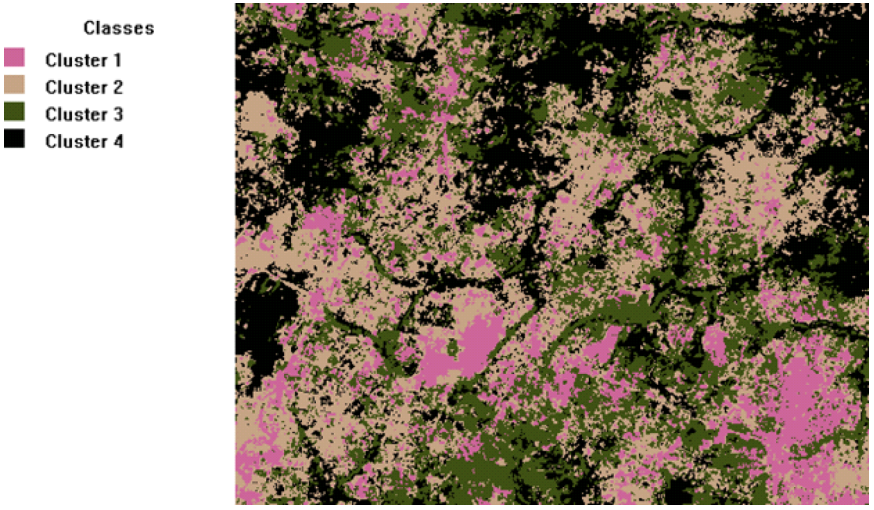
Reclass elevation
1= low risk
2=high risk

S/No	Elevation	Rank	Remark
1	320- >400 m	1	Low risk
2	200-320 m	2	High risk



S/No	Land cover	Rank	Remark
1	Open/bare ground	1	Low risk
2	Shrub/grass	2	Moderate risk
3	Forest	3	High risk

1= open or bare ground; low risk
2= shrub/grass; moderate risk
3= dense forest high risk



Malete Urban Reclass

Urban built up	1 2 3 4	Very high High Medium Low

Results and Discussions Modeling Malaria vulnerability Index Percentage of area modeled for malaria vulnerability index at 3 buffer zones

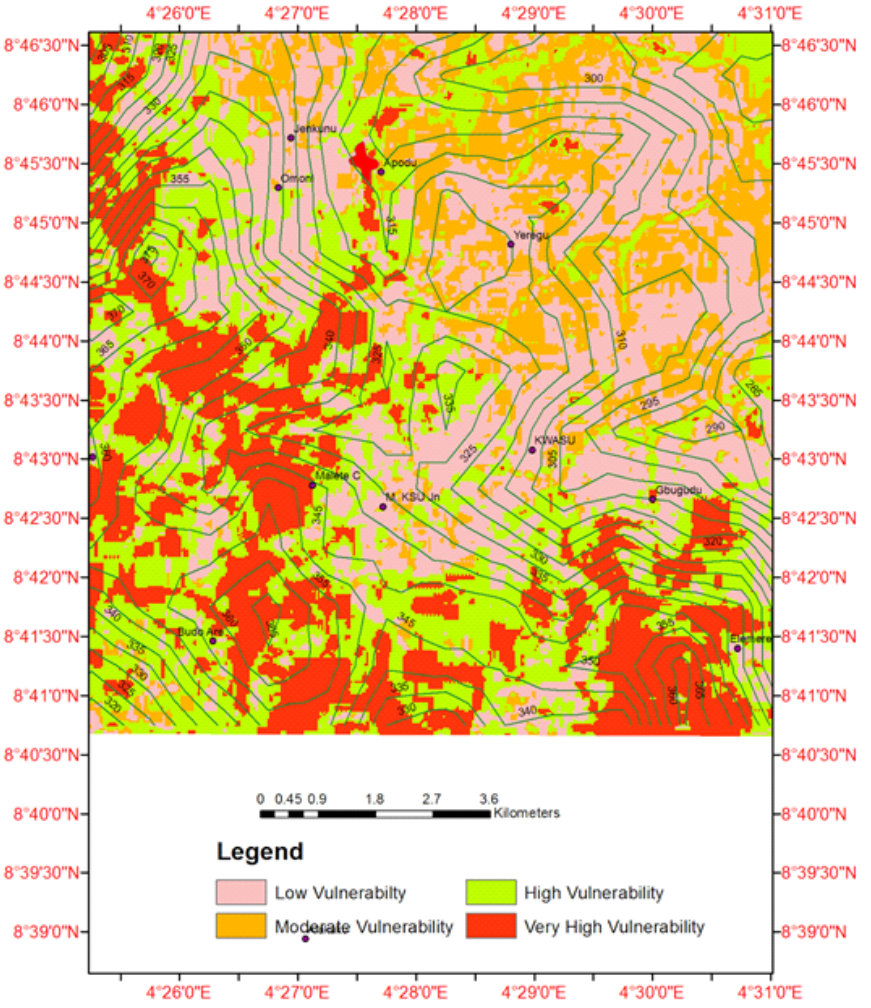
Settlements	100 m Buffer ring			200 m Buffer ring			300 m Buffer ring		
	L (%)	M (%)	H (%)	L (%)	M (%)	H (%)	L (%)	M (%)	H (%)
Apodu	20	60	20	00	60	40	05	20	75
Gbugudu	10	30	60	30	45	25	70	30	00
Elemere	90	10	00	45	50	05	00	40	60

