USE OF TREATED NET FOR MALARIA PREVENTION AMONG PRIMARY HEALTH-CARE CENTRE ATTENDEES IN ABUJA MUNICIPAL AREA COUNCIL, NIGERIA

BY

JOKODOLA, GBENGA SUNDAY
B.PHARM (Zaria, 1999), MPSN

MATRIC NUMBER: 130143

A DISSERTATION IN THE DEPARTMENT OF EPIDEMIOLOGY AND MEDICAL STATISTICS (EMS),

SUBMITTED TO THE DEPARTMENT OF EPIDEMIOLOGY AND MEDICAL STATISTICS, FACULTY OF PUBLIC HEALTH, COLLEGE OF MEDICINE, UNIVERSITY OF IBADAN, IBADAN, NIGERIA

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF

MASTERS IN PUBLIC HEALTH (FIELD EPIDEMIOLOGY)

January, 2015

USE OF TREATED NET FOR MALARIA PREVENTION AMONG PRIMARY HEALTH-CARE CENTRE ATTENDEES IN ABUJA MUNICIPAL AREA COUNCIL, NIGERIA

BY

JOKODOLA, GBENGA SUNDAY
B.PHARM (Zaria, 1999), MPSN

MATRIC NUMBER: 130143

A DISSERTATION IN THE DEPARTMENT OF EPIDEMIOLOGY AND MEDICAL STATISTICS (EMS),

SUBMITTED TO THE DEPARTMENT OF EPIDEMIOLOGY AND MEDICAL STATISTICS, FACULTY OF PUBLIC HEALTH, COLLEGE OF MEDICINE, UNIVERSITY OF IBADAN, IBADAN, NIGERIA

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF

MASTERS IN PUBLIC HEALTH (FIELD EPIDEMIOLOGY)

January, 2015

ABSTRACT

Malaria is a major public health problem, affecting mostly children and pregnant women. A major strategy of the Global Malaria Program is the use of Insecticide-Treated Nets (ITNs) as a vector-control measure. The residents of Abuja Municipal Area Council have been the target of many malaria prevention interventions over the last six years. However, earlier reports did not include attendees of Primary Health Care (PHC) centres. The objectives of this study were to determine knowledge and perceptions of malaria prevention, health-seeking behaviour and investigate factors associated with use of ITNs.

The study was descriptive cross-sectional in design. Semi-structured, interviewer-administered questionnaire was used to obtain information from 500 respondents attending 9 PHCs which were selected by three-stage sampling technique from the nine of the twelve wards in the Abuja Municipal Area Council. Statistical Package for Social Sciences (SPSS Version 17) was used to analysed the data using frequency, counts, means, cross-tabulations and logistic regression.

Mean age of respondents was 31±9 years, with a range of 18 - 55 years. Majority (60.6%), were females and about two-thirds (63.4%) had at least secondary school education. Main sources of information on malaria were health workers (37.6%) and the radio (32.6%). Almost all respondents (90%) were aware of malaria, and 66.8% knew mosquitoes transmit malaria. Thirty-seven percent of respondents stated fever as the main symptom of malaria while majority (80.4%), knew that malaria could be fatal. Respondents sought care for malaria at public health facilities (44.9%), pharmacies (32.4%), private health clinics (12.3%) and traditional healers (10.4%). Awareness of ITN use for preventing malaria was reported by 55.8% of respondents. Only 38% had positive attitudes to sleeping under ITNs while others indicated unwillingness to use ITNs because of heat (23%), movement out of bed (23%), availability of window and door nettings (11.9%) and neatness (1.6%). Use of ITNs was positively associated with good attitude ($p<0.05$). The use of ITNs was reported in 28.4% of respondents and more than half (53.5%) obtained them free, while 46.5% purchased their nets. Respondents who obtained their ITNs free from health facilities (53.5%), use it more than those who purchased it. Forty-two per cent of the respondents had children under 5 years of age, of which 36.2% of them slept under an ITN the night preceding the survey. Only 10.8% of the 29.6% pregnant women used an ITN the night preceding the survey.

Use of ITNs was positively associated with preventive knowledge (OR = 5.78; 95% CI = 3.62 – 9.36) and educational level (OR = 2.17; 95% CI = 0.99 – 4.72).

Poor attitude is a major factor on the low utilization of ITNs, despite the moderate level of knowledge. There is a need to improve attitudes by increasing awareness on the use of ITNs through health care personnel, pharmacies and the use of the print and electronic media. Free distribution to children and pregnant women may improve the use of ITNs but should be accompanied by comprehensive education on the importance of consistent use.

KEYWORDS: Knowledge on Malaria, Attitude to ITN use, Utilization of ITNs, Primary Health Care

Number of words: 491

ACKNOWLEDGEMENTS

I stand on the shoulders of giants. I humbly profess a deep depth of gratitude to my project and thesis advisor/guide/mentor: Dr. Olufunmilayo Fawole. Her work and willingness to share with me knowledge, resources and insight gave me an incredible opportunity to experience first-hand the rigours of true global public health. The motherly support, openness and friendliness was invaluable, rewarding and deeply impacting towards how public health professionals, and students can and should always work together towards a common goal of improving the lives of both those close to us as well as those communities deeply affected by health crises.

I thank Professor E.A. Bamgboye, for his public health wisdom and statistical guidance towards the outcome of this dissertation. His fatherly encouragement was very useful.

I appreciate the contributions of my immediate-past H.O.D., Dr. Ikeoluwapo Ajayi, and that of the former head of department of EMSEH (now EMS), Dr. Lola V. Adekunle, especially for their understanding and support towards the completion of this dissertation and indeed the degree itself.

I value the additional valuable inputs to this work obtained from my lecturer, Dr. Akin Fatiregun of the Department of Epidemiology: his objectivity was invaluable.

I appreciate the objective criticisms of my statistician friend and lecturer, Dr. Odun Akinyemi. The contributions of Dr. Pelumi and Dr. Balogun of the Department of Community Medicine were highly beneficial. I also appreciate my friends Mr. John and Mr. Femi of the department of health promotion and education. I cannot fail to mention my appreciation to Mr. Nathanael Afolabi and Mr. Aduroja of the Epidemiology Department for their invaluable help during the data entry and analysis stages of this dissertation, including giving me the tools needed to organize my results.

I am also deeply thankful for the support and work of each of the EMS administrative staff members, with particular reference to Mr. Tony for his support even when I was indisposed; and Mr. Akin for helping with logistics. The contribution of Mr. Ogundiran to my settling down in Ibadan for this course is written on "marble".

To my mothers Alice Adebisi Jokodola and Funke Atta, I need to say their support throughout my sustained effort to never stop my educational experience has never ceased: each one has been helpful at certain stages of my life.

My friends, especially Uncle Tomi, Engr. Kunle Aberuagba and family, Akin Oyegun, Pst. Femi Ipinlaiye, Amos and Tosin Akinyele, Felix and Pleasant Babawemimo, Amos and Doreen Magaji,

to mention a few, have been friends in deed. They stood by my family even in rain and shine. Thank you friends! Words cannot define my thanks to Pst. Kunle Omotoso & family for the support even during the incubation stage of my desire to attain an MPH in Epidemiology. To my all my brothers and sisters who have been helpful, especially Engr. Oladapo Jokodola, who provided the necessary ICT to start and complete this course, I say "I salute you sir, you have shown your kindness again".

I am quite grateful to the Director of Public Health, Abuja Municipal Area Council (AMAC), all the staff at AMAC, Local Council community leaders, all the Primary Health Centre staffs in A.M.A.C. and all the volunteers who participated in this survey: I am truly grateful for their time, feedback and openness. I appreciate the contributions of Dr. Fatunmbi of the Global Malaria Program, WHO. I also thank Dr (Mrs.) Abebe, and Drs. Abanida and Nwaze of the National program on Immunization, NPI, (now Primary Healthcare Development Agency - NPHCDA), Abuja for the internship training. For all those whom I could not mention due to space and time, do accept my recognition of your input to this successful attainment of a degree in epidemiology. Thank you very much.

I salute the patience of my children, Esther, David and Emmanuel while Daddy was working to attain this degree.

To my wife, my jewel of inestimable value, I can only say "Temi, this is surely another outcome of the support you give me: I love you and will always do".

Finally, I give all glory to God, The Almighty; The All-Sufficient, for LIFE and for this opportunity.

to mention a few, have been friends in deed. They stood by my family even in rain and shine. Thank you friends! Words cannot define my thanks to Pst. Kunle Omotoso & family for the support even during the incubation stage of my desire to attain an MPH in Epidemiology. To my all my brothers and sisters who have been helpful, especially Engr. Oladapo Jokodola, who provided the necessary ICT to start and complete this course, I say "I salute you sir, you have shown your kindness again".

I am quite grateful to the Director of Public Health, Abuja Municipal Area Council (AMAC), all the staff at AMAC, Local Council community leaders, all the Primary Health Centre staffs in A.M.A.C. and all the volunteers who participated in this survey: I am truly grateful for their time, feedback and openness. I appreciate the contributions of Dr. Fatunmbi of the Global Malaria Program, WHO. I also thank Dr (Mrs.) Abebe, and Drs. Abanida and Nwaze of the National program on Immunization, NPI, (now Primary Healthcare Development Agency - NPHCDA), Abuja for the internship training. For all those whom I could not mention due to space and time, do accept my recognition of your input to this successful attainment of a degree in epidemiology. Thank you very much.

I salute the patience of my children, Esther, David and Emmanuel while Daddy was working to attain this degree.

To my wife, my jewel of inestimable value. I can only say "Temi, this is surely another outcome of the support you give me: I love you and will always do".

Finally, I give all glory to God, The Almighty; The All-Sufficient, for LIFE and for this opportunity.

to mention a few, have been friends in deed. They stood by my family even in rain and shine. Thank you friends! Words cannot define my thanks to Pst. Kunle Omotoso & family for the support even during the incubation stage of my desire to attain an MPH in Epidemiology. To my all my brothers and sisters who have been helpful, especially Engr. Oladapo Jokodola, who provided the necessary ICT to start and complete this course, I say "I salute you sir, you have shown your kindness again".

I am quite grateful to the Director of Public Health, Abuja Municipal Area Council (AMAC), all the staff at AMAC, Local Council community leaders, all the Primary Health Centre staffs in A.M.A.C. and all the volunteers who participated in this survey: I am truly grateful for their time, feedback and openness. I appreciate the contributions of Dr. Fatunmbi of the Global Malaria Program, WHO. I also thank Dr (Mrs.) Abebe, and Drs. Abanida and Nwaze of the National program on Immunization, NPI, (now Primary Healthcare Development Agency - NPHCDA), Abuja for the internship training. For all those whom I could not mention due to space and time, do accept my recognition of your input to this successful attainment of a degree in epidemiology. Thank you very much.

I salute the patience of my children, Esther, David and Emmanuel while Daddy was working to attain this degree.

To my wife, my jewel of inestimable value, I can only say "Temi, this is surely another outcome of the support you give me: I love you and will always do".

Finally, I give all glory to God, The Almighty; The All-Sufficient, for LIFE and for this opportunity.

DEDICATION

To THE LORD God Almighty; ***I AM THAT I AM***; my all in all.

AND

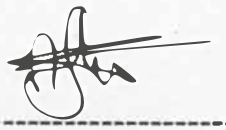
To my colleagues - *The Malaria Griots* at Malaria No More/ONE, USA;

To all members of the National Insecticide - Treated Nets (ITNs) Expert group of the Integrated Vector Management (IVM) Sub-committee of the National Malaria Elimination (NMEP), FMoH, Nigeria;

To ALL who are involved in combating the scourge of Malaria all over the world.

CERTIFICATION

I certify that this work was carried out by Pharm. Jokodola Gbenga Sunday under my supervision in the Department of Epidemiology and Medical Statistics (EMS), Faculty of Public Health, College of Medicine, University of Ibadan, Nigeria.



DR. (MRS.) OLUFUNMILAYO I. FAWOLE,

MBBS, M.Sc. (SA), FMCPH, FWACP, Cert, Clin. Epid(SA)

CERTIFICATION

I certify that this work was carried out by Pharm. Jokodola Gbenga Sunday under my supervision in the Department of Epidemiology and Medical Statistics (EMS), Faculty of Public Health, College of Medicine, University of Ibadan, Nigeria.

DR. (MRS.) OLUFUNMILAYO I. FAWOLE,

MBBS, M.Sc. (SA), FMCPH, FWACP, Cert, Clin. Epid(SA)

TABLE OF CONTENTS

Title Page		i
Abstract		ii
Acknowledgements		iv
Dedication		vi
Certification		vii
Table of Contents		vii
List of Tables		xii
List of Figures		xiii
Abbreviations		xiv
Glossary of Terms		xvi
CHAPTER ONE:	**INTRODUCTION**	
1.1	Background	1
1.2	Statement of Problem	2
1.3	Rationale of the Study	3
1.4	Objectives of the study	4
CHAPTER TWO:	**LITERATURE REVIEW**	
2.1	Epidemiology of Malaria	5
2.1.1	What is Malaria?	5
2.1.2	The Parasite: *Plasmodium*	7
2.1.3	The Vector: *Anopheles Mosquito*	10

2.1.4 Morbidity and Mortality Pattern 13

2.1.5 Endemicity and Transmission 14

2.1.6 Factors Determining Occurrence of Malaria 15

2.1.6.1 The Vector (Mosquito) Factor 16

2.1.6.2 The Host: Humans 17

2.1.6.3 The Parasite – Causative Agents 19

2.1.7 Economic Cost of Malaria 20

2. 1.7.1 The Costs of Malaria 20

2. 1.7.2 Malaria Burden in Nigeria 23

2.1.7.3 Progress with Malaria Control in Nigeria 23

2.1.7.4 Social and Economic Impact of Malaria 24

2.2 PREVENTION

2.2.1 Vector Control - Vector Control Measures 25

2.2.1.1 Integrated Vector Management (IVM) 26

2.2.1.2 In-door Residual Spraying (IRS) 27

2.2.1.3 Insecticide-Treated Materials (ITMN) 29

2.2.2 Commonly used Strategies in Homes 35

2.2.3 Implication of Malaria Control strategies to MDGs 35

2.3 Malaria Control 36

2.3.1 World Health Organization (WHO) Strategies to tackle Malaria 36

2.3.2 Malaria Control in Nigeria 37

2.4 Health – Seeking behaviour 38

2.1.4 Morbidity and Mortality Pattern 13

2.1.5 Endemicity and Transmission 14

2.1.6 Factors Determining Occurrence of Malaria 15

2.1.6.1 The Vector (Mosquito) Factor 16

2.1.6.2 The Host: Humans 17

2.1.6.3 The Parasite – Causative Agents 19

2.1.7 Economic Cost of Malaria 20

2. 1.7.1 The Costs of Malaria 20

2. 1.7.2 Malaria Burden in Nigeria 23

2.1.7.3 Progress with Malaria Control in Nigeria 23

2.1.7.4 Social and Economic Impact of Malaria 24

2.2 PREVENTION

2.2.1 Vector Control - Vector Control Measures 25

2.2.1.1 Integrated Vector Management (IVM) 26

2.2.1.2 In-door Residual Spraying (IRS) 27

2.2.1.3 Insecticide-Treated Materials (ITMN) 29

2.2.2 Commonly used Strategies in Homes 35

2.2.3 Implication of Malaria Control strategies to MDGs 35

2.3 Malaria Control 36

2.3.1 World Health Organization (WHO) Strategies to tackle Malaria 36

2.3.2 Malaria Control in Nigeria 37

2.4 Health – Seeking behaviour 38

2.1.4 Morbidity and Mortality Pattern 13

2.1.5 Endemicity and Transmission 14

2.1.6 Factors Determining Occurrence of Malaria 15

2.1.6.1 The Vector (Mosquito) Factor 16

2.1.6.2 The Host: Humans 17

2.1.6.3 The Parasite – Causative Agents 19

2.1.7 Economic Cost of Malaria 20

2. 1.7.1 The Costs of Malaria 20

2. 1.7.2 Malaria Burden in Nigeria 23

2.1.7.3 Progress with Malaria Control in Nigeria 23

2.1.7.4 Social and Economic Impact of Malaria 24

2.2 PREVENTION

2.2.1 Vector Control - Vector Control Measures 25

2.2.1.1 Integrated Vector Management (IVM) 26

2.2.1.2 In-door Residual Spraying (IRS) 27

2.2.1.3 Insecticide-Treated Materials (ITMN) 29

2.2.2 Commonly used Strategies in Homes 35

2.2.3 Implication of Malaria Control strategies to MDGs 35

2.3 Malaria Control 36

2.3.1 World Health Organization (WHO) Strategies to tackle Malaria 36

2.3.2 Malaria Control in Nigeria 37

2.4 Health – Seeking behaviour 38

CHAPTER THREE: MATERIAL AND METHODS

3.1.	The Study Location	40
3.2	Study Area	40
3.3	Study Population	41
3.4	Inclusion Criteria	41
3.5	Design and Scope of Study	41
3.6	Sample size Determination	41
3.7	Sampling procedure	42
3.8	Data Collection	43
3.9	Data Analysis	43
3.10	Ethical Considerations	43

CHAPTER FOUR: RESULTS

4.1	Socio Demographic Characteristics of Respondents	44
4.2	Household Structure / Economic Conditions of the Respondents	46
4.3	Respondents Knowledge of Malaria	47
4.4	Malaria Transmission, Symptoms and Prevention	48
4.5	Perceptions of the Severity of Malaria	51
4.6	Health – Seeking Behaviour and Source of Malaria Treatment	52
4.7.	Mosquito Issues	53
4.8	Knowledge, Attitude and Use of Insecticide Treated Nets	55
4.9	Perception on the use of Insecticide Treated Nets	58
4.10	Multivariate Analysis	61

CHAPTER THREE: MATERIAL AND METHODS

3.1.	The Study Location	40
3.2	Study Area	40
3.3	Study Population	41
3.4	Inclusion Criteria	41
3.5	Design and Scope of Study	41
3.6	Sample size Determination	41
3.7	Sampling procedure	42
3.8	Data Collection	43
3.9	Data Analysis	43
3.10	Ethical Considerations	43

CHAPTER FOUR: RESULTS

4.1	Socio Demographic Characteristics of Respondents	44
4.2	Household Structure / Economic Conditions of the Respondents	46
4.3	Respondents Knowledge of Malaria	47
4.4	Malaria Transmission, Symptoms and Prevention	48
4.5	Perceptions of the Severity of Malaria	51
4.6	Health – Seeking Behaviour and Source of Malaria Treatment	52
4.7.	Mosquito Issues	53
4.8	Knowledge, Attitude and Use of Insecticide Treated Nets	55
4.9	Perception on the use of Insecticide Treated Nets	58
4.10	Multivariate Analysis	61

CHAPTER FIVE: DISCUSSIONS, RECOMMENDATIONS AND CONCLUSIONS

5.1	Preamble	67
5.2	Epidemiology of Malaria	67
5.3	Living Conditions and Malaria	68
5.4	Knowledge about Cause of Malaria and Prevention of Malaria	69
5.5	Definition of Malaria, the Symptomatology and Prevalence among Respondents	70
5.6	Perception of (Best) Prevention Methods for Malaria	70
5.7	Health – Seeking Behaviour	71
5.8	Knowledge about ITNs, Attitude and Use	72
5.9	Issues involved in the Use of ITNs	73
5.10	The Role of Primary Health Workers in Influencing the Use of ITNs	75
5.11	Limitations of the Study	75
5.12	Recommendations	76
5.13	Conclusions	77
REFERENCES		78
APPENDICES		104

CHAPTER FIVE: DISCUSSIONS, RECOMMENDATIONS AND CONCLUSIONS

5.1	Preamble	67
5.2	Epidemiology of Malaria	67
5.3	Living Conditions and Malaria	68
5.4	Knowledge about Cause of Malaria and Prevention of Malaria	69
5.5	Definition of Malaria, the Symptomatology and Prevalence among Respondents	70
5.6	Perception of (Best) Prevention Methods for Malaria	70
5.7	Health – Seeking Behaviour	71
5.8	Knowledge about ITNs, Attitude and Use	72
5.9	Issues involved in the Use of ITNs	73
5.10	The Role of Primary Health Workers in Influencing the Use of ITNs	75
5.11	Limitations of the Study	75
5.12	Recommendations	76
5.13	Conclusions	77
REFERENCES		78
APPENDICES		104

CHAPTER FIVE: DISCUSSIONS, RECOMMENDATIONS AND CONCLUSIONS

5.1	Preamble	67
5.2	Epidemiology of Malaria	67
5.3	Living Conditions and Malaria	68
5.4	Knowledge about Cause of Malaria and Prevention of Malaria	69
5.5	Definition of Malaria, the Symptomatology and Prevalence among Respondents	70
5.6	Perception of (Best) Prevention Methods for Malaria	70
5.7	Health – Seeking Behaviour	71
5.8	Knowledge about ITNs, Attitude and Use	72
5.9	Issues involved in the Use of ITNs	73
5.10	The Role of Primary Health Workers in Influencing the Use of ITNs	75
5.11	Limitations of the Study	75
5.12	Recommendations	76
5.13	Conclusions	77
REFERENCES		78
APPENDICES		104

CHAPTER FIVE: DISCUSSIONS, RECOMMENDATIONS AND CONCLUSIONS

5.1	Preamble	67
5.2	Epidemiology of Malaria	67
5.3	Living Conditions and Malaria	68
5.4	Knowledge about Cause of Malaria and Prevention of Malaria	69
5.5	Definition of Malaria, the Symptomatology and Prevalence among Respondents	70
5.6	Perception of (Best) Prevention Methods for Malaria	70
5.7	Health – Seeking Behaviour	71
5.8	Knowledge about ITNs, Attitude and Use	72
5.9	Issues involved in the Use of ITNs	73
5.10	The Role of Primary Health Workers in Influencing the Use of ITNs	75
5.11	Limitations of the Study	75
5.12	Recommendations	76
5.13	Conclusions	77
REFERENCES		78
APPENDICES		104

LIST OF TABLES

Table 2.1	Recommended Insecticides for the Treatment of Mosquito Nets	30
Table 4.1	Socio-Demographic Characteristics of the Respondents	45
Table 4.2	Household Living Conditions of the Respondents	46
Table 4.3	Main source/ medium of information on malaria by the Respondents	47
Table 4.4	Respondents' knowledge on cause of malaria	48
Table 4.5	Respondents' perception of main symptom/sign of malaria	49
Table 4.6	Respondents best malaria prevention method	50
Table 4.7	Distribution of Respondents' last malaria episodes	51
Table 4.8	Respondents' health – seeking behaviour	52
Table 4.9	Percentage of respondents troubled by mosquito problems	53
Table 4.10	Respondents mosquito protection methods	54
Table 4.11	Household member using ITNs only on some Beds	56
Table 4.12	Respondents' reasons for use and non-use of ITNs	57
Table 4.13	Respondents Perception on the use of ITNS	58
Table 4.14	Respondents Perceived Reasons for Treating Bednets	60
Table 4.15	Perception on use of ITNs by Pregnant women and under 5 children	61
Table 4.16	Respondents' price perceptions for ITNs	62
Table 4.17	Respondents' Attitudes on ITNs	63
Table 4.18	Distribution of children under 5 years old who slept under a Net	64
Table 4.19	Distribution of pregnant women who slept under a Net	65
Table 4.20	Multivariate Analysis showing factors Influencing the Use of ITN	66

LIST OF FIGURES

Figure 2.1	Transmission of Malaria Parasite from the Vector to the Host	15
Figure 4.1	Distribution of Respondents Awareness of ITNs	55
Figure 4.2	Distribution Respondents' Attitudes / opinion on ITNs	59

ABBREVIATIONS

ACT	Artemisinin - Based Combination Therapy
AMAC	Abuja Municipal Area Council
An	Anopheles
CDC	Centers For Disease Control And Prevention
CMR	Crude Mortality Rate
DDT	Dichlorodiphenyltrichloroethane
DFID	Department For International Development (United Kingdom)
IEC	Information Education And Communication
FCT	Federal Capital Territory
IMCI	Integrated Management Of Childhood Illness
IRS	Indoor Residual Spraying
ITM	Insecticide-Treated Material
ITN	Insecticide-Treated Net
ITP	Intermittent Preventive Treatment
JCHEW	Junior Community Health Extension Worker
LLIN	Long-Lasting Insecticidal Nets
FMOH	Federal Ministry Of Health
NGO	Nongovernmental Organization
NMCP	National Malaria Control Programme
OIC	Officer In Charge
ORS	Oral Rehydration Solution
P. falciparum	Plasmodium Falciparum

P. malariae	Plasmodium Malariae
P. ovale	Plasmodium Ovale
P. vivax	Plasmodium Vivax
PHC	Primary Health Care
RBM	Roll Back Malaria
RDT	Rapid Diagnostic Test
SCHEW	Senior Community Health Extension Officer
SP	Sulfadoxine – Pyrimethamine
SPSS	Statistical Package For Social Sciences
UNICEF	United Nations Children's Fund
USAID	United States Agency For International Development
WHO	World Health Organisation

GLOSSARY OF TERMS

Anemia: A reduction in the number of circulating red blood cells or in the quantity of hemoglobin

Anopheles: A genus of mosquito, some species of which can transmit human malaria.

Artemisinin: A drug used against malaria, derived from the Qinghao plant, *Artemisia annua L.*

Cerebral malaria: A complication of Plasmodium falciparum malaria in which infected red blood cells obstructs blood circulation in the small blood vessels in the brain.

Clinical cure: Elimination of malaria symptoms, sometimes without eliminating all parasites.

Congenital malaria: Malaria in a newborn or infant, transmitted from the mother at birth.

Endemic: Where disease occurs on a consistent basis.

Epidemiology: The study of the distribution and determinants of health-related states or events in specified populations, and the application of this study to the control of health problems.

Epidemic: The occurrence of more cases of disease than expected in a given area or among a specific group of people over a particular period of time.

Eradication: The process of removing something permanently.

Erythrocyte: A red blood cell.

Erythrocytic stage: A stage in the life cycle of the malaria parasite found in the red blood cells.

Etiology: The cause or origin of a disease or disorder; the study of the factors that cause disease and of the method of their introduction into the host.

Exoerythrocytic stage: A stage in the life cycle of the malaria parasite found in liver cells.

Gametocyte: The sexual stage of malaria parasites.

Treatment - seeking / Health - Seeking: refers to a process followed by individuals and/or social groups for restoring health by using medical resources of all kinds.

Hepatocytes: Liver cells.

Hepatomegaly: Enlarged liver.

Hypnozoite: Dormant form of malaria parasites found in liver cells.

Hypoglycemia: Low blood glucose. Hypoglycemia can occur in malaria. In addition, treatment with quinine and quinidine stimulate insulin secretion, reducing blood glucose.

Indigenous malaria: Mosquito-borne transmission of malaria in a geographic area where malaria occurs regularly.

Induced malaria: Malaria acquired through artificial means (e.g. blood transfusion, shared needles or syringes, or malariotherapy).

Introduced malaria: Mosquito-borne transmission of malaria from an imported case in a geographic area where malaria does not occur regularly.

Macrogametocyte: The female form of the gametocyte.

Merozoite: A daughter-cell formed by asexual development in the life cycle of malaria parasites.

Microgametocyte: The male form of the gametocyte.

Oocyst: A stage in the life cycle of malaria parasites, oocysts are rounded cysts located in the outer wall of the stomach of mosquitoes.

Plasmodium: The genus of the parasite that causes malaria. The genus includes four species that infect humans: Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale and Plasmodium malariae

Protozoan: Single-celled organism that can perform all necessary functions of metabolism and reproduction.

Radical cure: (also: radical treatment) Complete elimination of malaria parasites from the body

Recrudescence: A repeated attack of malaria (short term relapse or delayed), due to the survival of malaria parasites in red blood cells.

Relapse: Recurrence of disease after it has been apparently cured.

Residual insecticide spraying: Treatment of houses where people spend night-time hours, by spraying insecticides that have residual efficacy (i.e., that continue to affect mosquitoes for several months). Residual insecticide spraying aims to kills mosquitoes when they come to rest on the walls, usually after a blood meal.

Resistance: The ability of an organism to develop strains that are impervious to specific threats to their existence. The malaria parasite has developed strains that are resistant to drugs such as

chloroquine. The Anopheles mosquito has developed strains that are resistant to DDT and other insecticides.

Schizogony: Asexual reproductive stage of malaria parasites. In red blood cells, schizogony entails development of a single trophozoite into numerous merozoites.

Schizont: A developmental form of the malaria parasite that contains many merozoites. Schizonts are seen in the liver-stage and blood-stage parasites.

Sporozoite: A stage in the life cycle of the malaria parasite. Sporozoites are produced in the mosquito and migrate to the mosquito's salivary glands. They can be inoculated into a human host when the mosquito takes a blood meal on the human.

Sporozoite rate: The proportion of female anopheline mosquitoes of a particular species that have sporozoites in their salivary glands (as seen by dissection), or that are positive in immunologic tests to detect sporozoite antigens

Trophozoite: A developmental form during the blood stage of malaria parasites. After merozoites have invaded the red blood cell, they develop into trophozoites.

Vector: An organism (e.g., Anopheles mosquitoes) that transmits an infectious agent (e.g. malaria parasites) from one host to the other (e.g., humans).

INTRODUCTION

1.1 Background

Malaria is a public health problem in more than 90 countries, inhabited by 40% of the world's population (WHO 2009). More than 90% of all malaria cases are in sub-Saharan Africa (WHO, 2010). Most people survive after an episode of malaria illness of 10-20 days; however mortality due to malaria is estimated to be over 1 million deaths each year. The vast majority of deaths occur among poor children in Africa, especially in remote rural areas with poor access to health services. (*WHO 1998).* It was estimated that about 25% of childhood deaths in Africa and half of fever episodes among African children under five years in endemic areas are attributed to malaria (WHO, 2010). Malaria causes death of approximately 750,000 children under five (the equivalent of almost 3000 children per day or one child every 30 seconds), and accounts for 10% of the total disease burden measured in disability adjusted life years (Goodman and Mills, 1999). Pregnant women are also at high risk; there is a fourfold increase in risk of disease and a twofold increase in death rates. HIV infection is associated with a significant increase in malaria prevalence in pregnant women of all parities with the effect apparent from early in gestation. (Verhoeff, *et al*., 1999). In Nigeria, malaria has continued to present a considerable risk to most households and is often stated as one of the top ten health problems. Malaria in Nigeria is endemic and is the leading cause of mortality and morbidity among the population, especially among children under five. It is estimated that malaria accounts for about 20% of hospital admissions in Nigeria and for 23% deaths among children under - five years (WHO, 2010).

Malaria continues to place an unacceptable burden on health and economic development in over 100 countries across the world. The economic cost of Malaria is enormous. Malaria affects the health and wealth of nations and individuals alike. In Africa today, malaria is understood to be both a disease of poverty and a cause of poverty (AMF, 2010). Malaria has significant measurable direct and indirect costs, and has recently been shown to be a major constraint to economic development. For developing economies this has meant that the gap in prosperity between countries with malaria and countries without malaria has become wider every single year.

Insecticide-treated bed nets (ITNs) are a form of personal protection that has repeatedly been shown to reduce severe disease and mortality due to malaria in endemic regions. (Binka and Akweongo, 2006). In community-wide trials in several African settings, ITNs have been shown to reduce all-cause mortality by about 20%. Untreated bed nets form a protective barrier around persons using them. However, mosquitoes can feed on people through the nets, and nets with even a few small holes provide little, if any, protection. The application of a residual insecticide greatly enhances the protective efficacy of bed nets. The insecticides used for treatment kill mosquitoes and other insects. The insecticides also have repellent properties that reduce the number of mosquitoes that enter the house and attempt to feed. In addition, if high community coverage is achieved, the numbers and longevity of mosquitoes will be reduced. When this happens, all members of the community are protected, regardless of bed net ownership. To achieve such effects, high community coverage is required, as for indoor residual spray.

1.2 Statement of Problem

Malaria currently accounts for nearly 110 million clinically diagnosed cases per year, 60% of outpatient visits and 30% hospitalizations, an estimated 300,000 children die of malaria each year, and up to 11% of maternal mortality. In addition to the direct health impact of malaria, there is also a severe social and economic burden on our communities and country as a whole, with about N132 billion lost to malaria annually in form of treatment costs, prevention, loss of man hours etc.

The costs of malaria include direct and indirect costs. The direct costs of malaria include a combination of personal and public expenditures on both prevention and treatment of the disease. The indirect costs of malaria include lost productivity or income associated with illness or death. This might be expressed as the cost of lost workdays or absenteeism from formal employment and the value of unpaid work done in the home by both men and women. In the case of death, the indirect cost includes the discounted future lifetime earnings of those who die. Another indirect cost of malaria is the human pain and suffering caused by the disease. Malaria also hampers children's schooling and social development through both absenteeism and permanent neurological and other damage associated with severe episodes of the disease.

The adverse malaria situation has put pressure on resources in the provision of medical services and on household income, which for a majority of people in Nigeria is already limited. Over a quarter of a very poor family's income can be absorbed in the cost of malaria treatment — added to this are the costs of prevention and the opportunity cost of labor lost to illness (*WHO/RBM,2002).* It is estimated that malaria reduces the Gross Domestic Product (GDP) of the Nigeria national income by 1.3% per annum and is projected to reduce economic growth in the year 2000-2001 by nearly 30% (WHO, 2000). Despite efforts to combat malaria, the disease has continued to be one of the main killers in Nigeria. Providing effective treatment alone is no longer enough to combat this scourge because malaria parasites are becoming increasingly resistant to drugs (Warrell and Herbert Gilles, 2002). Effective tools are now readily available, and many countries are successfully implementing comprehensive treatment and prevention strategies with significant impact and effect. This study aims at evaluating one of such strategies, the Insecticide-Treated Nets (ITNs).

1.3 Rationale of the Study

In April 2000, African heads of state participating in the Abuja Summit agreed that at least 60% of those at risk for malaria, particularly children under 5 years of age and pregnant women, are to benefit from the most suitable combination of personal and community protective measures such as ITNs by 2005. Before the development of insecticide-treated nets (ITNs) as a new technology in the mid-1980s, people in many countries were already using nets, mainly to protect themselves against biting insects and for cultural reasons (It was only recently appreciated that a net treated with insecticide offers much greater protection against malaria: not only does the net act as a barrier to prevent mosquitoes biting, but also the insecticide repels, inhibits, or kills any mosquitoes attracted to feed. Thus ITNs provide protection both to individuals sleeping under them and to other community members. The effect is so significant that use of ITNs is considered to be one of the most effective prevention measures for malaria.

The introduction of insecticide-treated nets world-wide as an intervention in the fight against malaria is expected to bring some respite. Insecticide-treated bed nets are advocated for the control and prevention of malaria in sub-Saharan Africa. However, widespread implementation of ITNs has been hampered by the need for frequent retreatment with insecticide. Several companies have

developed long-lasting nets that theoretically retain effective concentrations of insecticide after long-term use and repeated washings. CDC has been active in developing new long-lasting treatment technologies as well as evaluating candidate long-lasting ITNs in the laboratory and the field. For this intervention to succeed, the consumers or end-users must be able to appreciate insecticide-treated nets. The measurement of the level of appreciation involves a solid understanding of the population's knowledge, attitudes and practices regarding malaria and ITNs. This study seeks to find out how this applies to Nigeria.

To tackle morbidity and mortality due to malaria, there is necessity to increase the acceptability, affordability and access to ITNs. However, to design a malaria intervention initiative, there is need to establish how much people knew about malaria, how severe the malaria situation was, what attitudes people had towards malaria and what practices were currently used by households against mosquitoes and malaria. These and a number of other questions formed the basis for this survey.

To determine the usefulness of insecticide-treated nets (ITN) and malaria in Nigeria, a survey in the Municipal Area Council of Federal Capital Territory, F.C.T., Abuja, will be necessary to understanding the knowledge, attitudes, and practices related to malaria and insecticide - treated nets, especially since the introduction of strategies against malaria in the FCT, no proper documentation exist with respect to the PHC centres.

1.4 Objectives of the Study

1.4.1 General Objective

To determine the knowledge and perceptions on malaria prevention and Use of Treated Net (ITN_S) among Primary Health-Care Centre Attendees in Abuja Municipal Area Council

1.4.2 Specific Objectives

1. To determine knowledge about the causes, and prevention of malaria
2. To assess attitudes towards use of insecticide treatment
3. To describe the Health – seeking behaviour of residents of Abuja Municipal Local Council towards use of Insecticide-Treated Nets
4. To identify the effect of cost on ownership and use of ITNs
5. To determine factors influencing the use of ITNs by the respondents

CHAPTER TWO

LITERATURE REVIEW

2.1 EPIDEMIOLOGY OF MALARIA

2.1.1 WHAT IS MALARIA?

Malaria is a febrile, mosquito-borne infection, classically characterized by periodic chills, rigors, and high fevers followed by profuse sweating, which occur at regular intervals of 48 to 72 hours. Infection in humans begins when the infected female anopheline mosquito injects the sporozoite parasitic form from its salivary glands into the bloodstream during a blood meal. The sporozoites are carried to the liver, where they undergo asexual. When these infected liver cells burst, merozoites are released into the blood, where they invade red blood cells. The intraerythrocytic parasite develops through ring forms into schizonts that produce more infectious merozoites that affect additional red cells. The periodic fever is the result of synchronization of red cell lysis and release of more merozoites. Some of the organisms develop into distinct sexual forms (gametocytes) which, if ingested by the Anopheles mosquito during a feeding, can undergo sexual reproduction that starts the cycle over again.

Malaria, a protozoal disease, is older than recorded history, and probably plagued prehistoric man (Lambert, 2002). The first record of a treatment for the disease dates from 1600 A.D. in Peru, and utilized the quinine-rich bark of the Cinchona tree. (Lambert, 2002). Scientifically, it is not a newly described disease. The French physician Charles Louis Alphonse Laveran first identified the parasite under the microscope in 1880. Ronald Ross and Giovanni Grassi recognized the mosquito as the malaria vector in 1897 (Good, 2001).

However, despite enormous and diverse efforts to control this disease, malaria is among the top three most deadly communicable diseases and the most deadly tropical parasitic disease today(Sachs and Malaney, 2002). Worldwide, great and varied efforts are being made to learn about this disease and to determine how to control it. This is a formidable task. The official malaria eradication program, run by the World Health Organization (WHO), was cancelled in the late 1960s

because of growing difficulties, given that the complex and persistent nature of this disease became increasingly obvious. Management strategies today include the development of vaccines and chemotherapeutic agents, vector control, insecticides, education, bed nets and insecticide treated bed nets. Resistance to drugs by both the mosquito and the parasite is a growing obstacle in the battle against malaria. Combination therapy has been shown to increase the efficacy of combining drugs (Toure et al., 2003).