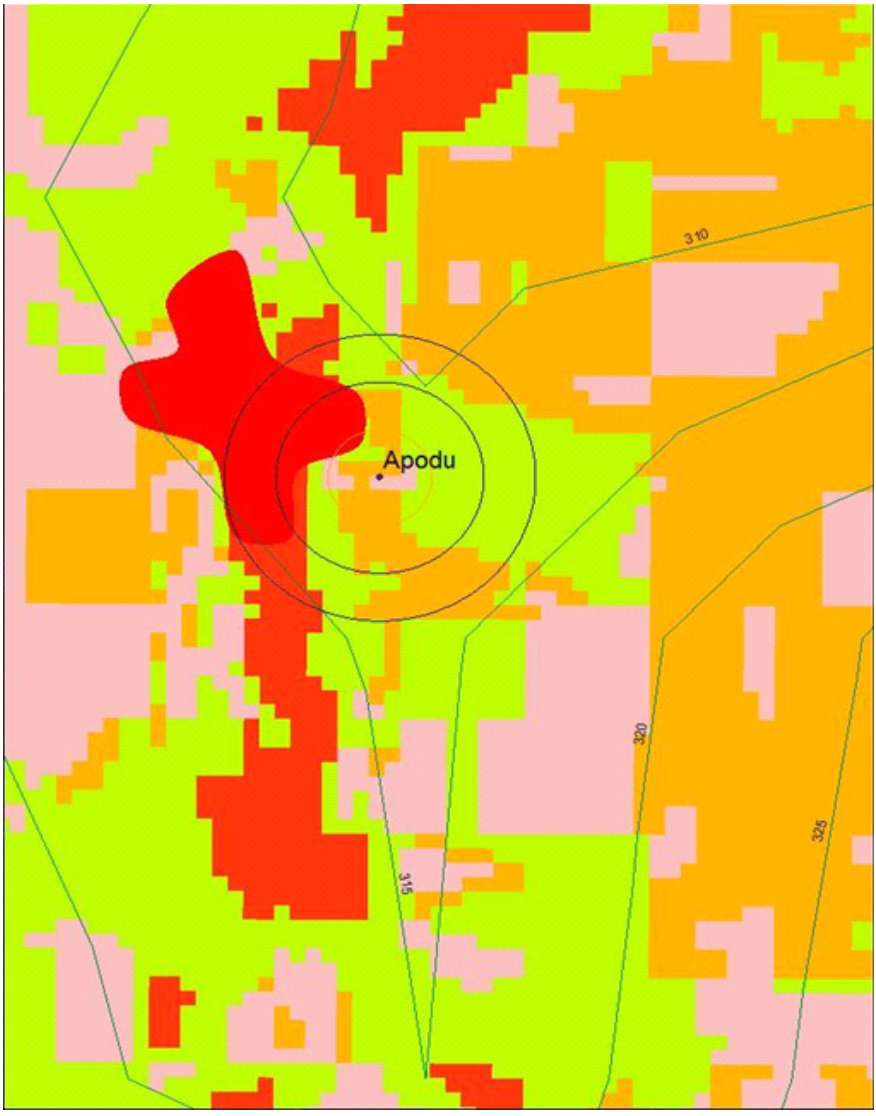
L = Low
M = Medium
H = High
High and very high were combined as a unit

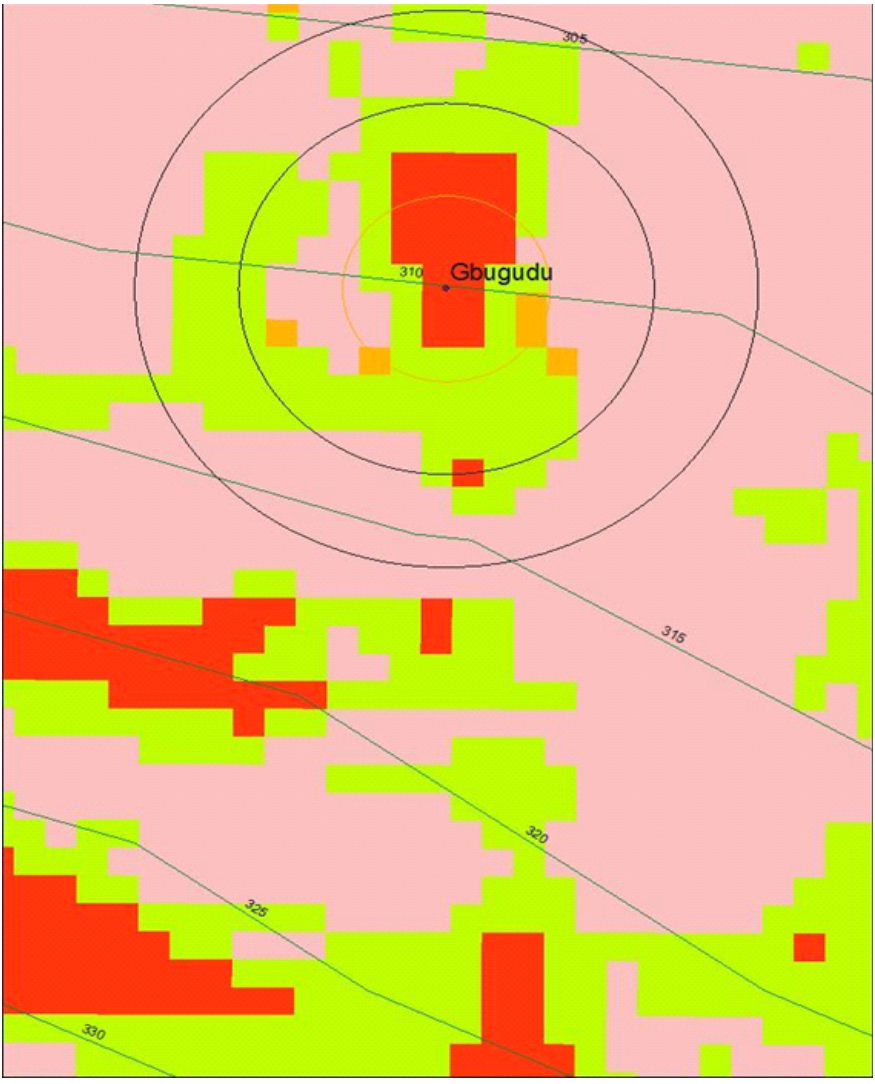
Vegetation cover, built up environment greatly defined the vulnerability index. dense vegetation and ponds within Apodu, Malete center built up with dense vegetation showed high vulnerability index, while settlements within 1 km radius around KWASU campus recorded lower index possibly due to low vegetation. Larger Area of relatively higher elevation in BiAla, Budo Are are modelled to be highly vulnerable due to the presence of dense vegetation although this area relatively had higher elevation (350m) it was not high enough to alter mosquito breeding habitat.