Although the above efforts have been successful to varying degrees, approximately 500 million clinical cases of malaria are reported each year (Kirkpatrick, 2003) and mortality estimates range between 0.7 and 2.7 million. Most of these deaths are young children. In sub-Saharan Africa, where malaria mortality is highest, 90% of reported malaria-related deaths are children under the age of five (Gardner, 1999). However, the actual figures of illness, morbidity and mortality may be very different from those cited above. Accuracy is impeded by the facts that most malarial deaths occur at home, many cases are misdiagnosed and functional microscopes are not available to most clinics in the area (Greenwood and Mutabingwa, 2002). Unfortunately, the disease burden is on the rise. Approximately 40% of the world's population lives in regions where malaria transmission is endemic, mainly tropical and sub-tropical regions (Aultman et al., 2002). Malaria has been successfully controlled, in fact effectively eliminated, in temperate regions of the world (Sachs and Malaney, 2002). The control strategies employed in temperate regions included changes in agricultural and construction practices, reducing the availability of standing water, and targeted vector control using insecticides such as DDT (Greenwood and Mutabingwa, 2002). Industrialization and improved housing conditions were instrumental in the elimination of the disease in temperate countries (Budiansky, 2002). Windows and walls reduce the amount of contact people have with mosquitoes. Additionally, the more severe seasons of the temperate regions provides another factor for the success of eradications programs as well. The role of the mosquito in the life cycle of P. falciparum requires that the parasite be able to maintain an extended infection in order to ensure transmission ability during the following season (Kyes et al., 2001). Strong seasonality results in lower basal levels of case reproduction (Sachs and Malaney, 2002). Now that the sequences of the three participants in the life cycle of human malaria, P. falciparum, Anopheles

gambiae, and Homo sapiens, are all completed and available, perhaps new strategies of disease control will succeed.

2.1.2 THE PARASITE: PLASMODIUM

Human malaria results from infection with Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale or Plasmodium malariae. Plasmodium falciparum causes a large majority of the clinical cases and mortalities (Bozdech et al., 2003). The protozoan Plasmodium is transmitted to humans by mosquitoes of the genus Anopheles. The mosquito picks up the parasite during a blood feeding from an animal with parasitaemia. The life cycle of Plasmodium will be described below.

The classic example of the strong selective pressure malaria puts on the human population is the high incidence of the potentially fatal sickle cell gene reported in regions with endemic malaria. People with one allele for sickled blood cells, the sickle cell trait, have a survival advantage in regions with endemic malaria. They are more likely to survive an infection by P. falciparum. Therefore, people with the sickle cell trait are more likely to survive to a reproductive age. However, the offspring of two people with sickle cell trait have a 25% chance of bearing offspring with sickle cell anaemia, which is often fatal and greatly reduces a person's expected longevity. The enormous effects that malaria has on countries where it is endemic explains this selection.

The virulence patterns of malaria were being documented as early as the 1920s. Malaria, specifically the fevers induced by infection with Plasmodium, was used at the time as a treatment for syphilis. It was also noted that reproducible virulence patterns were seen with the same isolate and immunity to a specific strain of one species of Plasmodium was achieved by infecting previously naïve patients (Kyes et al., 2001). Even through these most rudimentary types of experiments it was observed that immunity to a certain strain of Plasmodium was not equivalent to immunity to the disease malaria. More recent, controlled studies indicate that immunity to severe malaria is acquired more rapidly than immunity to mild malaria, especially in regions where transmission is high (Gupta et al., 1999).

To understand the challenges biologists face in combating this disease, and the strategies for vaccine and treatment development, it is essential to understand the basic life cycle of this parasite

Plasmodium parasites are protozoa of the phylum Apicomplexa (often referred to as sporozoans). These are animal parasites which exist in two hosts, have sexual and asexual stages, alternate between haploid and diploid phases and must be able to survive inside both hosts. The life cycle begins with the bite of an infected female anopheline mosquito. The mosquito takes her blood meal from the vertebrate (in this case a human) and injects both anticoagulant and haploid sporozoites into the human blood stream (Prescott et al., 2002). The sporozoites quickly travel to the hepatocytes (liver cells), where they mature. In the hepatocyte the sporozoites undergo multiple asexual fissions, or schizogony, to produce thousands of infective, haploid merozoites (Kyes et al., 2002). The merozoites are released into the blood stream and rapidly adhere to and invade host erythrocytes (red blood cells). It is from this that the immunity provided by the sickle cell trait can be explained. These parasites have high metabolic demands and cannot survive in the compromised red blood cells of a human with sub-optimal oxygen carrying-capacity. At this point, the patient is still in the prepatent period and does not exhibit any clinical symptoms.

Inside the erythrocyte, the merozoites again begin to replicate and divide asexually. Each merozoite gives rise to 6-32 daughter merozoites (Kyes et al., 2002) during 24-72 hours, depending on the species. Ultimately the infected erythrocytes lyse and merozoites are again released into the bloodstream and invade more cells. This cycle continues until the patient dies or the parasite slowed by either the host immune system or chemotherapeutic agents. The destruction of the erythrocyte and release of merozoites corresponds to the hallmark clinical presentation of the disease, the periodic fevers. The other possible life cycle for the merozoites is differentiation into macrogametocytes and microgametocytes that do not destroy the erythrocyte they inhabit while in the human host. These are ingested by anopheline mosquitoes and develop into male and female gametocytes. Inside the gut of the mosquito the erythrocytes do lyse and the gametes meet and fuse into diploid zygotes (the ookinete). This is the only diploid stage during the life time of the Plasmodium parasite. The ookinetes develop into sporozoites and migrate to the salivary gland of the mosquito (Good et al., 2001). The cycle is thus ready to begin again.

In 1996, an international effort was established to determine the sequence of the most deadly of the four Plasmodium species, P. falciparum. This goal was achieved, and reported in Nature magazine

in 2002 (Gardner et al., 2002), the same month the genome of Anopheles gambiae was reported in Science magazine (Holt et al., 2002). These discoveries will enable improved understanding of the species' individual biology and interactions. When the complete sequence of a clone of P. falciparum was first published (Gardner et al., 2002), it provided a large amount of new information about the parasite and simultaneously highlighted how much more there is to uncover. The 23 Mb genome encodes about 5,300 genes with an (A + T) – content of over 97% (Gardner et al., 2002). Sixty percent of the protein products did not have enough similarity to previously characterized proteins to be assigned a function (Gardner et al., 2002). Plasmodium falciparum has a highly conserved genome aside from the highly variable regions clustered close to the telomeres. The three most noted gene families in these regions, involved in immune evasion, are var, rif, and stevor (Florens et al., 2002). The gene products are P. falciparum erythrocyte membrane protein 1 (PfEMP1), repetitive interspersed family (rifin) and sub-telomeric variable ORF (stevor) proteins, respectively (Florens et al., 2002). The PfEMP1 proteins are exported to the surface of the infected erythrocyte where they mediate adherence to host endothelial regions. They give the parasite the ability to sequester large numbers of infected cells in to specific organs (Gardner et al., 2002). Almost all P. falciparum isolates in red blood cells are capable of cytoadherence, which can result in serious damage of the chosen organ. The damage is believed to be the result of blocked circulation or release of cytokines or nitrous oxide (NO) (Kyes et al., 1999). This can be fatal. Even under ideal medical conditions, 30% of patients with cerebral malaria will die.

Comparative analyses between sensitive and resistant strains of P. falciparum revealed polymorphisms (pfcrt, dhfr, dhps and pfmdr1) associated with resistance to commonly used drugs (Toure et al., 2003). Expression profiling, using high-density oligonucleotide arrays, has been used to determine relative levels and temporal patterns of expression in P. falciparum (Le Roch et al., 2003). Profiles of various stages during the P. falciparum life cycle allow us to determine shifts in transcription rates during the life cycle. This will be important information in identifying targets for multi-subunit vaccines. P. falciparum strains express variable antigens and exist in different body tissues. Therefore, in designing a treatment against the parasite, different immune responses for each form are necessary (Good et al., 2001). The paper written by Le Roch et al (2003) demonstrates that

genes with similar functions do follow similar patterns of expression. This should help to determine the function of unknown proteins. Proteomic expression profiling is also being used to characterize different stages of the parasite life cycle (Florens et al., 2002) and to identify potential new drug targets.

2.1.3 THE VECTOR: ANOPHELES MOSQUITO

Anopheles gambiae, Anopheles arabiensis and Anopheles funestus transmit most of human malaria and are all found in Africa (Besansky et al., 2004). Anopheles gambiae, the most famous and significant of these three, is one of sixty anopheline mosquitoes able to transmit malaria to humans (Budiansky, 2002). Anopheles gambiae is the primary malaria vector; this can be attributed, in part, to its relatively long life, strong anthropophily and endophily (the tendency to target humans for blood meal and the tendency to enter and rest inside of houses, respectively) (Besansky et al., 2004). Adult mosquitoes normally rest during the day inside human habitats and emerge to feed at night (Holt et al., 2002). Their larvae tend to develop in temporary bodies of water, such as those typically found near agricultural sites or even in flooded hoof prints (Vogel, 2002). All of these characteristics combine to make P. falciparum a successful vector.

That this behavior is remarkable can be highlighted with a comparison of the entomological inoculation rate (EIR) of infectious mosquitoes in Asia or South America compared to sub-Saharan Africa. The EIR measures how often one person is bitten by an infectious mosquito. In Asia or South America a person's EIR rarely exceeds 5 bites per year. In sub-Saharan Africa a person may have an EIR of over 1,000 bites per year. (Greenwood and Mutabingwa, 2004). Greenwood and Mutabingwa (2004) also report that during a single night in sub-Saharan Africa, hundreds of mosquitoes typically collect in a room occupied by humans; 1-5% of these are infectious.

Some disease control strategies deal with these anopheline mosquitoes rather than the parasite. One strategy for attacking mosquitoes is to develop more effective insecticides. The main obstacles to this line of attack are growing insecticide resistance and environmental concerns. The publication of the An. gambiae genome (Holt et al., 2002) should help to locate genes involved in resistance and to design chemicals for attacking new targets in the mosquito. The failure of the

WHO's malaria eradication program was, to a significant degree, due to increasing resistance to DDT and the fact that people did not want their homes to be sprayed (Greenwood and Mutabingwa, 2002). The current, most widely used, technique for vector control is bed nets treated with the insecticide pyrethroid. However, it is only a matter of time before pyrethroid, like DDT, loses its efficacy. Genomics may prove key in the development of new insecticides and may also improve the longevity of available insecticides (Hemingway, J. et al., 2002).

The viability of introducing genetically modified mosquitoes, which are either unable to transmit malaria to humans or are sterile, is also being investigated. The completed genome of An. gambiae has encouraged comparative studies between these mosquitoes and other arthropods and model organisms such as Drosophilia melanogaster. These studies may provide clues to account for their great effectiveness as a Plasmodium vector and could prove to be an effective tool for disease control. Ito and coworkers (2002) reported the creation of a stable strain of transgenic mosquitoes that were unable to transmit Plasmodium under laboratory conditions. Using bacteriophages they identified a peptide that blocks the parasite from crossing the epethelia of the mosquito. During a successful life cycle of a Plasmodium parasite they must cross the epethilium of both the midgut and the salivary glands. Attaching units of this peptide to a promoter activated by a blood meal, they were able to inhibit the development of the majority of parasites. This laboratory success is great but there remain many challenges before genetically modified mosquitoes could be considered a viable method for malaria control.

Recently, RNA interference (RNAi) was used to identify three genes in An. Gambiae which are involved in the insect's immune response. These genes seem to have effects on the development and survival of rodent malaria, Plasmodium berghei (Osta et al., 2004). Additionally, they have no orthologs in Drosophilia, making them good targets for parasite destruction that may not harm other organisms. Two of these genes, when silenced, resulted in a negative effect on the development of the parasite. This indicates that the Plasmodium and mosquito have coevolved such that the immune system of An. gambiae has been subverted to encourage the success of the parasite (Hemingway and Craig, 2004). The success of a parasite could be improved by increasing the fitness of its vector (Hurd, 2003). However, Plasmodium seems to reduce the fitness of its host, infected mosquitoes

WHO's malaria eradication program was, to a significant degree, due to increasing resistance to DDT and the fact that people did not want their homes to be sprayed (Greenwood and Mutabingwa, 2002). The current, most widely used, technique for vector control is bed nets treated with the insecticide pyrethroid. However, it is only a matter of time before pyrethroid, like DDT, loses its efficacy. Genomics may prove key in the development of new insecticides and may also improve the longevity of available insecticides (Hemingway, J. et al., 2002).

The viability of introducing genetically modified mosquitoes, which are either unable to transmit malaria to humans or are sterile, is also being investigated. The completed genome of An. gambiae has encouraged comparative studies between these mosquitoes and other arthropods and model organisms such as Drosophilia melanogaster. These studies may provide clues to account for their great effectiveness as a Plasmodium vector and could prove to be an effective tool for disease control. Ito and coworkers (2002) reported the creation of a stable strain of transgenic mosquitoes that were unable to transmit Plasmodium under laboratory conditions. Using bacteriophages they identified a peptide that blocks the parasite from crossing the epethelia of the mosquito. During a successful life cycle of a Plasmodium parasite they must cross the epethilium of both the midgut and the salivary glands. Attaching units of this peptide to a promoter activated by a blood meal, they were able to inhibit the development of the majority of parasites. This laboratory success is great but there remain many challenges before genetically modified mosquitoes could be considered a viable method for malaria control.

Recently, RNA interference (RNAi) was used to identify three genes in An. Gambiae which are involved in the insect's immune response. These genes seem to have effects on the development and survival of rodent malaria, Plasmodium berghei (Osta et al., 2004). Additionally, they have no orthologs in Drosophilia, making them good targets for parasite destruction that may not harm other organisms. Two of these genes, when silenced, resulted in a negative effect on the development of the parasite. This indicates that the Plasmodium and mosquito have coevolved such that the immune system of An. gambiae has been subverted to encourage the success of the parasite (Hemingway and Craig, 2004). The success of a parasite could be improved by increasing the fitness of its vector (Hurd, 2003). However, Plasmodium seems to reduce the fitness of its host; infected mosquitoes

live shorter lives, produce less offspring and show a reduced flight distance (Anderson et al., 1999, Hahn and Nuzhdin, 2004). When Osta et al. (2004) silenced the third gene, a positive effect on parasite development was seen. Perhaps targeting the immune response of the mosquito will prove to be more effective than boosting human immune response or attempting to replace populations with transgenic mosquitoes. Refractory alleles have been identified in the An. gambiae genome (Niare et al., 2002) but are not spread in wild populations, perhaps due to energetic costs (Hahn and Nuzhdin, 2004).

The engineered mosquitoes must be safely introduced into a population and must outcompete the wild mosquitoes (Ito et al., 2002). Major concerns about this technique include the development of resistant strains and the possibility that the transgene could make them viable carriers for other diseases (Enserink, 2002). The danger of selecting for parasites with increased virility must be considered. Increasing the genetic variability of the transgenic mosquito would help to minimize but perhaps not completely eliminate this risk. An international agreement would have to be reached before release could be considered. Assuming getting approval for this stratagem to be possible, other challenges exist. Semi-field facilities, where the genetics of the potential target population has been well characterized and compared to the release strain, would be necessary (Alphey et al., 2002). Understanding the behavior of the anopheline mosquitoes has proven to be helpful in strategizing disruption of target populations (Besansky et al., 1995). The release strain would have to be able to mate with the mosquitoes in the target population and drive the transgenes into the resultant population.

The creation of sterile mosquitoes, which would presumably lower the number of mosquitoes, is another possibility. Similar concerns exist concerning the introduction of a genetically modified organism into the wild hold for this scenario. It would also be important only to introduce male mosquitoes in order to avoid any increase in transmission (Alphey et al., 2002). The behavior of the vector is also considered when strategizing vector control. If the genes responsible for the anthrophily of the anopheline mosquitoes are identified, they could be targeted (Besansky et al., 1995).

2.1.4 MORBIDITY AND MORTALITY PATTERN

Country-specific evidence shows that Nigeria has the largest population at risk of malaria in Africa and therefore most vulnerable to the risk of missing MDGs target. The disease, malaria, is a major health problem in the country, with stable transmission throughout the country. It accounts for about 50 percent of out-patient consultation, 15 per cent of hospital admission, and also prime among the top three causes of death in the country (National Malaria Control Plan of Action 1996 to 2001). More importantly, it is a social and economic problem, which consume about US$3.5 million in government funding and US$2.3 million from other stakeholders in various control attempts in 2003 (WHO,2005). Approximately 50% of the Nigerian population experience at least one episode per year (Carter Centre, 2012). However, official estimate suggests as much as four bouts per person per year on the average (WHO, 1995 and 2002). The trend is rapidly increasing due to the current malaria resistance to first line anti-malarial drugs (WHO, 2000). The magnitude of incidence and death due to it is a multiple of all other tropical diseases put together. It is responsible for over 90% of reported cases of tropical disease in Nigeria (Alaba and Alaba 2003). The above suggests that malaria could be the largest contributor to total disease burden and productivity losses resulting from major tropical diseases in the country. Evidence on Nigeria given by the malaria report 2005 shows that malaria incidence throughout the country had been on the increase over the years ranging between 1.12 million at the beginning of 1990 and 2.25 million by the turn of the millennium 2000 and 2.61 million in 2003.

The disease carries with it two categories of costs; morbidity and mortality costs. Malaria morbidity affects households' welfare (through families' allocation to treatment and prevention of the disease), and decline in productivity, through lost time. In the case of mortality, losses to households include loss of future income and cumulative investment on the dead due to malaria.

In rural Africa south of the Sahara, child mortality caused by malaria is estimated to have increased by up to twofold during the 1980s and the early 1990s, while mortality resulting from other causes decreased over the same period. Factors contributing to the increase in malaria include: (i) resistance of parasites to commonly used antimalarial drugs; (ii) breakdown of control programmes; (iii) complex emergencies; (iv) collapse of local primary health services; and (v) resistance of mosquito

vectors to insecticides. Within this same period, however, malaria was well-controlled in the five northernmost African countries, and elimination or a very low level of transmission was maintained in some of the islands off the coast of Africa. Throughout the past decades, malaria was generally much less intense in Central America and South America than in Africa and South-East Asia, where transmission is mostly limited to P. vivax--except for the Amazon basin—and a relatively low but fairly stable incidence was reported throughout the 1990s.

From the available data, it is not yet possible to determine with sufficient confidence whether the global burden of malaria has changed substantially, for better or worse, since 2000 when Roll Back Malaria (RBM) implementation began in many countries. In some areas, fluctuations in malaria transmission from year to year potentially confound evaluations of broader trends. Therefore, conclusions typically require an analysis of epidemiological data over multiple years. For the high-burden continent of Africa, reliable data on under-5 mortality from birth history surveys and demographic surveillance will only become available after a time lag of several years. Nevertheless, for some countries and areas throughout the world there is evidence that successful control has had an impact on malaria disease burden.

2.1.5 ENDEMICITY AND TRANSMISSION

Endemicity (or disease intensity) is a measure of disease prevalence in a particular region and prevalence is the proportion of people infected at a given point in time. The vast majority of malaria disease and death occurs within areas of high prevalence and the level of endemicity within these areas is of particular interest to groups involved in malaria control. Information about areas of unstable malaria transmission is important for regions that are close to malaria elimination and it is more appropriate to measure disease incidence in these areas.

Areas suffering the same level of endemicity often have similar characteristics of disease spread, which can help experts assess the severity of the local malaria problem and, to some extent, what needs to be done. There are no hard and fast rules about how to classify the intensity, or endemicity, of malaria disease. Over time some standards have evolved but different countries, people and groups prefer different approaches.

Within areas of stable malaria transmission, malaria endemicity can be subdivided into three risk classes. These classes are pertinent to control using the most widely deployed malaria control method, insecticide-treated nets (ITNs). Endemicity is measured as the percent of people in a community who are infected with malaria parasites at a given point in time. In the lowest risk class (≤5%), control with ITNs is relatively easy. In the intermediate risk class (>5% to <40%), models predict that malaria can be controlled if everyone uses an ITN every night. In high risk areas (≥40%), additional measures, in combination with universal coverage of ITNs, are required to control malaria.

2.1.6 FACTORS DETERMINING OCCURRENCE OF MALARIA

Factors that determine the occurrence of malaria are those that influence the three components of the malaria life cycle:

1. Anopheles mosquitoes must be present, which are in contact with humans, and in which the parasites can complete the "invertebrate host" half of their life cycle
2. Humans must be present, who are in contact with Anopheles mosquitoes, and in whom the parasites can complete the "vertebrate host" half of their life cycle
3. Malaria parasites must be present.

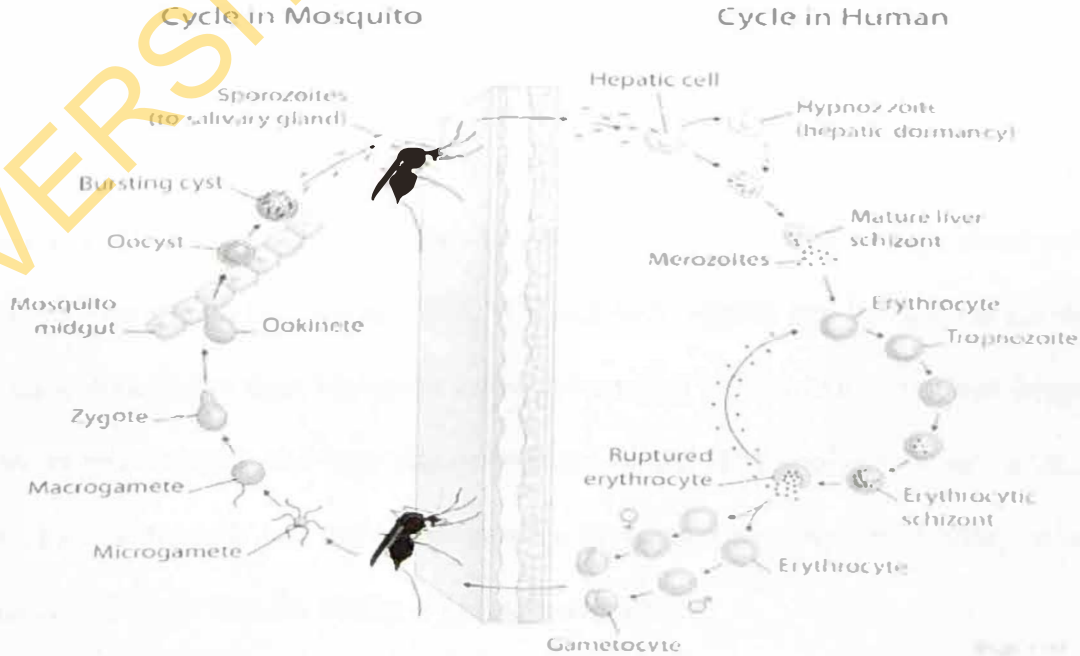


Figure 2.1: The Transmission of the Malaria Parasite from the Vector to the Host

Within areas of stable malaria transmission, malaria endemicity can be subdivided into three risk classes. These classes are pertinent to control using the most widely deployed malaria control method, insecticide-treated nets (ITNs). Endemicity is measured as the percent of people in a community who are infected with malaria parasites at a given point in time. In the lowest risk class (≤5%), control with ITNs is relatively easy. In the intermediate risk class (>5% to <40%), models predict that malaria can be controlled if everyone uses an ITN every night. In high risk areas (≥40%), additional measures, in combination with universal coverage of ITNs, are required to control malaria.

2.1.6 FACTORS DETERMINING OCCURRENCE OF MALARIA

Factors that determine the occurrence of malaria are those that influence the three components of the malaria life cycle:

1. Anopheles mosquitoes must be present, which are in contact with humans, and in which the parasites can complete the "invertebrate host" half of their life cycle
2. Humans must be present, who are in contact with Anopheles mosquitoes, and in whom the parasites can complete the "vertebrate host" half of their life cycle
3. Malaria parasites must be present.

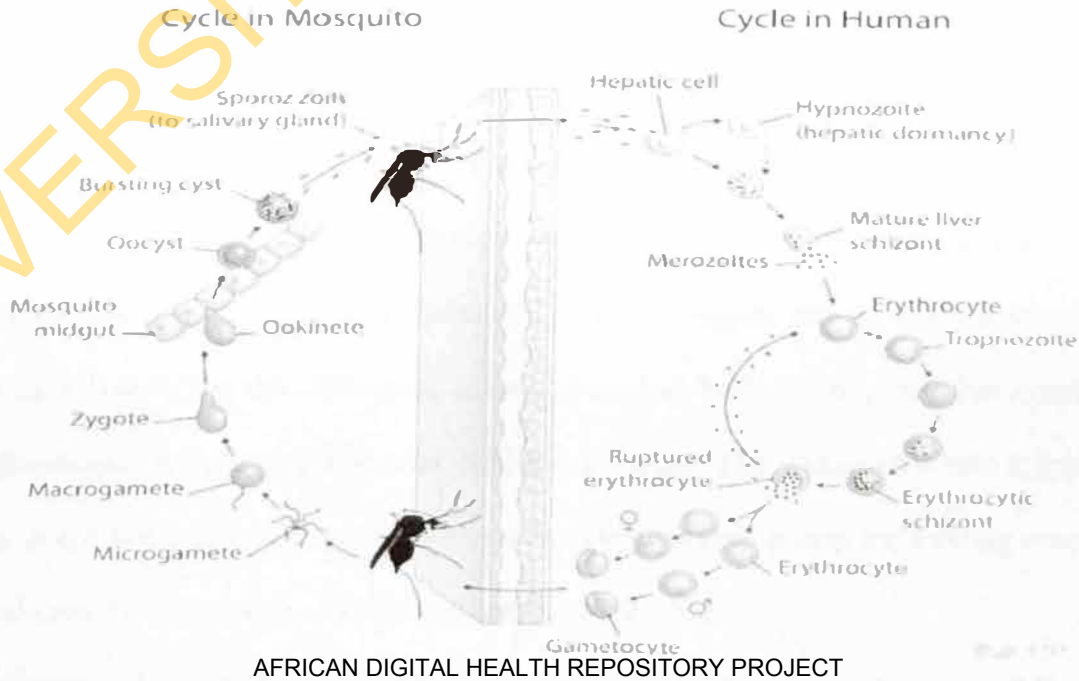


Figure 2.1: The Transmission of the Malaria Parasite from the Vector to the Host

2.1.6.1 The Vector (Mosquito) Factor

Malaria is transmitted from man to man by the female anopheles mosquito, one of the most capable vectors of human disease. Various species have been found to be the vectors in different parts of the world. A. gambiae complex is the chief vector in Africa and A. freeborni in N. America. Nearly 45 species of the mosquito have been found in India and A. culicifacies, A. fluviatilis, A. minimus, A. philippinensis, A. stephensi, A. sundaicus, and A. leucosphyrushave been implicated in the transmission of malaria. The areas of distribution are different for these mosquitoes: A. fluviatilis, A. minimus are found in the foot-hill regions, A. stephensi, A. sundaicus are found in the coastal regions, A. culicifacies and A. philippinensis are found in the plains. Species like A. stephensi are highly adaptable and are found to be very potent vectors of human malaria.

Mosquitoes choose the blood donor by odours and visual clues and can learn from experience! Human behaviour also plays a role and males are more frequently bitten. The genome of A. gambiae has now been cracked and the effort is expected to help in future research into mosquito control strategies.

Other diseases transmitted by Anopheles mosquitoes: Apart from malaria, anopheles mosquitoes are also known to transmit W. bancrofti (filarial worm); the Timorese filaria, Brugia timori; several arboviruses including eastern and western equine encephalitis, Venezualan equine encephalitis, onyong-nyong, tataguine etc.

The female mosquito has a specialised apparatus to penetrate the skin of its victim. At the end of the slender proboscis, there are two pairs of cutting stylets that slide against one another to slice through the skin. Once through the skin, the mosquito's proboscis begins probing for a tiny blood vessel. If it does not strike one on the first try, the mosquito will pull back slightly and try again at another angle through the same hole in the skin. Inside the proboscis are two hollow tubes, one that injects saliva into the microscopic wound and one that withdraws blood. The mosquito's saliva includes a combination of antihemostatic and anti- inflammatory enzymes that disrupt the clotting process and inhibit the pain reaction (so that the victim is unaware of the bite!)

The female mosquito lays 30-150 eggs every 2-3 days. Human blood is needed to nourish these eggs and Anopheles shows the most regular cycles of blood feeding and egg laying. As a corollary, by

using personal protective measures against mosquito bites, like using mosquito nets, one can deny the blood meal and hence help in mosquito control. Anopheles mosquitoes enter the house between 5 p.m. and 9.30 p.m. and again in early hours of morning. They start biting by late evening and the peak of biting activity is at midnight and early hours of morning. By keeping the windows and doors closed between 5 p.m. and 10 p.m. and again in early morning, one can prevent the entry of these mosquitoes into the house. Also protect yourself against the bites in the evenings and early mornings by wearing garments that cover the body as much as possible and at bedtime, by using mosquito nets without fail.

Mosquitoes can fly up to several kilometers! And they can reach far off places by taking shelter in motor vehicles, ships and aircraft. The average life span of a mosquito is 2-3 weeks. It can be longer in ideal. The adult mosquitoes hide themselves behind cupboards, clothes, curtains and other dark and cool corners during the day and come out to bite at night. It is important to minimize these hiding places. Therefore keep the cupboards and such other things closed; do not hang clothes at corners of the room, instead keep them inside the wardrobes or cupboards.

Anopheles mosquitoes breed in natural water collections. Therefore, breeding increases dramatically in the rainy season when water collects in bottles, tins, tender coconut shells, buckets, tyres etc., that are thrown out in the open and these provide ample breeding ground. Also wells, ponds, water tanks, paddy fields etc., act as breeding grounds. Construction sites provide ample breeding places for the mosquito - water on the concrete slabs (used for curing), water collected in tanks, water collected in and around the construction site owing to blockage of water drains - all these help breeding. It is very important to destroy these water collections or to keep them properly covered to prevent breeding. Usually it takes about a week for the eggs to develop into adults.

2.1.6.2 The Host: Humans

As discussed above, malaria is a disease devastating millions of people each year and has been described for over a century. Despite the fact that strong attempts to eradicate malaria have been made, the disease burden is still on the rise and some estimate that the number of cases could double in the next twenty years without the development of new methods for control (Sachs and Malaney, 2002). Aside from the human tragedy this predicts, an economic disaster is also likely for the

stricken countries. Gallup and Sachs (2001) report that, during the period 1965 - 1990, the annual growth rates in malarious countries are 1.3 % lower compared to non-malarious countries. This corresponds to a 50% decrease in per capita Gross Domestic Product (GDP) (Gardner et al., 2002). Malaney and Sachs (2001) hypothesize that this apparent correlation between poverty and malaria runs both ways. Poverty may increase the incidence of malaria; malaria may also increase the likelihood of poverty. An increase in population in malarious regions, compounded by weak public health systems in developing countries, climate changes (Hay et al., 2002), new agriculture practices such as irrigation and dam construction (Sachs and Malaney, 2002), increased resistance to antimalarial treatments and insecticides (Bozdech et al., 2003) and the complexity and flexibility of the genetics (Gardner et al., 2002) have all contributed to the increase in malaria.

That malaria is a 'disease of poverty' greatly contributes to its persistence. Kettler and Marjanovic (2004) define the term "healthy years" as measuring the healthy years lost by premature death and years lost measured in disability-adjusted life years, for patients debilitated by disease. Diseases of poverty, such as malaria, human immunodeficiency virus (HIV), tuberculosis, African trypanosmiasis and leishmaniasis, are responsible for 14 million deaths each year, with 90% of the cases occurring in developing nations. They are responsible for the loss of one half to two thirds of the healthy years lost in the developing world (Kettler and Marjanovic, 2004). Yet, these diseases are neglected because of the people they affect.

During the period between 1975 and 1996, only 3 of 1,223 drugs developed were antimalarials (Greenwood and Mutabingwa, 2002). The need for malarial drugs has long outstripped the supply. This can be explained, in part, by the fact that the large number of people suffering from malaria and other diseases of poverty are not customers (Kettler and Marjanovic, 2004). They cannot purchase new drugs and therefore do not exist as a viable market for a biotechnology company's investment. The involvement of biotechnology companies is crucial in the fight against malaria. When the P. falciparum sequence became available, the biotechnology companies acted quickly to advance this knowledge into products. Aside from the new vaccine candidates developed, biotechnology companies produced both a needle-free injection device (Bioject Medical Technologies) and kits for parasite detection (AMRAD corp.) (Kettler and Marjanovic, 2004). The contribution of their

research power is essential for the success of malaria control campaigns. The difficulty of involving the biotechnology companies lies in their dependency upon earning a profit and in the fact that they mostly receive outside funding. Funding is not easily procured when a viable market does not exist. Most biotech companies would be interested in researching these diseases, even if only for public relations purposes, if they were given any compensation incentive. Policy changes must be made to make the production of these drugs possible. These policies would need to be enacted on a global scale. Models based on national laws such as the American Orphan drug act have been proposed (Kettler and Marjanovic, 2004). These would lower the cost and risk for the companies while increasing the expected return.

Additionally, more specific regions need to be identified as regions in need of more resources. One study in Kenya showed that the insecticide-treated bednet (ITN) programs were distributing their products to regions where nongovernmental organizations (NGOs) were present, rather than to areas where malaria transmission was highest (Greenwood and Mutabingwa, 2004). Organized strategies need to be employed to achieve the highest possible efficacy. Four studies of home management of malaria revealed large reductions in severe illness when children were treated at early stages. Intermittent preventive treatment in infants (IPTi) was tried in conjunction with normal vaccine schedules. Healthy babies were given full treatments of antimalarial drugs and this reduced the amount of malaria and anaemia (Toure et al., 2004). One important element of this study was their use of organizations involved in vaccine distribution to administer malaria treatment. This type of cooperation is cost-effective and could cover extensive areas. These studies suggest that improvements can be made by training local healthcare workers to educate themselves and people in their communities about appropriate drugs to prescribe (Toure et al. 2004). With the cooperation of science, government and charitable foundations it may soon be possible to bring malaria under control.

2.1.6.3 The Parasite – Causative Agents

Malaria is caused by protozoan parasites called Plasmodia, belonging to the parasitic phylum Apicomplexa. More than 200 species of the genus Plasmodium (=plasma + eidos, form) have been identified that are parasitic to reptiles, birds, and mammals.[1] Four Plasmodium species have been

well known to cause human malaria, namely, P. falciparum, P. vivax, P. ovale, and P. malariae. A fifth one, P. knowlesi, has been recently documented to cause human infections in many countries of Southeast Asia.[2] Very rare cases of malaria have been reported due to other species such as Plasmodium brasilianum, Plasmodium cynomolgi, Plasmodium cynomolgi bastianellii, Plasmodium inui, Plasmodium rhodiani, Plasmodium schwetzi, Plasmodium semiovale, Plasmodium simium and Plasmodium eylesi. All malaria parasites infecting humans probably jumped from the great apes (in case of P. knowlesi, macaques) to man.

2.1.7 ECONOMIC COST OF MALARIA

2. 1.7.1. THE COSTS OF MALARIA

Malaria has implications for the development of household members and the country through various mechanisms. One, malaria impairs the ability of people to work hard by losing productive time during care-giving activities, while adults with malaria severely compromise household/family resources, as their capacity to work, earn income and save for their families is reduced. Added to this, the illness

generates new financial demands to cover medical treatment, threatening food supply and in extreme cases funeral expenses. Two, it affects child's development and compromise future productive capacity due to absenteeism from school associated with malaria attack.

Also, malaria is known to be a main cause of anaemia, epileptic convulsions, growth faltering, and neurological squeal. These are 5 all likely to affect children's performance at school. Three, in the agricultural sector/rural area, peak of malaria transmission has been found to coincide with the peak of planting and harvest seasons when demand for labour is supposed to be high. With this vast expanse of land goes uncultivated and substantial harvest are lost because workers are sick.

In 1995, 28 percent of household revenue in Sub Saharan Africa went to treat malaria alone. Approximately 10 percent of hospital admissions in Africa are due to malaria. A single bout of malaria is estimated to cost a sum equivalent to 10-20 working days in India and Africa. A very-low-income African family, whose yearly income is $68, spends $19 for malaria treatment each year. Malaria tends to strike at harvest time for five or six months each year (see Appendix 3). Malaria

takes an enormous toll on human health and well-being, in tropical regions including the Indian subcontinent, Sri Lanka, Sub-Saharan Africa, Oceania, and parts of the Americas. In many of these regions, the burden has been increasing even further in recent years.

The costs of malaria are also enormous when measured in economic terms. Highly malarious countries are among the very poorest in the world, and typically have very low rates of economic growth; many have experienced outright declines in living standards in the past thirty years. Malaria has played a significant role in the poor economic performance of these countries. Malaria imposes a heavy cost not only on a country's current income, but also on its rate of its economic growth, and therefore on its level of economic development in the long run. The evidence strongly suggests that malaria obstructs overall economic development. During the period 1965-1990, highly malarious countries suffered a growth penalty of more than one percentage point per year (compared with countries without malaria), even after taking into account the effects of economic policy and other factors that also influence economic growth. The annual loss of growth from malaria is estimated to range as high as 1.3 percentage points per year. If this loss is compounded for fifteen years, the GNP level in the fifteenth year is reduced by nearly a fifth, and the toll continues to mount with time.

Traditional analyses have underestimated the short-run costs of malaria. These considerations indicate that the cost of malaria is substantially greater than economists have previously estimated. Traditional estimates have looked at some of the short-run costs of malaria without taking into account the longer-term effects of malaria on economic growth and development. Short-run costs—including lost work time, economic losses associated with infant and child mortality and morbidity, and the costs of treatment and prevention— are typically estimated to be higher than one percent of a country's gross national product. These estimates, however, neglect many other short-run costs. For instance, very few studies include the economic costs of the pain and suffering associated with the disease. Yet researchers have found that households might be willing to pay several times the direct income loss caused by malaria in order to avoid it, suggesting that the pain, suffering and uncertainty associated with the disease is very high and should certainly be included among its short-term costs. These short-run costs are likely to have risen in recent years due to increasing number and complexity of cases in many countries. Moreover, the spread of drug-resistant malaria is

substantially raising the costs of treatment in many cases, as well as the burdens of morbidity and mortality. Children and adults needing blood transfusions due to malaria are too often inadvertently infected with HIV, hepatitis C virus, and other infectious agents which taint the blood supply. Furthermore, these analyses have completely neglected the long-run costs. Beyond these high and rising short-run costs, malaria impedes economic growth and long-term development in many ways. Malaria may impede the flows of trade, foreign investment, and commerce, thereby affecting a country's entire population. Tourists shun regions with high malaria, as do multinational firms choosing the location of foreign investments. Also, the economic effect of malaria on infected individuals may greatly exceed the direct costs of any single episode of the disease. Repeated bouts of malaria tend to hinder a child's physical and cognitive development, and may reduce a child's attendance and performance at school. Furthermore, repeated bouts of malaria may expose individuals to chronic malnutrition and to increased vulnerability to other diseases.