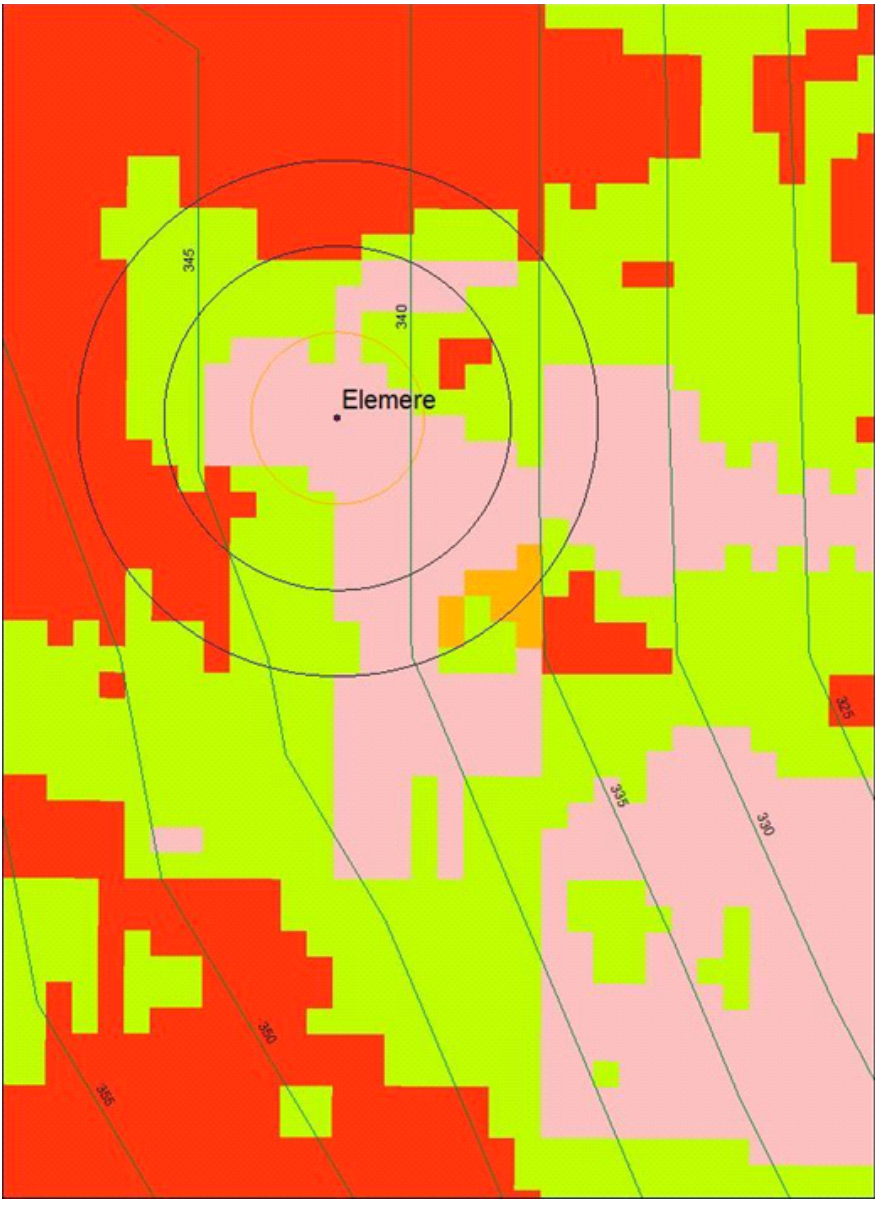
Apodu and Elemere had the highest malaria vulnerability index within 300m radius that is the vulnerability index increases as one moves away from the center of the settlement. The possible explanation for this high vulnerability could be the presence of pond/lake in Apodu. This is a good breeding site for mosquito couple with dense vegetation as one move from the centre of the settlements. The Fulani who stay some few meters away from the centre of settlements were more at risk (confirm the number of Fulani tested positive)

Unlike Apodu, Gbugudu was at highest risk at 100 m buffer (60%) but the vulnerability index decreases as one move away from the settlement centre. The absence of thick vegetation and presence numerous cultivated farmlands on the eastern part could have been responsible for this observation, as shown below: **Figures Illustrating Modeling of Malaria vulnerability Index at different buffer rings**


4°26'0"E
4°27'0"E
4°28'0"E
4°29'0"E
4°30'0"E
4°31'0"E
8°46'30"N
8°46'0"N
8°45'30"N
8°45'0"N
8°44'30"N
8°44'0"N
8°43'30"N
8°43'0"N
8°42'30"N
8°42'0"N
8°41'30"N
8°41'0"N
8°40'30"N
8°40'0"N
8°39'30"N
8°39'0"N
Jehkunu
Apodu
Omoni
Yenagu
KWASU
Mainle C
M. KSU Jn
Gbugbdu
Buda Are
Elekere
0 0.45 0.9 1.8 2.7 3.6
Kilometers
Legend
Low Vulnerabilty
High Vulnerability
Moderate Vulnerability
Very High Vulnerability


Apodu
310
320
325
315


305
310
Gbugudu
315
320
325
330


Elemere
345
340
325
335
330
360
355

CHAPTER FOUR
Appendix 3:
Intervention Strategies and Capability Development

Training of household leaders (fathers, mothers and grandparents) and caregivers on causal factors and prevention of malaria in the rural communities under studied.

Rationale: Members of all the three communities were educated about the hazard status of malaria and the vulnerability risk possed by the conditions of their proximal environment. Series of Integrated Vector Management approaches for malaria control (IVM) have been adopted and become standard priority of the Roll Back Malaria portfolio. Such activities and campaign over the years included the use of personal protective measures such as Long Lasting Insecticidal nets (LLINs), Wearing of protective clothing, Use of repellents which appear in various forms. Chemical control such as: Indoor Residual Spraying Spray (IRS), Larviciding and Outdoor spraying.
In this surveillance, Long lasting insectide treated nets (LLITNs) were distributed to the community members along with Mass Drug Administration (MDA) to infected persons (Appendix 3)

Pictures Depicting Malaria Team Activities at Apodu Community






PLUS 2.0


Lumartem
Cipla
1x24
Artemether 20 mg &
Lumefantrine 120 mg Tablets
1x12
Artemether 20 mg &
Lumefantrine 120 mg Tablets
1x24
Artemether 20 mg &
Lumefantrine 120 mg Tablets

















GIS Malaria Risk Vulnerability Mapping at Apodu Community









Mosquito Larva Habitat at Apodu






Lumartem



A Member of Malaria Group Community Health Extension Worker Teaching Health Education

















CHAPTER FIVE
Appendix 4
Final Expenditure (give details on a separate sheet):

TITLE OF PROJECT: RISK BASED ASSESSMENT AND MAPPING OF MALARIA DISTRIBUTION IN RURAL KWARA STATE (ONE-YEAR EXPENDITURE REPORT)

Activities	**Remarks**	**Cost in Naira (#)**
1. Project Inauguration	Initiation of Community Entry, Mobilization, Participation and Advocacy Visit. General sensitization of the three rural communities Community based discussion on 'risk mapping with remote sensing and RDTs as predictor of allocation of public health resources among rural communities. To be conducted in local dialect / *lingua franca* and attended by various	Logistics, fuelling of Vehicles to sites for the whole programme = #35,000 Entertainment / Refreshment = #5,000 Translator= #5,000 **Sub-Total= #45,000**

	stakeholders from the University, health sector and other policy makers.	
2. Procurement of GIS resources	Commissioning of experts, software and equipment. Test Printing of Maps.	Purchase of Garmin GPS entrx 10 Device=$325 Equivalent =#105,000 Purchase of 5000x5000 pixel image only=$450 Equivalent =#202, 500 Purchase of Digital Data & installation of raster processing software=#25,000 Printer for Map production and Honorarium for GIS expert=#20,000 **Sub-Total=352,500**
3. Training of members of research team and support staff and field activities	(i) GIS resource person (RS Expert) has trained core investigators on the use of RS and GIS equipment to capture environmental data.	Allowance for research assistants = #50,000 **Sub-Total=#50,000**

	(ii) Training of research assistants (5 Nos.) on handling of microscope, use of RDT and other specialised equipment	
4. Malaria Diagnosis with RDTs and Quantification with Light Microscopy	Malaria burden was estimated at both communities using (i) direct RDT diagnostic test AND Light Microscopes.	Laboratory Materials and reagents = #100,000 Allowance for RDT technicians = #20,000 Allowance for Laboratory Microscopist = #30,000 Purchase of RDT Malaria kits (216 Quantity) at the rate of #3500= #756,000 **Sub-Total= = #906,000**
5. Intervention with Antimalarial Drugs	Intervention deployed are Long Lasting Insecticide Treated BedNets (LLITNs), Pain Medications and Antimalarial Drugs.	Purchase of 150 packet of Artemether-Lumenfantrine at the rate of #750=**#112,500**

	The first line brand of Artemisinin Based Combination Therapy (ACT), a fixed two doses daily over three days of Artemether / lumefantrine combination therapy were administered by the medical personnel for all malaria positive cases (Appendix 3).	**Sub-Total = #112,500**
6. Data Analysis	Relevant statistical software (e.g. Epi-info, R, SPSS or JMP) were utilised to analyse all generated data. Multivariate regression analysis was also used to test the relationship between the abundance of potential aquatic / larval habitats, and house density, socioeconomic status, and planning and drainage.	Honorarium for Data Analyst=#40,000 **Sub-Total= #40,000**

	Test of difference in potential malaria prevalence between the communities were conducted and reported. Data generated shall be published and translated into intelligence to achieve sound and sustainable malaria control programme	
7. Research Secretariat	For accurate documentation and record keeping For Quality Assurance and delivery. Enhancement of good laboratory and field practices.	Purchase of routine office materials such as papers, toners, extension boxes, plug, laptop charger, cardboards, pins, cello tapes, staplers etc.,=#50,000 **Sub-Total=#50,000**
8. Dissemination	Conferences / seminar Community meetings Scholarly Publications	Hotel and Flight reservation form at KWASU travels=#1,000 Conferences / seminar=#10,000