The burden of malaria is very high and rising. Short-term costs alone are likely to result in economic losses of several percent of GDP in a single year. Moreover, malaria hinders long-term economic growth, so that the burden of the disease increases over time as countries are deprived of the rise in living standards that they would experience if not for malaria. There are important differences in malaria across regions and countries. The patterns and costs of malaria incidence are highly place-specific. No single biological, economic or political reason can be adduced for the observed patterns and trends in malaria transmission. No single intervention, therefore, is appropriate in all contexts. Interventions should be adapted to specific local ecological, epidemiological, economic, and social conditions. Even the goals of malaria interventions should be place-specific.

The effects of human behavior on malaria are similarly place-specific. Anthropogenic changes such as deforestation, road-construction and agricultural development generally increase the intensity of malaria transmission. But the specific effects of such ecological disturbances are often unpredictable, due to geographical diversity in the biology of the mosquitoes that transmit the disease.

Any drug therapy strategy should be designed to minimize the threat of resistant parasites. Specific strategies, however, must be tailored to the patient, the community and the region in which they are employed. The selection of drugs and treatment protocols must be based on reliable clinical and

substantially raising the costs of treatment in many cases, as well as the burdens of morbidity and mortality. Children and adults needing blood transfusions due to malaria are too often inadvertently infected with HIV, hepatitis C virus, and other infectious agents which taint the blood supply. Furthermore, these analyses have completely neglected the long-run costs. Beyond these high and rising short-run costs, malaria impedes economic growth and long-term development in many ways. Malaria may impede the flows of trade, foreign investment, and commerce, thereby affecting a country's entire population. Tourists shun regions with high malaria, as do multinational firms choosing the location of foreign investments. Also, the economic effect of malaria on infected individuals may greatly exceed the direct costs of any single episode of the disease. Repeated bouts of malaria tend to hinder a child's physical and cognitive development, and may reduce a child's attendance and performance at school. Furthermore, repeated bouts of malaria may expose individuals to chronic malnutrition and to increased vulnerability to other diseases.

The burden of malaria is very high and rising. Short-term costs alone are likely to result in economic losses of several percent of GDP in a single year. Moreover, malaria hinders long-term economic growth, so that the burden of the disease increases over time as countries are deprived of the rise in living standards that they would experience if not for malaria. There are important differences in malaria across regions and countries. The patterns and costs of malaria incidence are highly place-specific. No single biological, economic or political reason can be adduced for the observed patterns and trends in malaria transmission. No single intervention, therefore, is appropriate in all contexts. Interventions should be adapted to specific local ecological, epidemiological, economic, and social conditions. Even the goals of malaria interventions should be place-specific.

The effects of human behavior on malaria are similarly place-specific. Anthropogenic changes such as deforestation, road-construction and agricultural development generally increase the intensity of malaria transmission. But the specific effects of such ecological disturbances are often unpredictable, due to geographical diversity in the biology of the mosquitoes that transmit the disease.

Any drug therapy strategy should be designed to minimize the threat of resistant parasites. Specific strategies, however, must be tailored to the patient, the community and the region in which they are employed. The selection of drugs and treatment protocols must be based on reliable clinical and

epidemiological assessments of efficacy. Therefore, the patterns of incidence of malaria, and the costs associated with it, are different in different contexts. No magic bullet can be applied universally.

2.1.7.2 MALARIA BURDEN IN NIGERIA

Malaria is a major cause of morbidity and mortality in Nigeria and accounts for 60% of outpatient visits and 30% of hospitalizations among children under five years of age. In 2010, the NMIS found an overall national malaria prevalence of 42% in children under-five at community level (NPC et al., 2012) while in 2013, a cross-sectional study involving 120 health facilities in six states found that on average 59% of children presenting with fever at health facilities across the country tested positive for malaria using rapid diagnostic tests (RDTs). The rates varied between states with the being 16% in Lagos state and the highest, 71% in Kwara state (Mokuolu et al., 2013).

It is estimated that over 300,000 children die from Malaria annually in Nigeria (NPC et al., 2012). To put this is perspective, more than 80% of estimated malaria deaths in 2012 worldwide occurred in just 17 countries, with two countries, Nigeria and the Democratic Republic of the Congo (DRC) together accounting for 40% of the estimated global total (WHO, 2013). With almost three times the population of the DRC it is therefore most probable that Nigeria alone contributes 25% to 30% of the global mortality burden of malaria. Locally, malaria causes up to 11% of maternal mortality, 25% of infant mortality, and 20% of under-five mortality.

2.1.7.3 PROGRESS WITH MALARIA CONTROL IN NIGERIA

While the burden of malaria is still high, significant progress has been made with reducing morbidity and mortality rates since the inception of the Roll Back Malaria campaign. Malaria risk as measured by prevalance in children aged 2-10 years showed a progressive decline between 2000 and 2010 (NMCP et al., 2013) as shown in Figure 2.0. These reductions occurred as a result of a major scale-up of vector control interventions, treatment with artemisinin-based combination therapies (ACTs), public health education campaigns, socio-economic factors and more. While the risk of malaria is high in much of the country, there are some differences in risk between regions with the highest prevalence > 50% seen in four States: Zamfara, Kebbi, Kwara and Osun while prevalence 40-50% seen in 10 States: Sokoto, Katsina, Niger, Oyo, Ekiti, Ondo, Kogi, Benue, Cross Rivers and Ebonyi.

epidemiological assessments of efficacy. Therefore, the patterns of incidence of malaria, and the costs associated with it, are different in different contexts. No magic bullet can be applied universally.

2.1.7.2 MALARIA BURDEN IN NIGERIA

Malaria is a major cause of morbidity and mortality in Nigeria and accounts for 60% of outpatient visits and 30% of hospitalizations among children under five years of age. In 2010, the NMIS found an overall national malaria prevalence of 42% in children under-five at community level (NPC et al., 2012) while in 2013, a cross-sectional study involving 120 health facilities in six states found that on average 59% of children presenting with fever at health facilities across the country tested positive for malaria using rapid diagnostic tests (RDTs). The rates varied between states with the lowest being 16% in Lagos state and the highest, 71% in Kwara state (Mokuolu et al., 2013).

It is estimated that over 300,000 children die from Malaria annually in Nigeria (NPC et al., 2012). To put this is perspective, more than 80% of estimated malaria deaths in 2012 worldwide occurred in just 17 countries, with two countries, Nigeria and the Democratic Republic of the Congo (DRC) together accounting for 40% of the estimated global total (WHO, 2013). With almost three times the population of the DRC it is therefore most probable that Nigeria alone contributes 25% to 30% of the global mortality burden of malaria. Locally, malaria causes up to 11% of maternal mortality, 25% of infant mortality, and 20% of under-five mortality.

2.1.7.3 PROGRESS WITH MALARIA CONTROL IN NIGERIA

While the burden of malaria is still high, significant progress has been made with reducing morbidity and mortality rates since the inception of the Roll Back Malaria campaign. Malaria risk as measured by prevalance in children aged 2-10 years showed a progressive decline between 2000 and 2010 (NMCP et al., 2013) as shown in Figure 2.0. These reductions occurred as a result of a major scale-up of vector control interventions, treatment with artemisinin-based combination therapies (ACTs), public health education campaigns, socio-economic factors and more. While the risk of malaria is high in much of the country, there are some differences in risk between regions with the highest prevalence > 50% seen in four States: Zamfara, Kebbi, Kwara and Osun while prevalence 40-50% seen in 10 States: Sokoto, Katsina, Niger, Oyo, Ekiti, Ondo, Kogi, Benue, Cross Rivers and Ebonyi.

These differences can be attributed to variations in intervention coverage, soci-demographic factors, capacity of the health systems, climate and ecology in the States.

2.1.7.4 SOCIAL AND ECONOMIC IMPACT OF MALARIA IN NIGERIA

Effects on businesses

Malaria affects many businesses and private sector enterprises through employee absenteeism occasioned by their own ill health or that of their dependants. In addition, companies also experience increased health care spending to maintain health of employees. All these result in:

- Decreased productivity
- Loss of company competitiveness
- Business failure and loss of reputation

In a study of businesses in Africa in 2011, 72% of companies reported that malaria negatively affected their business while 40% reported that this effect was "serious" (Roll Back Malaria, 2011).

Social effects

Children and women in rural areas are at the greatest risk of death or severe debility from malaria and often benefit least from malaria programmes when resources are scarce. Even with efforts to ensure equity in coverage with prevention measures such as ITN ownership, disadvantaged communities have lower access to public health care services. Each episode of malaria drains the household resources – with expenditure of US$ 12-20 per episode of malaria (Sicuri et al., 2013) and almost 50% of household expenditure on health being spent on malaria (Onwujekwe et al., 2000).

Malaria therefore:

- Worsens household poverty in already vulnerable populations
- Increases the risk of mortality from lack of resources to seek treatment
- Increases burden of expenditure on families when mortality occurs – up to one year's resources may be required to bury a family member.

Effects on Education

In the 1990's a study in Nigeria showed that malaria accounted for 15% of health-related absenteeism from school (Leighton and Foster, 1993). Malaria affects mental and physical development in children and in high burden countries like Nigeria, up to 60% of children in affected

communities may face learning impairment due to repeated illness and innocuously, from effects of severe anaemia. Malaria therefore negatively impacts education and lack of education reduces individual competitiveness and keeps affected households in an unending cycle of poverty and malaria.

Effects on Economic Growth

From 2014, Nigeria became Africa's largest economy. The country also has the largest malaria burden, which continues to dampen economic growth. Malaria is estimated to cause US$ 12 billion loss in Africa annually (Gallup and Sachs, 2001), while the World Economic Forum has acknowledged that in high burden countries like Nigeria, malaria can impact the gross domestic product by as much as an estimated 5–6% per year (World Economic Forum, 2006).

2.2 PREVENTION

2.2.1 VECTOR CONTROL - VECTOR CONTROL MEASURES

Vector control aims to decrease contacts between humans and vectors of human disease. Control of mosquitoes may prevent malaria as well as several other mosquito-borne diseases. Elimination of malaria in an area does not require the elimination of all Anopheles mosquitoes capable of transmitting the disease. In North America and Europe, Anopheles mosquitoes capable of transmitting malaria are still present, but the parasite has been eliminated. Socio-economic improvements (e.g., houses with screened windows, air conditioning) combined with vector reduction efforts and effective treatment have led to the elimination of malaria without the complete elimination of the vectors.

Vector control remains the most generally effective measure to prevent malaria transmission and therefore is one of the four basic technical elements of the Global Malaria Control Strategy. The principal objective of vector control is the reduction of malaria morbidity and mortality by reducing the levels of transmission. Vector control methods vary considerably in their applicability, cost and sustainability of their results. The choice of vector control will depend on the magnitude of the malaria burden, the feasibility of timely and correct application of the required interventions and the possibility of sustaining the resulting modified epidemiological situation. WHO recommends a

systematic approach to vector control based on evidence and knowledge of the local situation. This approach is called Integrated Vector Management (IVM).

2.2.1.1 Integrated Vector Management (IVM)

Vector control remains the most generally effective measure to prevent malaria transmission and therefore is one of the four basic technical elements of the Global Malaria Control Strategy. The principal objective of vector control is the reduction of malaria morbidity and mortality by reducing the levels of transmission. Vector control methods vary considerably in their applicability, cost and sustainability of their results. The choice of vector control will depend on the magnitude of the malaria burden, the feasibility of timely and correct application of the required interventions and the possibility of sustaining the resulting modified epidemiological situation. WHO recommends a systematic approach to vector control based on evidence and knowledge of the local situation. This approach is called Integrated vector management (IVM).

View the report of a WHO Study Group on Malaria Vector Control and Personal Protection that reviews the current vector control strategies and their effectiveness in various operational and eco-epidemiological settings and identified challenges for implementation in different health systems.

Integrated Vector Management is a decision-making process for the management of vector populations, so as to reduce or interrupt transmission of vector-borne diseases. Its characteristic features include:

* Selection of methods based on knowledge of local vector biology, disease transmission and morbidity;

* Utilization of a range of interventions, often in combination and synergistically;

* Collaboration within the health sector and with other public and private sectors that impact on vector breeding;

* Engagement with local communities and other stakeholders;

* A public health regulatory and legislative framework;

* Rational use of insecticides;

* Good management practices.

An IVM approach takes into account the available health infrastructure and resources and integrates all available and effective measures, whether chemical, biological, or environmental. IVM also encourages an integrated approach to disease control.

2.2.1.2 In-door Residual Spraying (IRS)

Many malaria vectors are endophilic, resting inside houses after taking a blood meal. These mosquitoes are particularly susceptible to control through indoor residual spraying (IRS). As its name implies, IRS involves coating the walls and other surfaces of a house with a residual insecticide. For several months, the insecticide will kill mosquitoes and other insects that come in contact with these surfaces. IRS does not directly prevent people from being bitten by mosquitoes. Rather, it usually kills mosquitoes after they have fed, if they come to rest on the sprayed surface. IRS thus prevents transmission of infection to other persons. To be effective, IRS must be applied to a very high proportion of households in an area (usually >70%).

IRS with DDT and dieldrin was the primary malaria control method used during the Global Malaria Eradication Campaign (1955-1969). The campaign did not achieve its stated objective but it did eliminate malaria from several areas and sharply reduced the burden of malaria disease in others. Resistance to DDT and dieldrin and concern over their environmental impact led to the introduction of other, more expensive insecticides. As the eradication campaign wore on, the responsibility for maintaining it was shifted to endemic countries that were not able to shoulder the financial burden. The campaign collapsed and in many areas, malaria soon returned to pre-campaign levels.

As a result of the cost of IRS, the negative publicity due to the failure of the Malaria Eradication Campaign, and environmental concerns about residual insecticides, IRS programs were largely disbanded other than in a few countries with resources to continue them. However, the recent success of IRS in reducing malaria cases in South Africa by more than 80% has revived interest in this malaria prevention tool. It has also reignited the debate over whether or not DDT should have a place in malaria control. With support from the Global Fund to fight AIDS, Tuberculosis and Malaria as well as the President's Malaria Initiative, several countries have initiated IRS programs—many using DDT in their arsenal of insecticides—for the control of malaria.

Insecticide-treated nets (ITNs) are a form of effective vector control, when coverage rates are high and a large proportion of human-biting by local vectors takes place after people have gone to sleep. It can also be used for personal protection. Their use has repeatedly been shown to reduce severe disease and mortality due to malaria in endemic regions. In community-wide trials in several African settings, ITNs have been shown to reduce all-cause mortality by about 20%.

Insecticide-treated bed nets (ITNs) are a form of personal protection that has repeatedly been shown to reduce severe disease and mortality due to malaria in endemic regions. In community-wide trials in several African settings, ITNs have been shown to reduce all-cause mortality by about 20%.

Insecticide-treated bed nets (ITNs) are now a major intervention for malaria control.

Untreated bed nets form a protective barrier around persons using them. However, mosquitoes can feed on people through the nets, and nets with even a few small holes provide little, if any, protection. The application of a residual insecticide greatly enhances the protective efficacy of bed nets. The insecticides used for treatment kill mosquitoes and other insects. The insecticides also have repellent properties that reduce the number of mosquitoes that enter the house and attempt to feed. In addition, if high community coverage is achieved, the numbers and longevity of mosquitoes will be reduced. When this happens, all members of the community are protected, regardless of bed net ownership. To achieve such effects, high community coverage is required, as for indoor residual spray.

There are several types of nets available. Nets may vary by size, material, and/or treatment. Most nets are made of polyester but nets are also available in cotton, polyethylene, or polypropylene.

Currently, only pyrethroid insecticides are approved for use on ITNs. These insecticides have veryx low mammalian toxicity but are highly toxic to insects and have a rapid knock-down effect, even at very low doses. Pyrethroids have a high residual effect: they do not rapidly break down unless washed or exposed to sunlight.

Previously, nets had to be retreated at intervals of 6-12 months, more frequently if the nets were washed. Nets were retreated by simply dipping them in a mixture of water and insecticide and allowing them to dry in a shady place. The need for frequent retreatment was a major barrier to full

implementation of ITNs in endemic countries. The additional cost of the insecticide and the lack of understanding of its importance resulted in very low retreatment rates in most African countries.

2.2.1.4 Insecticide-Treated Mosquito Nets

Sleeping under an untreated mosquito net provides a physical barrier against mosquitoes – but mosquitoes can still bite if there is a small hole or tear in the net or if any part of the body is touching the net. Treating nets with a suitable insecticide increases the level of protection: the insecticide kills or repels mosquitoes before they can enter the net or bite the person sleeping under the net. Insecticide treatment of nets provides personal protection for all those who sleep under them even when coverage is low. High coverage of the population (≥60%, although some studies indicate 50%) with insecticide-treated nets (ITNs) can reduce the adult mosquito population and may therefore also protect people who do not use ITNs. In Africa, ITNs work well against all malaria vector species if used regularly and correctly. Distribution of untreated nets is not recommended because when they become torn or holed, as they inevitably will, they offer little or no protection against mosquitoes. In recent years, ITNs have been shown to be very effective in reducing malaria mortality and morbidity in the chronic phase of complex emergencies. For example, even limited distribution of ITNs has reduced malaria mortality and morbidity in Afghan refugee camps: 3 years after receiving free nets, 65% of refugees were still using them and achieving better than 70% protection against malaria attacks (Rowland et al., 1997). The impact in other refugee situations has been mixed; for example ITNs have been effective in Viet Nam (Cong and Schapira, 1998) but less effective in refugee camps on the Thai–Myanmar border (Luxemburger et al., 1996). Nets vary in size and are made from a variety of fabrics. Long-lasting insecticidal nets are preferable in complex emergencies to avoid the need for treating and drying nets in the field, and for regular re-treatment. If long-lasting nets are not available, insecticide treatment of conventional ITNs in the presence of the recipients is preferable to distribution of pretreated nets, because of problems in ensuring the use of good-quality insecticide products and proper dosing of pretreated nets. Moreover, if the presence of insecticide is not apparent to recipients of pretreated nets, as is often the case, they are less likely to seek re-treatment of their nets later. Finally, experience indicates that organizations that distribute pretreated nets often

of the recipients was essential to stimulate appropriate use and later re-treatment. The easiest method for treating nets on the spot involves simple plastic bags, each large enough to contain a net plus the appropriate volume of water. Treatment consists of adding 500 ml (for a synthetic net) or 2 litres (for a cotton net) of water to a bag, plus a dose of insecticide, mixing thoroughly, introducing the net and making a knot in the bag. Users are then asked to soak the net in the solution contained in the bag and to dry it once they are back home or in their shelters. This method is simple, limits queuing, and takes little time for either users or dippers – although subsequent disposal of bags may be problematic. The quantities of insecticide needed per treated net are listed in Table 2.1 shown below:

Table 2.1: Recommended insecticides for treatment of mosquito nets

Insecticide	Formulation	Dose for one net (any size)
Deltamethrin	25%WT	1 tablet
Lambda-cyhalothrin	2.5%CS	10ml
Alpha-cypermethrin	10%SC	6ml
Cyfluthrin	5%EW	15%
Etofenprox	10%EW	30ml
Permethrin	10%EC	75ml

**Source: WHO(2003). Instrfuctions for treatment & Use of Itns. Geneva, Worldd Health Organisation (WHO/CDS/RBM/2002.41).*
**EC=emulsifiable concentrate; SC= suspension concentrate;CS=microencapsulated;EW=oil-in-water emulsion*

Depending on the persistence of the insecticide used, the frequency of net washing, and the seasonality of malaria transmission, ITNs normally need to be re-treated every 6–12 months. The amount of insecticide needed to treat enough nets for a family is less than the amount required to spray the walls and ceiling of a house. Net treatment thus costs less than house spraying – but the cost of providing nets may be higher than the cost of two or three rounds of IRS. Long-lasting insecticide-treated nets (LLINs) are increasingly available. These are factory-treated mosquito nets that are expected to retain their biological activity for a minimum number of standard WHO washes and a minimum period of time under field conditions. Currently, an LLIN would be expected to retain biological activity for at least 20 standard WHO washes under laboratory conditions and 3 years of recommended use under field conditions. This makes them very attractive for use in

for treating nets on the spot involves simple plastic bags, each large enough to contain a net plus the appropriate volume of water. Treatment consists of adding 500 ml (for a synthetic net) or 2 litres (for a cotton net) of water to a bag, plus a dose of insecticide, mixing thoroughly, introducing the net and making a knot in the bag. Users are then asked to soak the net in the solution contained in the bag and to dry it once they are back home or in their shelters. This method is simple, limits queuing, and takes little time for either users or dippers – although subsequent disposal of bags may be problematic. The quantities of insecticide needed per treated net are listed in Table 2.1 shown below:

Table 2.1: Recommended insecticides for treatment of mosquito nets

Insecticide	Formulation	Dose for one net (any size)
Deltamethrin	25%WT	1 tablet
Lambda-cyhalothrin	2.5%CS	10ml
Alpha-cypermethrin	10%SC	6ml
Cyfluthrin	5%EW	15%
Etofenprox	10%EW	30ml
Permethrin	10%EC	75ml

**Source: WHO(2003). Instrfuctions for treatment & Use of Itns. Geneva, Worldd Health Organisation (WHO/CDS/RBM/2002.41).*
**EC=emulsifiable concentrate; SC= suspension concentrate;CS=microencapsulated;EW=oil-in-water emulsion*

Depending on the persistence of the insecticide used, the frequency of net washing, and the seasonality of malaria transmission, ITNs normally need to be re-treated every 6–12 months. The amount of insecticide needed to treat enough nets for a family is less than the amount required to spray the walls and ceiling of a house. Net treatment thus costs less than house spraying – but the cost of providing nets may be higher than the cost of two or three rounds of IRS. Long-lasting insecticide-treated nets (LLINs) are increasingly available. These are factory-treated mosquito nets that are expected to retain their biological activity for a minimum number of standard WHO washes and a minimum period of time under field conditions. Currently, an LLIN would be expected to retain biological activity for at least 20 standard WHO washes under laboratory conditions and 3 years of recommended use under field conditions. This makes them very attractive for use in emergency situations despite their higher cost compared with conventional nets. The only LLINs

currently recommended by WHO for malaria prevention and control are Olyset Net® and PermaNet® 2.0; in December 2003 PermaNet® 2.0 received an interim recommendation requiring further large-scale field studies to confirm long-lasting efficacy for prevention and control of malaria and other vector-borne diseases in different settings. The wash resistance of PermaNet® 2.0 over 20 washes was recently demonstrated in an Afghan refugee camp (Graham et al., 2005). LLINs made of polyethylene are stronger and more durable. Institutional buyers should follow the WHO 2001 guidelines Specifications for netting materials. Nets can be used indoors or outdoors. Indoors, they can be suspended from walls or ceilings using string or guy ropes. Outdoors, nets can be supported on poles; rounded poles should be used to avoid damaging the netting and care is needed to hold them firmly in position (Rozendaal, 1997). Before nets are distributed, it is important to find out about sleeping practices and consult the population on how nets can best be suspended or supported. Distribution of nets must be accompanied by information and, if necessary, materials to enable people to use them correctly (WHO, 2005). Pictorial leaflets about treated nets should also emphasize the importance of not washing nets, of keeping them out of sunlight and rain, and on the need for timely re-treatment.

Because of the behavioural change needed to make ITN interventions a success, community distribution of treated nets in acute emergencies is an option only if the target community is already in the habit of using nets. Where community vector control interventions (IRS) are already ongoing, community ITN distribution in acute crises is unnecessary. Distribution of ITNs should initially target high-priority vulnerable groups who are biologically at increased risk of severe disease and who thus benefit most from the personal protection effect. The quality and likely effectiveness of the intervention should be assessed by monitoring at the time of distribution and 1 month and 6 months later (to determine appropriate use and retention), using the following indicators: a) Coverage = number of ITNs distributed/target population size (%). b) Utilization rate = number of people using ITNs/number of people given ITNs (%). c) Retention rate = number of people retaining ITNs/number of people originally given ITNs (%). d) Deterioration rate = average number of holes per ITN. Even nets with some holes can be protective against mosquitoes if they are treated with pyrethroid insecticide – this is one of the purposes of the insecticide treatment. Knowing the

currently recommended by WHO for malaria prevention and control are Olyset Net® and PermaNet® 2.0; in December 2003 PermaNet® 2.0 received an interim recommendation requiring further large-scale field studies to confirm long-lasting efficacy for prevention and control of malaria and other vector-borne diseases in different settings. The wash resistance of PermaNet® 2.0 over 20 washes was recently demonstrated in an Afghan refugee camp (Graham et al., 2005). LLINs made of polyethylene are stronger and more durable. Institutional buyers should follow the WHO 2001 guidelines Specifications for netting materials. Nets can be used indoors or outdoors. Indoors, they can be suspended from walls or ceilings using string or guy ropes. Outdoors, nets can be supported on poles; rounded poles should be used to avoid damaging the netting and care is needed to hold them firmly in position (Rozendaal, 1997). Before nets are distributed, it is important to find out about sleeping practices and consult the population on how nets can best be suspended or supported. Distribution of nets must be accompanied by information and, if necessary, materials to enable people to use them correctly (WHO, 2005). Pictorial leaflets about treated nets should also emphasize the importance of not washing nets, of keeping them out of sunlight and rain, and on the need for timely re-treatment.

Because of the behavioural change needed to make ITN interventions a success, community distribution of treated nets in acute emergencies is an option only if the target community is already in the habit of using nets. Where community vector control interventions (IRS) are already ongoing, community ITN distribution in acute crises is unnecessary. Distribution of ITNs should initially target high-priority vulnerable groups who are biologically at increased risk of severe disease and who thus benefit most from the personal protection effect. The quality and likely effectiveness of the intervention should be assessed by monitoring at the time of distribution and 1 month and 6 months later (to determine appropriate use and retention), using the following indicators: a) Coverage = number of ITNs distributed/target population size (%). b) Utilization rate = number of people using ITNs/number of people given ITNs (%). c) Retention rate = number of people retaining ITNs/number of people originally given ITNs (%). d) Deterioration rate = average number of holes per ITN. Even nets with some holes can be protective against mosquitoes if they are treated with pyrethroid insecticide – this is one of the purposes of the insecticide treatment. Knowing the

deterioration rate allows further purchases of ITNs to replace grossly damaged nets to be planned. Insecticide-treated blankets and plastic sheeting are the most promising tools but have not yet passed WHOPES evaluation. These methods – and others that have been shown to be appropriate for complex emergencies in certain settings (mainly Asia) but whose application in other parts of the world would require local operational research. Other insecticide-treated materials Insecticide-treated nets may not be appropriate in complex emergency situations where people have no tradition of net use, shelter is very basic, or obtaining sufficient supplies of nets takes a long time or is too costly. In such situations, insecticide treatment of other materials – tents, blankets, sheets, clothing and curtains – may be more acceptable and more feasible. Pyrethroid treatment of these materials has been tried in a range of settings, in particular among Afghan refugees and more recently in Kenya (Macintyre et al., 2003). Insecticide - treated blankets and plastic sheeting are the most promising but have not yet passed required WHOPES evaluation.

Insecticide-treated plastic sheeting (ITPS)

Research is under way to determine the effectiveness of insecticide treatment of the plastic sheeting that is increasingly being provided as shelter in emergencies in Africa (Allan, 2001). The laminated polyethylene tarpaulin is impregnated with deltamethrin during manufacture and the insecticide migrates slowly to the surface to replace that which is lost. Entomological trials in refugee camps in Pakistan showed that the insecticide is present for at least a year and kills mosquitoes that come into contact with it (Graham et al., 2002a). The mode of action of ITPS (approx. size: 4 m x 5 m) would be comparable to indoor residual spraying, with a potential community protective effect at high coverage but no personal protection effect. Results from an initial field trial in Sierra Leone into the effectiveness of ITPS against malaria are currently being analyzed by the Centre for International Emergency, Disaster and Refugee Studies/Johns Hopkins University. The potential of ITPS is likely to depend on local vector resistance patterns and the ratio of ITPS to other mosquito resting sites in a given situation. Evidence from other countries and modes of use (e.g. as roofing, wall, and tent) is still needed. In situations where commercially available ITPS is being used, the duration of effectiveness against malaria, and safety under field conditions should be monitored and reported to build up the evidence base. Blankets, top sheets and clothing Permethrin treatment of top sheets,

blankets and chaddars (the veil or wrap worn by many Muslim women) has been tried among Afghan refugees.

Compared with a placebo, insecticide treatment was shown to provide 62% protection against falciparum malaria and 46% protection against vivax malaria (Rowland et al., 1999). A trial in Kabul, Afghanistan, showed that treated bedding provided a level of protection against cutaneous leishmaniasis (a disease that is transmitted by sand flies) equivalent to that provided by treated nets (Reyburn et al., 2000). Permethrin is the preferred insecticide because of its low toxicity, at a target dose of 0.5–1 g/m2 (Graham et al., 2002b). The good personal protection afforded by insecticide-treated blankets is due mostly to the repellent effect of the permethrin. Effectiveness is comparable to, but shorter-lived than, that of ITNs. Treated blankets, top sheets and chaddars could play an important role in malaria prevention in emergencies because they are easily available – blankets are often included as a standard item in emergency relief kits, and top sheets and chaddars are widely used in some cultures – and because they can be used regardless of whether people sleep indoors or outdoors and of the type of shelter. In addition, providing protection by treating these materials is cheaper than providing protection with treated nets, since the only cost involved is that of the insecticide. The duration of effectiveness of pretreated blankets (either stockpiled or in field use) still needs to be evaluated. Further research is also required to find out whether treated blankets can provide protection against malaria in endemic conditions in Africa: a recent study of permethrin-treated sheets among Kenyan nomads indicates a protective effect (Macintyre et al., 2003)

Insecticide-Treated Curtains

In areas where mosquitoes bite early in the evening, before people go to sleep under nets, use of insecticide-treated curtains over openings such as windows, doors and eave gaps may provide some protection. Treated curtains can be very cheap if shelters or houses have a limited number of openings. They have been shown to have an impact in some settings, for example in west Africa (Habluetzel et al., 1999) and in Afghanistan, where people have been encouraged to use treated nets as curtains when they move indoors after the summer.

Long-Lasting Insecticide-treated Nets (LLINs)

A number of new long-lasting insecticidal products are expected to reach the market in the near future. Long-lasting formulations that could be used to treat conventional nets in the field may be particularly useful in emergencies, helping to overcome the current delays in supply of long-lasting insecticidal nets, or may be used to improve conventional nets that have already been distributed. It will be important to use products that conform to WHOPES specifications for safety, efficacy and operational acceptability. Insecticide zooprophylaxis Insecticide zooprophylaxis could be used in settings where vectors bite domestic animals as well as humans, for example in south and south-west Asia where A. culicifacies and A. stephensi feed on cattle 90% of the time and humans 10% of the time. Rather than being applied to houses, the insecticide – usually deltamethrin – is applied to the hair and skin of domestic livestock, such as cattle, goats and sheep, using a sponge or animal dip. Mosquitoes pick up a lethal dose of insecticide when they attempt to feed on a "treated" animal. Trials of this method in Afghan refugee camps have shown its effect on malaria to be comparable to that of IRS but at 20% of the cost, since less insecticide is required (Rowland et al., 2001). Although still at the development stage, insecticide zooprophylaxis has been widely used in Afghan refugee settlements in Pakistan. However, it will not work against anthropophilic vectors such as A. gambiae in Africa.

More recently, several companies have developed long-lasting insecticide-treated nets (LLINs) that retain lethal concentrations of insecticide for at least 3 years. The WHO Pesticide Evaluation Scheme has recommended five of these LLINs for use in the prevention of malaria. CDC is currently testing these and other LLINs in Atlanta and Kenya.

The WHO Pesticide Evaluation Scheme recommends these LLINs:

1. DuraNet (Clarke Mosquito Control)
2. Interceptor Net (BASF)
3. NetProtect (Intelligent Insect Control) (also marketed as ICON Life (Syngenta)
4. Olyset Net (Sumitomo Chemical)
5. PermaNet (Vestergaard-Frandsen)

Travelers to malaria-risk areas may also use ITNs as one of several precautions against malaria.

Long-Lasting Insecticide-treated Nets (LLINs)

A number of new long-lasting insecticidal products are expected to reach the market in the near future. Long-lasting formulations that could be used to treat conventional nets in the field may be particularly useful in emergencies, helping to overcome the current delays in supply of long-lasting insecticidal nets, or may be used to improve conventional nets that have already been distributed. It will be important to use products that conform to WHOPES specifications for safety, efficacy and operational acceptability. Insecticide zooprophylaxis Insecticide zooprophylaxis could be used in settings where vectors bite domestic animals as well as humans, for example in south and south-west Asia where A. culicifacies and A. stephensi feed on cattle 90% of the time and humans 10% of the time. Rather than being applied to houses, the insecticide – usually deltamethrin – is applied to the hair and skin of domestic livestock, such as cattle, goats and sheep, using a sponge or animal dip. Mosquitoes pick up a lethal dose of insecticide when they attempt to feed on a "treated" animal. Trials of this method in Afghan refugee camps have shown its effect on malaria to be comparable to that of IRS but at 20% of the cost, since less insecticide is required (Rowland et al., 2001). Although still at the development stage, insecticide zooprophylaxis has been widely used in Afghan refugee settlements in Pakistan. However, it will not work against anthropophilic vectors such as A. gambiae in Africa.

More recently, several companies have developed long-lasting insecticide-treated nets (LLINs) that retain lethal concentrations of insecticide for at least 3 years. The WHO Pesticide Evaluation Scheme has recommended five of these LLINs for use in the prevention of malaria. CDC is currently testing these and other LLINs in Atlanta and Kenya.

The WHO Pesticide Evaluation Scheme recommends these LLINs:

1. DuraNet (Clarke Mosquito Control)
2. Interceptor Net (BASF)
3. NetProtect (Intelligent Insect Control) (also marketed as ICON Life (Syngenta)
4. Olyset Net (Sumitomo Chemical)
5. PermaNet (Vestergaard-Frandsen)

Travellers may also use ITNs as one of several precautions against malaria.

Long-Lasting Insecticidal Nets (LLINs)

A number of new long-lasting insecticidal products are expected to reach the market in the near future. Long-lasting formulations that could be used to treat conventional nets in the field may be particularly useful in emergencies, helping to overcome the current delays in supply of long-lasting insecticidal nets, or may be used to improve conventional nets that have already been distributed. It will be important to use products that conform to WHOPES specifications for safety, efficacy and operational acceptability. Insecticide zooprophylaxis Insecticide zooprophylaxis could be used in settings where vectors bite domestic animals as well as humans, for example in south and south-west Asia where A. culicifacies and A. stephensi feed on cattle 90% of the time and humans 10% of the time. Rather than being applied to houses, the insecticide – usually deltamethrin – is applied to the hair and skin of domestic livestock, such as cattle, goats and sheep, using a sponge or animal dip. Mosquitoes pick up a lethal dose of insecticide when they attempt to feed on a "treated" animal. Trials of this method in Afghan refugee camps have shown its effect on malaria to be comparable to that of IRS but at 20% of the cost, since less insecticide is required (Rowland et al., 2001). Although still at the development stage, insecticide zooprophylaxis has been widely used in Afghan refugee settlements in Pakistan. However, it will not work against anthropophilic vectors such as A. gambiae in Africa.

More recently, several companies have developed long-lasting insecticide-treated nets (LLINs) that retain lethal concentrations of insecticide for at least 3 years. The WHO Pesticide Evaluation Scheme has recommended five of these LLINs for use in the prevention of malaria. CDC is currently testing these and other LLINs in Atlanta and Kenya.

The WHO Pesticide Evaluation Scheme recommends these LLINs:

1. DuraNet (Clarke Mosquito Control)
2. Interceptor Net (BASF)
3. NetProtect (Intelligent Insect Control) (also marketed as ICON Life (Syngenta)
4. Olyset Net (Sumitomo Chemical)
5. PermaNet (Vestergaard-Frandsen)

Travelers to malaria-risk areas may also use ITNs as one of several precautions against malaria.

A number of new long-lasting insecticidal products are expected to reach the market in the near future. Long-lasting formulations that could be used to treat conventional nets in the field may be particularly useful in emergencies, helping to overcome the current delays in supply of long-lasting insecticidal nets, or may be used to improve conventional nets that have already been distributed. It will be important to use products that conform to WHOPES specifications for safety, efficacy and operational acceptability. Insecticide zooprophylaxis Insecticide zooprophylaxis could be used in settings where vectors bite domestic animals as well as humans, for example in south and south-west Asia where A. culicifacies and A. stephensi feed on cattle 90% of the time and humans 10% of the time. Rather than being applied to houses, the insecticide – usually deltamethrin – is applied to the hair and skin of domestic livestock, such as cattle, goats and sheep, using a sponge or animal dip. Mosquitoes pick up a lethal dose of insecticide when they attempt to feed on a "treated" animal. Trials of this method in Afghan refugee camps have shown its effect on malaria to be comparable to that of IRS but at 20% of the cost, since less insecticide is required (Rowland et al., 2001). Although still at the development stage, insecticide zooprophylaxis has been widely used in Afghan refugee settlements in Pakistan. However, it will not work against anthropophilic vectors such as A. gambiae in Africa.

More recently, several companies have developed long-lasting insecticide-treated nets (LLINs) that retain lethal concentrations of insecticide for at least 3 years. The WHO Pesticide Evaluation Scheme has recommended five of these LLINs for use in the prevention of malaria. CDC is currently testing these and other LLINs in Atlanta and Kenya.

The WHO Pesticide Evaluation Scheme recommends these LLINs:

1. DuraNet (Clarke Mosquito Control)
2. Interceptor Net (BASF)
3. NetProtect (Intelligent Insect Control) (also marketed as ICON Life (Syngenta)
4. Olyset Net (Sumitomo Chemical)
5. PermaNet (Vestergaard-Frandsen)

Travelers to malaria-risk areas may also use ITNs as one of several precautions against malaria.