		Community meetings=#10,000 Payment for Scholarly Publications=$119=#53,550 **Sub-Total=#74,550**
9. Miscellaneous	Lunch for Core Members of the Malaria Team at the end of each trip to the settlement	Lunch for Six Members of the team =#50,000 **Sub-Total=#50,000**
GRAND TOTAL		**#1,680,550**

CHAPTER SIX:
GENERAL CONCLUSIONS AND RECOMMENDATIONS

Vegetation cover, built up environment greatly defines the vulnerability index in many malaria endemic areas. The study was carried out to determine the prevalence of malaria infection in some specific rural communities of Apodu, Gbugudu, Elemere and other allied settlements such as Bi-Ala, Budo Are, all located at the outskirt of Kwara State University, Malete, Nigeria.

Findings of this study showed dense vegetation and ponds within Apodu, Elemere and Malete center which serves a good breeding site for mosquito couple with dense vegetation was responsible for the high vulnerability index at these areas. Settlements within 1 km radius around KWASU campus recorded lower index possibly due to low vegetation. Larger Area of relatively higher elevation as it occurred in Bi-Ala, Budo-Are and similar areas are found to be highly vulnerable due to the presence of dense vegetation. One observes a trend in the vulnerability index as it decreases as one move away from the settlement centre. Unlike Apodu, Gbugudu was at highest risk at 100 m buffer zone. The absence of thick vegetation and presence of numerous cultivated farmlands on the eastern part could have been responsible for this condition.

Also cluster settlements and heavily built up areas was ranked high as compared to non-settled area. High population density favoured the creation of stagnant water usually find in adjacent to open bath room which as was observed in most settlements visited.

Re-training of household leaders (fathers, mothers and grandparents) and caregivers on causal factors and prevention of malaria in the rural

communities under studied is recommended to be able to effectively assess the effect of intervention program provided. Members of all the three communities were to be re-enlightened about the hazard status of malaria and the vulnerability risk possed by the conditions of their proximal environment. This should also include series of Integrated Vector Management approaches for malaria control (IVM). Such activities and campaign should include the use and adoption of personal protective measures such as Long Lasting Insecticidal nets (LLINs), Wearing of protective clothing, Use of repellents which appear in various forms. The essence would be for the villagers to take responsibility for ownership and be able to self apply and manage these approaches.

CHAPTER SEVEN
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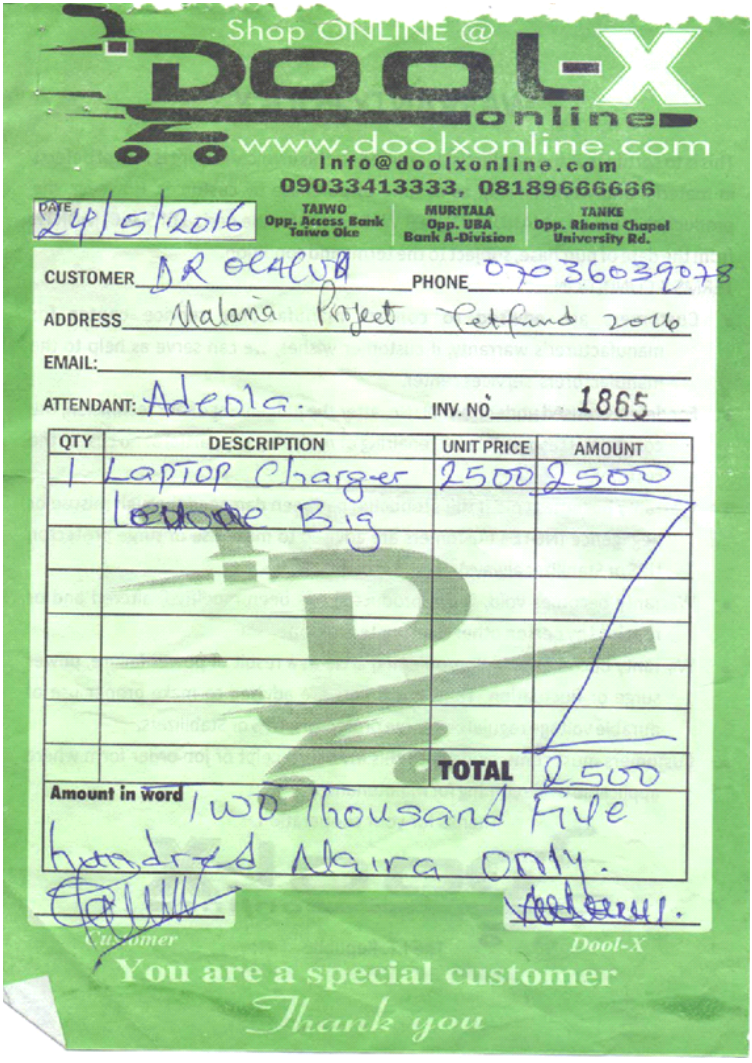
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RECEIPT OF EXPENDITURE
APPENDIX FIVE



Shop ONLINE @
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TAIWO Opp. Access Bank Taiwo Oke | MURITALA Opp. UBA Bank A-Division | YANKE Opp. Rhema Chapel University Rd.

DATE 24/5/2016

CUSTOMER DR OLACUA PHONE 07036039078

ADDRESS Malaria Project Petfund 2016

EMAIL:

ATTENDANT: Adeola. INV. NO 1865

QTY	DESCRIPTION	UNIT PRICE	AMOUNT
1	Laptop Charger Lenovo Big	2500	2500
		TOTAL	2500

Amount in word Two Thousand Five hundred Naira Only.