2.2.2 COMMONLY USED STRATEGIES IN HOMES

Home-use products include coils, insecticide aerosols, mosquito repellents and vaporizing mats. Like treated curtains, these products may be of some use in areas where mosquitoes bite early in the evening. However, vaporizing mats require electricity, which is unlikely to be available in most resettlement sites or camps. These methods are needed every evening and may therefore be too costly, although social marketing of mosquito repellents in Afghanistan did have reasonable success and indicated protection against malaria (Rowland et al., 2004a). In acute emergencies repellents may have logistic advantages (e.g. less bulk) over other methods, and a recent trial in an Afghan refugee camp demonstrated up to 50% protective efficacy against falciparum malaria (Rowland et al., 2004b). Repellents may provide a good temporary solution provided that recipients are disciplined about applying them.

2.2.3 IMPLICATION OF MALARIA CONTROL STRATEGIES TO MDGS

The primary focus of the first and the sixth components of the millennium development goals (MDGs), adopted by the United Nations in 2000, is to solve the problems associated with diseases and poverty respectively. The first item of the MDGs aims to halt and afterwards begins to reverse the incidence of malaria and other major diseases by 2015. Also, the sixth of the listed objectives of the MDGs is to reduce to half, between 1990 and 2015, the proportion of people below absolute poverty level. Ever since the millennium development goals were set and globally adopted in principle and supported with huge human and financial commitments, only few of the malaria endemic countries could claim that various initiated strategies to combat a disease that has bedevilled Africa for more than 40 years since independence have had significant impact in rolling back the disease. Despite various declarations by African governments in the 1990s and complementary effort promised in the main content of the Roll back Malaria Declaration in Abuja in 2000, malaria remains a major health challenge. About 107 countries and territories involving about 3.2 billion people are still at risk of malaria attack as at 2004 (World Health Organisation [WHO], 2005). Present estimates suggest that around 350–500 million clinical disease episodes occur annually (Bawah and Binka, 2005). Around 60% of clinical cases and over 80% of the deaths due to malaria occur in Africa south of the Sahara (Alaba, 2005).

The above has serious implication for economic growth and welfare. Malaria is responsible for an estimated average annual reduction of 1.3% in 2 economic growth for those countries with the highest burden, Nigeria inclusive. The seemingly intractable trend of this ancient scourge has compounded the national and household poverty due to intensive loss of productive time to attack and death. A cause for worry at the moment is the growing resistance of the disease to cheap first line drugs and the need for the more expensive ACT combination therapy. Given that malaria is endemic throughout Nigeria, and that more than half the country's population are living below poverty line. Malaria incidence may increase significantly in Nigeria because many may not be able to afford the newly introduced drugs due to poverty. The above will no doubt constrain the ability of the country to achieve the target set out in the NEEDS and the MDGs.

For the affected individuals, the consequences include emotional distress caused by illness and sometimes death. Associated with this is the critical need to care for those infected and to find ways of replacing their contributions to the household and the community. A decrease of labour productivity resulting in loss of income, reduction of savings, and food, reduced support for the elderly; death of adult children, and the growing burden of orphanage is left to the family and concerned friends which finally trickle down to the national economy. This translates into substantial direct, indirect, intangible costs, and life time loss of earnings, all of which determine poverty and welfare status of the households and finally the economy at large.

2.3 MALARIA CONTROL

2.3.1 World Health Organization (WHO) Strategies to tackle Malaria

The World Health Organization's target, and that of the Roll Back Malaria Partnership, is to cut malaria by half by 2010, with the goal of reaching the MDG target by 2015.

The World Health Organization urges four main strategies to tackle Malaria:

1. Prevention, through protection against mosquito bites
2. Rapid treatment with effective anti-malarial medicines
3. A special effort to protect pregnant women and young children
4. Pre-empting epidemics by detecting them and acting swiftly to stop them

In KwaZulu Natal, South Africa, cases of malaria plummeted by a remarkable 90% between 2000 and 2004. This was due to a combination of political commitment, health education in schools and on the radio, involvement of traditional leaders, community groups, NGOs and industry and a government-led programme of indoor spraying with insecticides. The lesson is that success is possible with the right strategy and political will.

2.3.2 Malaria Control in Nigeria

Malaria is the commonest cause of hospital attendance in all age groups in all parts of Nigeria. It is also one of the four commonest causes of childhood mortality in the country, the other three being acute respiratory infection (pneumonia), diarrhoea and measles. It is estimated that 50% of the population has at least one episode of malaria each year while children under 5 have on the average of 2 – 4 attacks in a year. Malaria has severe negative effects on maternal health and birth outcomes. It causes maternal anaemia, increases miscarriage and low birth weight.

Plasmodium (P) falciparum is the most predominant parasite specie accounting for about 98% of malaria cases in the country. P. malariae usually occurs as a mixed infection with P. falciparum. Anopheles gambiae is the main vector of malaria in Nigeria, but An. Funestus and An.arabiensis are commonly encountered. An. Melas is found in the coastal areas.

While Malaria remains a major public health and development challenge in Nigeria, its control will need to be addressed, not as a separate, vertical, disease-specific intervention, but as part of a health systems strengthening effort to provide holistic services in all facets of care, an as part of a larger community-development effort. The Nigerian Government is determined to accelerate and intensify efforts on malaria control during the next 5-year planning cycle. The malaria control plan builds on the National Malaria Strategic Plan (NMSP) for Malaria Control that was developed by the National Malaria Control Programme in partnership with the RBM Partners, States' Ministries of Health and other Stakeholders to enable national scale-up of key preventive and curative interventions.

This malaria strategic plan addresses national health and development priorities, including the Roll Back Malaria (RBM) Goals and the Millennium Development Goals (MDGs). The malaria control strategy contained herein includes demonstrable performance results, including malaria-specific [illegible] mortality". The strategic plan provides a monitoring and evaluation

and 2004. This was due to a combination of political commitment, health education in schools and on the radio, involvement of traditional leaders, community groups, NGOs and industry and a government-led programme of indoor spraying with insecticides. The lesson is that success is possible with the right strategy and political will.

2.3.2 Malaria Control in Nigeria

Malaria is the commonest cause of hospital attendance in all age groups in all parts of Nigeria. It is also one of the four commonest causes of childhood mortality in the country, the other three being acute respiratory infection (pneumonia), diarrhoea and measles. It is estimated that 50% of the population has at least one episode of malaria each year while children under 5 have on the average of 2 – 4 attacks in a year. Malaria has severe negative effects on maternal health and birth outcomes. It causes maternal anaemia, increases miscarriage and low birth weight.

Plasmodium (P) falciparum is the most predominant parasite specie accounting for about 98% of malaria cases in the country. P. malariae usually occurs as a mixed infection with P. falciparum. Anopheles gambiae is the main vector of malaria in Nigeria, but An. Funestus and An.arabiensis are commonly encountered. An. Melas is found in the coastal areas.

While Malaria remains a major public health and development challenge in Nigeria, its control will need to be addressed, not as a separate, vertical, disease-specific intervention, but as part of a health systems strengthening effort to provide holistic services in all facets of care, an as part of a larger community-development effort. The Nigerian Government is determined to accelerate and intensify efforts on malaria control during the next 5-year planning cycle. The malaria control plan builds on the National Malaria Strategic Plan (NMSP) for Malaria Control that was developed by the National Malaria Control Programme in partnership with the RBM Partners, States' Ministries of Health and other Stakeholders to enable national scale-up of key preventive and curative interventions.

This malaria strategic plan addresses national health and development priorities, including the Roll Back Malaria (RBM) Goals and the Millennium Development Goals (MDGs). The malaria control strategy contained herein includes demonstrable performance results, including malaria-specific morbidity and overall "all-cause mortality". The strategic plan provides a monitoring and evaluation

framework, ensuring that Nigeria deploys an evidence-based and cost-effective package of interventions that are appropriately evaluated and documented. Finally the strategic plan includes a "business plan" component to enable efficient collaboration among all the partners in the public sector, the private and commercial sector and civil society.

2.4 HEALTH – SEEKING BEHAVIOUR

Health-seeking refers to a process followed by individuals and/or social groups for restoring health by using medical resources of all kinds. Field studies undertaken on lay understanding of malaria in different parts of Africa explore knowledge and gaps in knowledge about malaria and "folk illnesses" that overlap with the biomedical definition of malaria. A number of investigators centered their work on eliciting important gaps in people's comprehension of malaria. One of their main objectives was to investigate whether people knew the cause of malaria and link it to malaria symptomatology. Several authors reported that the malaria-mosquito link, and especially the details of the mode of transmission, was not clear to a considerable number of persons in the communities studied (e.g. Agyepong, 1992; Aikins et al., 1994; Mwenesi et al., 1995). On the other hand, Winch et al. (1996), working on the Tanzanian coast, noted that a high proportion (92.9%) of respondents were aware of the malaria-mosquito link, and people in fact defined malaria as that type of 'fever' caused by mosquitoes. A study in Ghana (Ahorlu et al., 1997) also found that the most people in the community knew mosquitoes to be the cause of malaria. Most studies also reported that malaria was attributed to various 'natural' causes, besides mosquitoes, including weather changes, hot sun, cold, rains, drinking or walking through dirty water and hard work (Brieger et al., 1984-85; Gessler et al., 1995b; Helizter-Allen and Kendall, 1992; Matthies, 1998; Munguti, 1998; Ongore et al., 1989; Ramakrishna et al., 1988-89).

On a different level, malaria was considered in a broader context of local illness terms referring to symptoms that overlap with the biomedical concept of malaria. In a community in Malawi (Helitzer-Allen and Kendall, 1992), the local term malungo was used for malaria. However, in the cultural concept, seven different types of malungo were distinguished, each of them with its own aetiology, symptomatology and treatment. Similar findings were reported from rural Ghana (Agyepong 1992; referring to febrile illnesses, asra, overlapped with malaria,

interventions that are appropriately evaluated and documented. Finally the strategic plan includes a "business plan" component to enable efficient collaboration among all the partners in the public sector, the private and commercial sector and civil society.

2.4 HEALTH – SEEKING BEHAVIOUR

Health-seeking refers to a process followed by individuals and/or social groups for restoring health by using medical resources of all kinds. Field studies undertaken on lay understanding of malaria in different parts of Africa explore knowledge and gaps in knowledge about malaria and "folk illnesses" that overlap with the biomedical definition of malaria. A number of investigators centered their work on eliciting important gaps in people's comprehension of malaria. One of their main objectives was to investigate whether people knew the cause of malaria and link it to malaria symptomatology. Several authors reported that the malaria-mosquito link, and especially the details of the mode of transmission, was not clear to a considerable number of persons in the communities studied (e.g. Agyepong, 1992; Aikins et al., 1994; Mwenesi et al., 1995). On the other hand, Winch et al. (1996), working on the Tanzanian coast, noted that a high proportion (92.9%) of respondents were aware of the malaria-mosquito link, and people in fact defined malaria as that type of 'fever' caused by mosquitoes. A study in Ghana (Ahorlu et al., 1997) also found that the most people in the community knew mosquitoes to be the cause of malaria. Most studies also reported that malaria was attributed to various 'natural' causes, besides mosquitoes, including weather changes, hot sun, cold, rains, drinking or walking through dirty water and hard work (Brieger et al., 1984-85; Gessler et al., 1995b; Helizter-Allen and Kendall, 1992; Matthies, 1998; Munguti, 1998; Ongore et al., 1989; Ramakrishna et al., 1988-89).

On a different level, malaria was considered in a broader context of local illness terms referring to symptoms that overlap with the biomedical concept of malaria. In a community in Malawi (Helitzer-Allen and Kendall, 1992), the local term malungo was used for malaria. However, in the cultural concept, seven different types of malungo were distinguished, each of them with its own aetiology, symptomatology and treatment. Similar findings were reported from rural Ghana (Agyepong 1992; Ahorlu et al., 1997), where the term referring to febrile illnesses, asra, overlapped with malaria.

symptoms. Kengeya-Kayondo et al. (1994) reported omusujja as a 'folk illness' in rural Uganda which referred to any kind of fever, including malaria, and feeling unwell. In the Swahili speaking part of East Africa, the term homa was found to correspond to a certain extent to biomedically defined malaria. Homa can literally be translated as fever, but has a much broader sense. Mwenesi (1993) described homa as a 'folk illness' related with febrile conditions, of which malaria is one of its many manifestations. Similarly, Winch et al. (1996) reported for Tanzania that homa can be considered as cover term, and malaria (or homa ya malaria) was just one among many fevers (homa). They found that a variety of causes, including spirits, were related to other types of homa. Looking more at the dynamics of illness progression. Beckerleg (1994: 305) described in her study in Kenya that homa is "conceived as following a natural course through the body, producing specific symptoms as the disease progresses". Probably the finding that had most impact for application in control programmes was that in many communities severe manifestations of malaria were not related to malaria (or the term that most closely refers to malaria) by the population, and thus treatment with malaria control measures was not perceived to be efficacious. The best known example is that of cerebral malaria: convulsions were commonly attributed to other causes than complications of malaria and referred to as a 'folk illness', largely unrelated to malaria. Ramakrishna et al. (1988-89), for example, reported that the Yoruba in Nigeria see the condition as being caused by leaving a child on the cold ground. Studies in Burkina Faso (Bonnet, 1986; Schwab, 1998) Ghana (Aikins et al., 1993) and Kenya (Mwenesi, 1993) showed that convulsions were commonly attributed to 'supernatural' agents. In Tanzania, the Swahili term degedege was frequently used in order to refer to a 'folk illness' whose symptoms most closely corresponded to those of cerebral malaria, but which was related to attacks by spirits (Gessler et al., 1995b; Makema et al., 1996; Winch et al. 1996). However, of the present study area, Matthies (1998) and for coastal Tanzania. Tarimo et al. (2000) found that a high proportion of study respondents did perceive degedege as a form of severe malaria in children. In several studies, it was found that other complications, namely severe anaemia and splenomegaly, were also not recognised as consequences of malaria and attributed to other, different but 'natural' causes (Mwenesi, 1993; Winch et al., 1996).

CHAPTER THREE

MATERIALS AND METHOD

3.1 Study location

The Federal Capital Territory (FCT) is located in the geographical center of Nigeria. Lying between latitude 8.25 and 9.20 North of the Equator and longitude 6.45 and 7.39 East of the Greenwich Meridian, Abuja is located geographically at the Centre of the country. The Federal Capital Territory has a landmass of about 8,000 sq.km out of which the city itself occupies only 250 sq.km. Abuja is located within the Savannah region with moderate climatic conditions. Its undulating plains and hills with virgin parkland scenery make the city an attractive place to live. It is bounded to the North by Kaduna State, the West by Niger State, the East and Southeast by Nasarawa State and the Southwest by Kogi State. Abuja has an approximate population of 5 million people and increasing at the rate of 5% per annum. The FCT and the capital city of Abuja has become in 10 years of existence, one of Nigeria's fastest growing urban centres. Abuja officially replaced Lagos as capital in December 1991, after 15 years of planning and construction. The city is located in a scenic valley of rolling grasslands in an ethnically neutral area. It is made up of both urban and rural settlement with different people of different tribes such as Yoruba, Hausa, Ibo, Tiv, Ibibio etc. The occupation of the inhabitants is mostly entrepreneur, politicians, civil servants and traders, etc. Most of the inhabitants belong to the upper socio- economic class while others come from the Middle and Low socio-economic. Abuja is a newly developing national capital. There is a high level migration from different states in the nation to FCT. It is the venue of international and national meetings and a place of tourist attraction. FCT is administratively divided into Area councils, districts and wards. There are 6 local government (Area) councils namely, Abaji, Abuja Municipal, Bwari, Gwagwalada, Kuje, and Kwali.

3.2 Study Area

For this study, Abuja Municipal Area Council was the study area. Districts in Abuja Municipality include Central district, Maitama, Wuse, Wuse II, Jabi, Kado Estate, Gwarinpa, Garki, Apo, and

Asokoro, Yanya, Karmo, Lugbe, etc . All districts have high or medium-high levels of malaria (CDC, 2002). The organizational structure of the AMAC health department is headed by a director of Public Health. The director co-ordinates all activities in all the PHC centres with the assistance of Assistant directors and monitoring and Evaluation officers. Each PHC Post is headed by an officer in charge (OIC), who is either an SCHEW or JCHEW as the case may be. The OIC has assistants such as Registered Nurses/Midwives, and attendants.

3.3 Study Population

The study population was residents of Abuja municipal area council, aged above 18, attending Primary Health centres.

3.4 Inclusion Criteria

Only resident attending PHC centres within the Abuja Municipal Area Council (AMAC) are eligible for this study. Respondents should reside within the geographical location of each PHC centre.

3.5 Study Design and Scope of Study

Descriptive Cross-sectional design was used to obtained information from the respondents on prevalence, of malaria, patterns of prevention and on the use of ITNs; it documents the protection patterns against mosquitoes and suggestions on scaling up the provision of ITNs.

3.6 Sample Size Determination

The Prevalence target population expected to have good variables about malaria and ITNs, 49% (Okrah, et al, 2002) was used. The sample size was determined using formula for determining the sample size of single proportions.

$$n = \frac{Z^2 p*q}{d^2}$$

Where:

n = The desired sample size = Minimum sample size when N > 10,000

z = The standard normal deviate, set at 1.96 for this study, corresponding to 95% confidence level

p = the proportion in the target population expected to have good variables about malaria and ITNs; P of 49% was used (Okrah et al., 2002)

q = 1 – p - the proportion in the target population expected NOT to have proper awareness about malaria and ITNs.

d = Degree of accuracy desired, set at 0.05

$$n = Z^2 pq / d^2$$

$$\Rightarrow \quad n = \frac{(1.96)^2 (0.490)(0.51)}{(0.05)^2}$$

$$= 384$$

Adjustments for Non-Response

Due to the cosmopolitan nature of Municipal council of Abuja, a response rate of 80% (80/100 or 0.8), is anticipated. Therefore, the sample size is adjusted as follows:

$$n = \frac{n}{\text{Response rate} / 100}$$

$$= n / 0.8$$

$$= \frac{384}{0.8}$$

$$= 480$$

Approximately = 500

Therefore a minimum sample size of 500 would be interviewed. This means that a total of 500 questionnaires were administered.

3.7 Sampling procedure

Multistage Sampling Technique

Stage 1: From the sampling frame comprising of the six Local Government Council Areas of Abuja, Abuja Municipal Local Council (AMAC) was chosen purposively.

~~Stage 2~~: From the 9 geographical Districts/Wards with PHC facilities in AMAC, all nine (9) wards was selected purposively. (See Annex A).

~~Stage 3~~: Sampling frame of all 28 PHC centres in selected geographical Wards was then drawn and a total of 14 PHC Centres was finally selected. (See Annex B for List of 14 PHC Centres)

All Adults above 18 were interviewed at the selected PHCs irrespective of reasons for attendance at each PHC facility. From the selected PHC centres, proportionate sampling was used to determine the number of attendees to be interviewed from each PHC centre.

The Questionnaire was **pre-tested** at Kado Estate, Abuja Municipal Area Council, which is a location not included in the list of PHC centres used for this study.

3.8 Data Collection

The data was collected through a semi- structured questionnaire with most portions pre-coded. A team of interviewers were trained by the investigator for one day prior the commencement of data collection. Data collection was conducted in a face-to-face interview approach, between the morning hours and early afternoon since each centre closes active duties by 2pm. The selected respondents were interviewed after their primary reasons for attending the centre had been attended to. Data was checked for completeness at the end of each day.