Customer

Dool-X

You are a special customer

Thank you

OMICS International

Payment Receipt

Dr Olalubi
Malaria Project
Tetfund

General Information

Merchant	: OMICS International
Address	: 731 Gull Ave, Foster City CA 94404, USA
Contact	: +1- 650-268-9744

Note: If the payment is processed through Credit/Debit Card, The Card statement will be shown on the name of Omics International or iMedPub depending on the currency.

Order Information

Date / Time	: 2016-08-28 18:28:36
Invoice Number	: 2470-6965-5-142
Description	: Publication Fee -OMICS PUBLISHING GROUP
Amount	: $ 119
Payment Method	: card

Results

Response	: Your Transaction will be completed within 24 hours
Transaction ID	: ch_18RLpQB1IgixzzktVoO48NIO

Customer Billing Information

Name	: Oluwasogo A OLALUBI
Address	: 2360 Corporate Circle, Suite 400, Henderson, NV 89074-7722, USA
City	: MALETE, ILORIN
State / Province	: KWARA
Zip / Postal Code	: +234
Country	: NIGERIA
Phone	: +2347036039078
E-Mail	: olalubisogo@gmail.com

Customer Shipping Information

Name	: Oluwasogo A OLALUBI
Address	: 2360 Corporate Circle, Suite 400, Henderson, NV 89074-7722, USA
Country	: NIGERIA
E-Mail	: olalubisogo@gmail.com

* This is Computer generated temporary receipt. Signature is not necessary.
* If you have any questions or concerns with this order, please mail to mailto:accounts.openaccess@omicsonline.org contact : +1- 650-268-9744

*** Thank You ***



Mail - Olawasogo Olalubi - Outlook

https://outlook.office.com/owa/?realm=kwasu.edu.ng&path=/mail/attachmentlightbox

Office 365 Outlook

TERRAserver

Receipt

Order Information
Order ID: 382195
Order Date: 2/29/2016
Order Time: 5:04:33 PM

Billing Information
Dr. Olalubi O
Malaria Project
KWASU
Malete
Ilorin, NG

Product Description	Technical Description	Cost	Quantity	Total
Garmin GPS etrex 10	2.2" Monochrome display	$325.00	1	$325.00

Cart Total: $325.00
Discounts: -$0.00
Order Total: $325.00

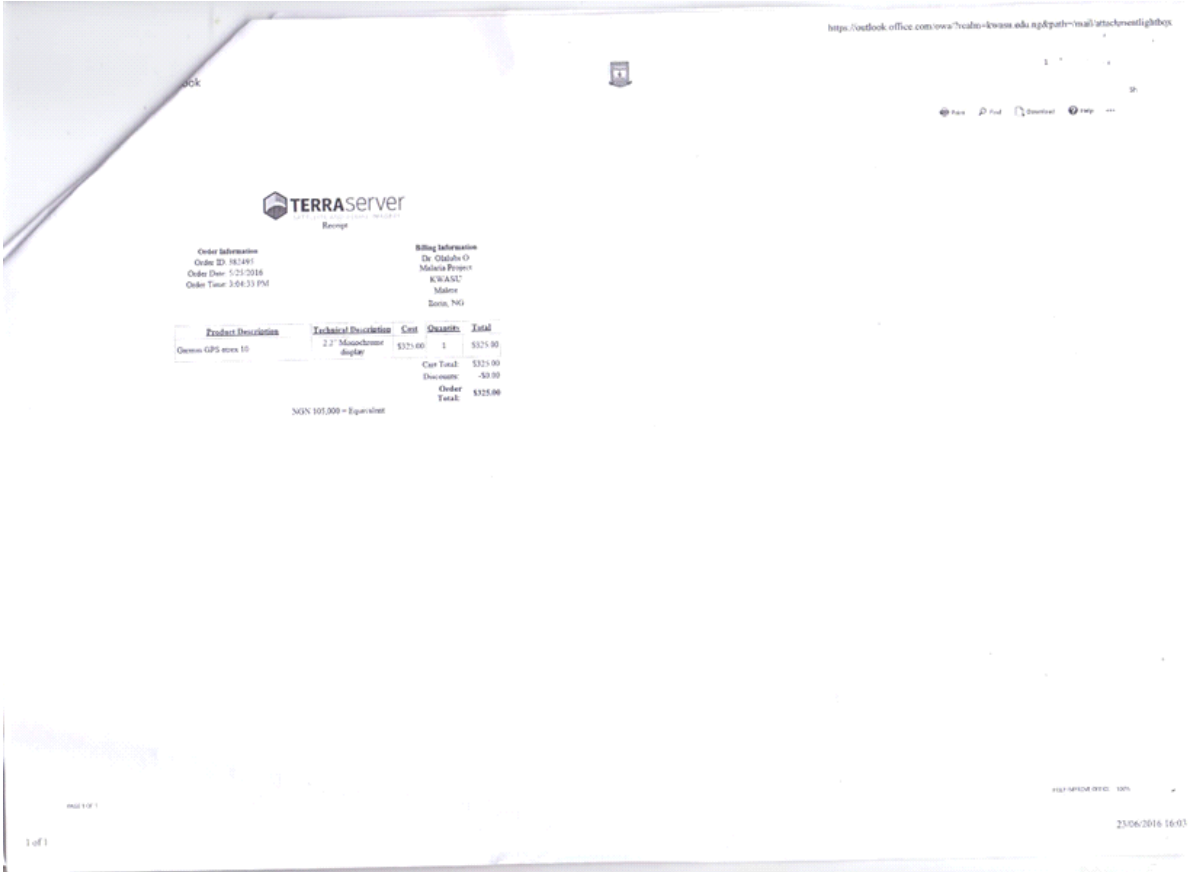
NGN 105,000 = Equivalent

Paid

Dr Olalubi A Olawasogo,
Principal Investigator/Head,
Dept of Public Health,
KWASU

1 of 1

23/06/2016 16:03



https://outlook.office.com/owa/?realm=kwasu.edu.ng&path=/mail/attachmentlightbox

ack

TERRAserver

Receipt

Order Information
Order ID: 882495
Order Date: 5/25/2016
Order Time: 3:04:33 PM

Billing Information
Dr. Olalubi O
Malaria Project
KWASU
Malete
Ilorin, NG

Product Description	Technical Description	Cost	Quantity	Total
Garmin GPS etrex 10	2.2" Monochrome display	$325.00	1	$325.00

Cart Total: $325.00
Discounts: -$0.00
Order Total: $325.00

NGN 105,000 = Equivalent

1 of 1

23/06/2016 16:03



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KWARA STATE UNIVERSITY, MALETE
The University for Community Development

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RECEIPT

CAMPUS ADDRESS
CT&T, Administration Block,
Kwara State University, Malete.
P.M.B. 1530, Ilorin, Nigeria.

ILORIN ADDRESS:
KWASU Contact Office, Top Floor,
Former ADC Building, Old Jebba Road,
Sango, Ilorin, Kwara State.
08060844116, 08030623335
Email: campustravels.kwasu@gmail.com

Date: 23-03-2016 No. 013

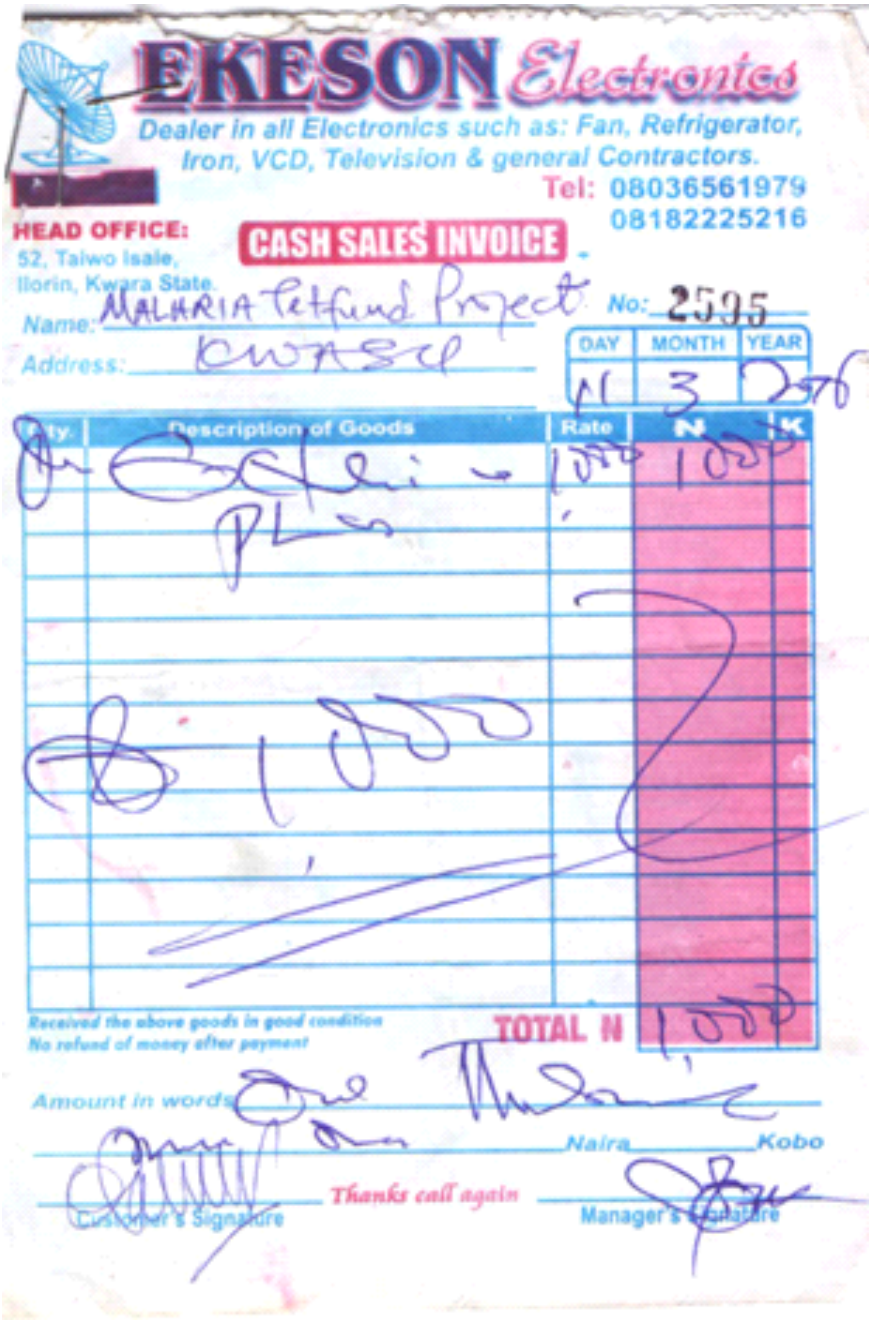
Received from: Dr. Olalubi Oluwasogo Adewoye

The sum of: One Thousand naira only

Being payment for: Hotel and flight Reservation forms

₦ 1,000 :CASH

Receiver's Signature



EKESON Electronics

Dealer in all Electronics such as: Fan, Refrigerator, Iron, VCD, Television & general Contractors.

Tel: 08036561979
08182225216

HEAD OFFICE:
52, Taiwo Isale,
Ilorin, Kwara State.

CASH SALES INVOICE

No: 2595

Name: MALARIA Refund Project

Address: KWASU

DAY	MONTH	YEAR
11	3	2016

Qty.	Description of Goods	Rate	₦	K
	Iron	1000	1000	
	Plug			
			1000	

Received the above goods in good condition
No refund of money after payment

TOTAL ₦ 1000

Amount in words: One Thousand

Naira Kobo

Customer's Signature

Thanks call again

Manager's Signature

TERRAserver

Receipt

Order Information
Order ID: 382461
Order Date: 2/25/2016
Order Time: 4:04:33 PM
Order Total: $450

Billing Information
Dr Olawunmi Olabode
H.O.U Dept Public Health
KWASU
Ilorin, NG

Product Description	Image Description	Cost	Quantity	Total
Mobile Image	Landsat 7 bands Pan bands 8 Spatial 30m	$450.00	1	$450.00

Discount: -$0.00

Order Total: $450.00

TERRAserver

Receipt

Order Information
Order ID: 382462
Order Date: 2/25/2016
Order Time: 5:04:33 PM
Order Total: $490

Billing Information
Dr Olawunmi Olabode
H.O.U Dept Public Health
KWASU

Product Description	Image Description	Cost	Quantity	Total
5000 x 5000 pixel Image Only	2/12/2013 1.5m Image	$245.00	2	$490.00

Cart Total: $490.00

Discount: -$0.00

Order Total: $490.00

TERRAserver

Receipt

Order Information
Order ID: 382801
Order Date: 2/25/2016
Order Time: 4:04:33 PM
Order Total: $450

Billing Information
Dr Oluwatoyo Olalubi
H.O.U Dept Public Health
KWASU
Ilorin, NG

Product Description	Image Description	Cost	Quantity	Total
Malete Image	Landsat 7 bands Pan bands 8 Ikonos 70cm	$450.00	1	$450.00

Discounts: -$0.00
Order Total: **$450.00**

TERRAserver

Receipt

Order Information
Order ID: 382401?
Order Date: 2/25/2016
Order Time: 3:04:33 PM
Order Total: $490

Billing Information
Dr Oluwatoyo Olalubi
H.O.U Dept Public Health
KWASU

Product Description	Image Description	Cost	Quantity	Total
5000 x 5000 pixel Image Only	2/13/2013 0.5m Image	$245.00	2	$490.00

Cart Total: $490.00
Discounts: -$0.00
Order Total: **$490.00**

Malaria Lettuce Project
PI & Head,
Dept of Public Health
KWASU.

Dennis & Dennis (Nig.) Enterprises

SCIENTIFIC & MEDICAL SUPPLIERS

OFFICE:
Taiwo Road,
Near Chupet Stores,
Ilorin, Kwara State

08057977509, 08033853498

CASH / CREDIT SALES INVOICE

POSTAL ADDRESS:
P. O. Box 8443,
Ilorin, Kwara State.

No. 965

Name: Malaria Pet fund CCD Project DR OLALUBI A.U

Day	Month	Year
19	05	16

QTY.	DESCRIPTIONS	RATE	N	K
216	pkts RDT (malaria kit)	3500	756,000	00
150	pkt Artemether Lumenfantrine	750	112,500	00

Received the above goods in good condition, no refund of money after payment. Goods Sold are not returnable.

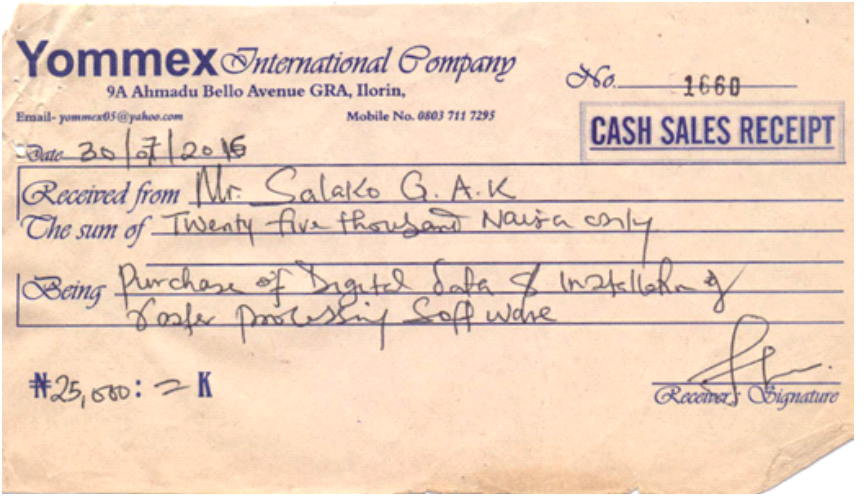
Total N 868,500 =

Amount in Words: Eight hundred and sixty eight thousand

Naira ______ Kobo

Customer's Signature May 19th 2016

For: Dennis & Dennis



Yommex International Company

9A Ahmadu Bello Avenue GRA, Ilorin,

Email- yommex05@yahoo.com Mobile No. 0803 711 7295

No. 1660

CASH SALES RECEIPT

Date 30/7/2015

Received from Mr. Salako G. A. K

The sum of Twenty five thousand Naira only

Being Purchase of Digital Data & Installation of Voter processing Soft ware

₦25,000: = K

Receiver's Signature

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