3.9 Data Analysis

The questionnaires were collated for data entry and the analysis was done using SPSS version 17.0. The analysis carried out included descriptive, inferential statistics and logistic regression to determine socio demographic data, the knowledge of respondents on ITNs, the personal experience of respondent with the use of ITNs, and factors that contribute to high prevalence of malaria. .

3.10 Ethical Considerations

Ethical approval was sought from the UI/UCH Institutional Review Board.

For the participants, interview was carried out in a place with maximum auditory privacy within the PHC Centre. Informed consent was obtained verbally before interviews. The participants were also informed of the purpose of the research and assured that they will not be identified in the course of

Stage 3: Sampling frame of all 28 PHC centres in selected geographical Wards was then drawn and a total of 14 PHC Centres was finally selected. (See Annex B for List of 14 PHC Centres)

All Adults above 18 were interviewed at the selected PHCs irrespective of reasons for attendance at each PHC facility. From the selected PHC centres, proportionate sampling was used to determine the number of attendees to be interviewed from each PHC centre.

The Questionnaire was **pre-tested** at Kado Estate, Abuja Municipal Area Council, which is a location not included in the list of PHC centres used for this study.

3.8 Data Collection

The data was collected through a semi- structured questionnaire with most portions pre-coded. A team of interviewers were trained by the investigator for one day prior the commencement of data collection. Data collection was conducted in a face-to-face interview approach, between the morning hours and early afternoon since each centre closes active duties by 2pm. The selected respondents were interviewed after their primary reasons for attending the centre had been attended to. Data was checked for completeness at the end of each day.

3.9 Data Analysis

The questionnaires were collated for data entry and the analysis was done using SPSS version 17.0. The analysis carried out included descriptive, inferential statistics and logistic regression to determine socio demographic data, the knowledge of respondents on ITNs, the personal experience of respondent with the use of ITNs, and factors that contribute to high prevalence of malaria. .

3.10 Ethical Considerations

Ethical approval was sought from the UI/UCH Institutional Review Board.

For the participants, interview was carried out in a place with maximum auditory privacy within the PHC Centre. Informed consent was obtained verbally before interviews. The participants were also informed of the purpose of the research and assured that they will not be identified in the course of interview, as stated on each copy of the questionnaire.

CHAPTER FOUR

RESULTS

The results will be presented in the following format:

1. Socio demographic characteristics of respondents
2. Household Living conditions of respondents
3. Malaria: transmission, symptoms and prevention methods
4. Mosquitoes: Prevention methods
5. Health – seeking behaviour and source of malaria treatment
6. Insecticide-treated nets: knowledge, perceptions and use

4.1 Socio-Demographic Characteristics of Respondents

As shown in table 1, majority of the respondents (60.6 %), were between the ages of 20 and 39 years. The mean age was 30±9 years and the modal age was 20 years. Most (60.6%) of the respondents were women. (Figure1)

Table 1 shows that 18.4% of the respondents did not have formal education, 18.2% attended primary school, while more than half of respondents (63.4%), had attained at least secondary school or post-secondary education (secondary school-37.8%, post-secondary school/tertiary-25.6%). Table 1 also shows that there was equal proportion of farmers and traders (20.2%). Similarly, there was equal distribution of civil servants and students, both accounting for a quarter each of the respondents.

Table 4.1: Socio-Demographic Characteristics of the Respondents (N=500)

Characteristic	N	%
Age group (years)		
< 20	108	21.6
20 – 29	145	29.0
30 – 39	158	31.6
40 – 49	68	13.6
50 +	21	4.2
Mean= 30±9 years		
Sex distribution		
Male	197	39.4
Female	303	60.6
Educational level		
Never Attended School	92	18.4
Primary Education	91	18.2
Secondary Education	189	37.8
Post – Secondary	128	25.6
Occupation		
Farmer	101	20.2
Trader	101	20.2
Student	127	25.4
Civil servant	127	25.4
Artisan	44	8.8

4.2 Household Structure / Economic Conditions

Majority of the respondents, (79.8%), lived in houses with one to three rooms. Half of the respondents had door and window nets. The main sources of lighting were electricity supply- (59.4%) and kerosene/paraffin lamp (38.0%). The main source of drinking water were borehole (36.8%), in - house tap and stand - pipe in street or area (26%), and wells (27%). The types of toilet facilities in use were pit latrine (42.6%) and flush toilet (38.2%) while (19.2%) had no toilet facility.

Table 4.2: Household Living Conditions of the Respondents (N=500)

Characteristic	N	%
Number of rooms per household/household size		
1	145	29.0
2-4	280	56
5+	47	9.4
Not Disclosed	28	5.6
Source of lighting		
Electricity	297	59.4
Kerosene/Paraffin Lamp	190	38.0
Wax candle/other	13	2.6
Source of drinking water		
In - house tap	77	15.4
Stand - pipe in street/local area /Water Sellers)	59	11.8
Bore-hole/Well	319	63.8
River/ Stream	45	9.0
Type of toilet facility		
Own flush toilet/ Shared flush toilet	191	38.2
Own pit latrine/ Shared pit latrine	213	42.6
No toilet/ Others(bush, etc)	96	19.2

4.3 Respondents Knowledge of Malaria

Respondents were asked if they had ever heard of malaria as a disease. The survey revealed that a very high proportion (90%), of respondents were aware. In addition, more than eighty percent of respondents, (80.4%), knew that malaria could result in death. Table 4.3 summarizes the responses obtained on the main source of information on malaria. The dominant sources of information on malaria were television (24%), radio (32.6%) and health workers (37.6%).

Table 4.3: Main source/ medium of information on malaria by the Respondents (N=500)

Characteristic	N	%
Radio	163	32.6
Television	120	24
Newspaper/magazine	7	1.4
Posters	15	3.0
Friends/Relative	2	0.4
Health workers	188	37.6
Government officials	3	0.6
Church/mosque	2	0.4

4.4 Malaria Transmission, Symptoms and Prevention

As shown in Table 4.4, the fact that mosquitoes transmits malaria was known by a high proportion (66.8%) of respondents. Working in the sun and drinking dirty water was cited by 8.6% and 6.2% of respondents.

Table 4.4: Respondents' knowledge on cause of malaria (N=500)

Main Cause of Malaria	N	%
Working in the sun	43	8.6
Being in the rain	11	2.2
Getting cold	13	2.6
Drinking dirty water	31	6.2
Another person with malaria	7	1.4
Mosquito bite	334	66.8
Don't know	61	12.2

Table 4.5 below shows that most respondents (37%) mentioned fever as the main symptom of malaria. Other symptoms that had a fair level of mention included, feeling cold (20.8%), headache (10.8%) and general body weakness (7.8%).

Table 4.5: Respondents' perception of main symptom/sign of malaria (N=500)

Symptom	N	%
Fever	185	37.0
Feeling cold	104	20.8
Headache	54	10.8
Eyes yellow	6	1.2
Vomiting	23	4.6
Diarrhoea	2	0.4
General weakness	39	7.8
Pain	25	5.0
Loss of appetite	11	2.2
Don't know	51	10.2

Respondents had many opinions about ways to prevent malaria, however, 11.6% of respondents did not do anything nor had any idea of how to prevent malaria (Table 4.6). Thirty-eight percent (38%) of respondents perceived that sleeping under a mosquito net was an effective method of malaria prevention. The use of Insecticide sprays (15%), and keeping the house and surrounding clean (6.0%), were cited by other respondents as the best preventive method.

Table 4.6: Respondents best malaria prevention method (N=500)

Prevention method	N	%
Sleeping under a mosquito net	190	38.0
Take preventive drugs	9	1.8
Stay away from dark places & Stagnant water	26	5.2
Use mosquito coil	31	6.2
Insecticide sprays	75	15.0
Avoid going out in cold/Avoid staying under sun for long	4	0.8
Close doors and windows at night	34	6.8
Keep the house and surrounds clean	30	6.0
Use nettings on windows and doors	30	6.0
Drinking clean water	3	.6
Don't do anything/Don`t know	58	11.6

4.5 Perceptions of the Severity of Malaria

History of episodes of malaria in the 14 days preceding the survey, occurred among, 20% of respondents, while 48.6% of respondents recorded at least one episode within the last 12 months of the survey. At least one malaria episode was reported by 12.8% of respondents in the one year preceding this survey, as shown in Table 4.7.

Also shown in table 4.7 is the distribution of population at risk of malaria. Children under-5 were perceived to be at highest risk of contracting malaria, by 51.6% of respondents. In addition, in the last month preceding the survey, 39.9% of the under- 5 children were reported to have had malaria and nearly all of these children, (96.2. %), received treatment.

Table 4.7: Distribution of Respondents' last malaria episodes (N=500)

Period since the last malaria episode	N	%
Within 14 days	82	16.4
Within the last 12 months	243	48.6
Over 1 year ago (over 12 months ago)	64	12.8
Don't know.	111	22.2
People at high risk of malaria		
Adult men	19	3.8
Adult women	30	6.0
Children under 5years old	258	51.6
Pregnant women	36	7.2
Children between 5-14 years	66	13.2
Elderly people	12	2.4
Others (everybody, etc)	11	2.2
Don't know	68	13.6

4.6 Health – Seeking Behaviour and Source of Malaria Treatment

Most of the respondents (77%), sought help for the treatment of malaria (Table 4.8). Majority of PHC centres attendees (60.4%), indicated that they always sought treatment when they have malaria. Also from Table 4.8 below, public health facilities (Government hospitals) were the main place of treatment (44.9%), while pharmacies accounted for 32.4%.

Table 4.8: Health – seeking behaviour among the PHC centers' attendees (N=500)

Characteristic	n	%
Always seek treatment	302	60.4
Sometimes seek treatment	83	16.6
Never seek treatment	3	0.6
Don't know	112	22.4
Source of healthcare		
Pharmacy	162	32.4
Traditional Healer	52	10.4
Government Hospital/Clinic	225	44.9
Private Hospital/Clinic	61	12.3

The findings are summarized in Table 4.10 below. The commonest method used for preventing mosquito bites by respondents was the mosquito net (25.4%), while insecticide spray accounted for 25.1%. Interestingly, the use of nettings on doors and windows was reported by 12.2% of respondents. While a further 8.9% resorted to closing of doors and windows, 7.4% of respondents reported the use of mosquito coils while 1.6% used no method.

Table 4.10: Respondents mosquito protection methods (n = 500)

Characteristics	N	%
Use insecticide spray	125	25.1
Clean the area around the house	76	15.2
Close windows and doors	44	8.9
Light fire in the house	3	0.5
Use coils	37	7.4
Apply mosquito repellant to skin	5	0.9
Use traditional plants	5	0.9
Use a mosquito net	127	25.4
Light candle	2	0.3
Use nettings on windows and doors	61	12.2
Burn cow dung/ traditional plants	5	1.1
Other traditional	1	0.2
Other commercial	1	0.2
No method	8	1.6

4.8 Knowledge, Attitude and Use of Insecticide Treated Nets (ITNs)

Figure 4.1 shows the respondents awareness of the use of ITNs for preventing malaria as reported by 55.8% of respondents.

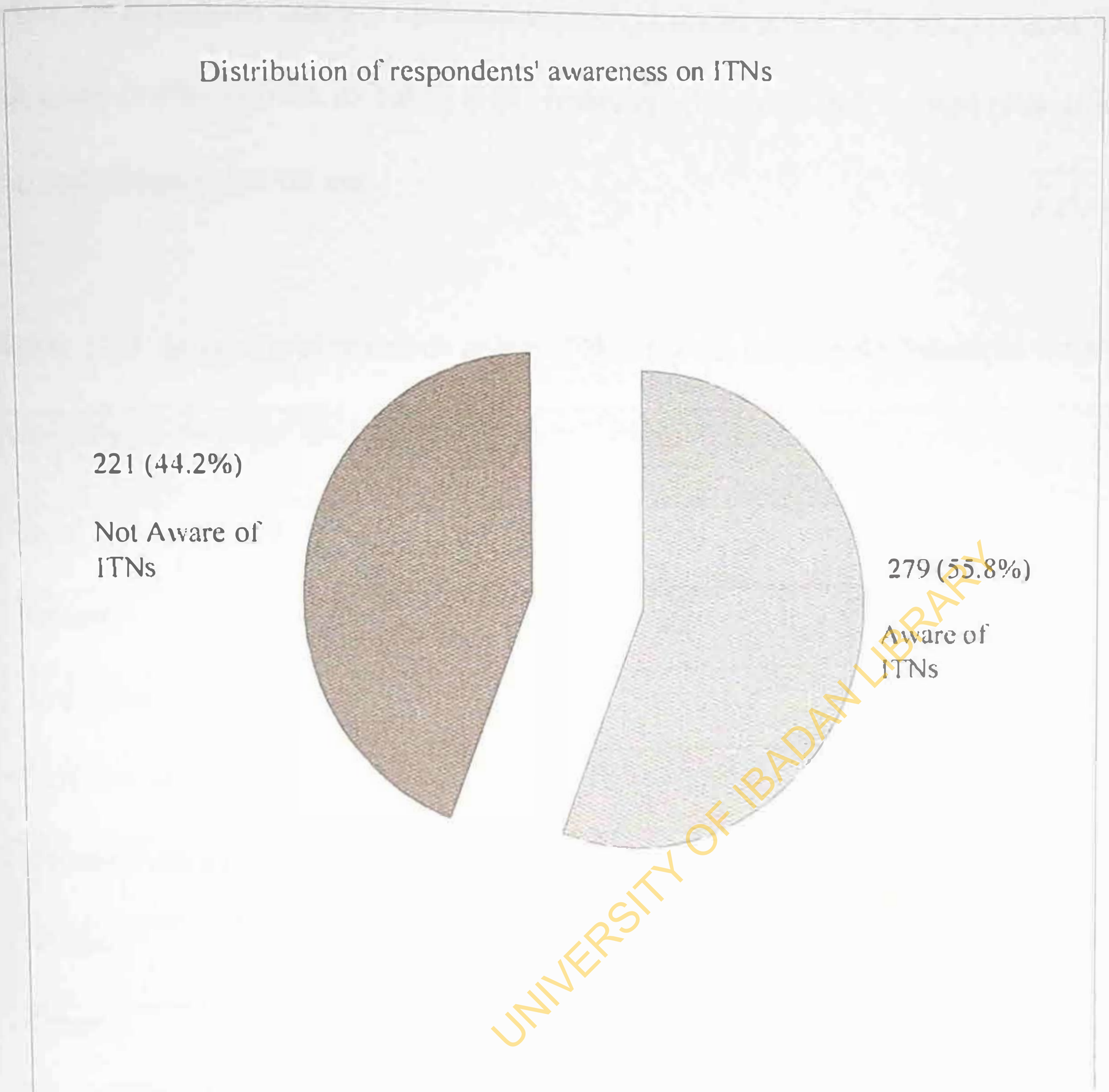


Figure 4.1: Respondents awareness on ITNs (n =500)

Despite the high percentage (55.8%) of respondents with knowledge of ITNs, only 28.4% reported usage. Among those aware, only 39.7% had nets on all beds. Among respondents using ITNs in households with nets only on some beds (60.3%), it was interestingly discovered that it was primarily the adults and not children who slept under a net. The main reason for using ITNs among net users is also shown in Table 4.11. Interestingly, only 28.9% cited prevention against malaria as the main reason for its use.

Table 4.11: Household member using ITNs only on some beds (Multiple responses=245)

Household member (Multiple responses=245)	n	%
Head of household	49	20
Spouse	38	15.5
Bed shared with spouse	26	10.6
Children under-5 years old	91	37.2
Children above 5 years old	32	13.1
Visitors	5	2.0
Others	4	1.6
Reasons for ITN usage (N=79)		
To prevent against mosquito bites	46	59.2
To prevent malaria	23	28.9
To prevent annoyance from mosquitoes	7	8.3
Others/ Don't know	3	3.6

Despite the high percentage (55.8%) of respondents with knowledge of ITNs, only 28.4% reported usage. Among those aware, only 39.7% had nets on all beds. Among respondents using ITNs in households with nets only on some beds (60.3%), it was interestingly discovered that it was primarily the adults and not children who slept under a net. The main reason for using ITNs among net users is also shown in Table 4.11. Interestingly, only 28.9% cited prevention against malaria as the main reason for its use.

Table 4.11: Household member using ITNs only on some beds (Multiple responses=245)

Household member (Multiple responses=245)	n	%
Head of household	49	20
Spouse	38	15.5
Bed shared with spouse	26	10.6
Children under-5 years old	91	37.2
Children above 5 years old	32	13.1
Visitors	5	2.0
Others	4	1.6
Reasons for ITN usage (N=79)		
To prevent against mosquito bites	46	59.2
To prevent malaria	23	28.9
To prevent annoyance from mosquitoes	7	8.3
Others/ Don't know	3	3.6

The respondents in households that had ITNs only on some beds (60.3%) were asked why it was not on all beds. As shown in Table 4.12 below, the main reason, cited by respondents, was the unavailability of nets (45.3%). Reasons were also given by 200 respondents on their non-usage of ITNs in their households. As in households with ITNs on some but not all be, the unavailability of ITNs (24.5%), high cost of ITNs (15.9%) and lack of knowledge about where to buy nets (18.0%), were cited as the main reasons for non-use.

Table 4.12: Respondents' reasons for use and non-use ITNs

Reasons for ITNs Usage (n=48)	N	%
ITNs are too expensive	10	23.3
I am not interested in putting them on every bed	4	8.1
I don't know how to fit the net on all the bed	1	1.2
Only children need nets	2	3.5
Only adults need nets	1	1.2
Some beds are not occupied	3	5.8
Nets not available	20	45.3
We have window & door nettings	3	7.0
Don't know	2	2.3
Others were	2	2.3
Reasons for non-use of ITNs (n=200)		
I am not bothered by mosquitoes	21	10.3
Nets are too expensive	32	15.9
I feel uncomfortable sleeping under a mosquito net	26	13.6
I don't know where to buy a net from	36	18
Nets are too hot	9	4.4
Nets are not available in this area	49	24.5
Others	27	13.3

4.9 Perceptions on the use of Insecticide Treated Nets

Respondents, who were aware of ITNs (279), (regardless of whether or not they used ITNs in their households), were asked to cite the benefits of sleeping under a net). Prevention from mosquito bites was cited by 61% of respondents, while 19.8% respondents cited prevention from malaria. Benefits of sleeping under a net are summarized in Table 4.13 below. The 279 respondents who were aware of ITNs were asked about problems associated with sleeping under an ITN. About a third of the respondents had no problems with sleeping under nets while 23.6% complained that sleeping under a net was too hot. Some others (19.5%) said that the net would not allow in enough air.

Table 4.13: Respondents Perceptions on the use of Insecticide Treated Nets

Benefits of sleeping under a net (n=279)	N	%
Don't get bitten by mosquito	170	61.0
Don't get malaria	55	19.8
Don't get bothered by other insects	8	3.0
Sleep better	13	4.6
It was warmer	2	0.6
Other	7	2.6
Not disclosed	24	8.4
Benefits of sleeping under a net (n=461)		
It is too hot sleeping in a net	109	23.6
Mosquitoes can still bite through the net	34	7.4
It is difficult if you want to get up in the night	37	8
It takes time to tuck the net each night	27	5.9
There is not enough air	90	19.5
None/No difficulty	140	30.4
Other	24	5.2

During data collection, interviewers explained to respondents what an Insecticide Treated Net (ITN) is and then asked how important they perceived it to be to their households. Their responses are summarized as shown in figure 4.2. Many (68.0%) of respondents perceived a bed net treated with insecticide to be very important to their household.

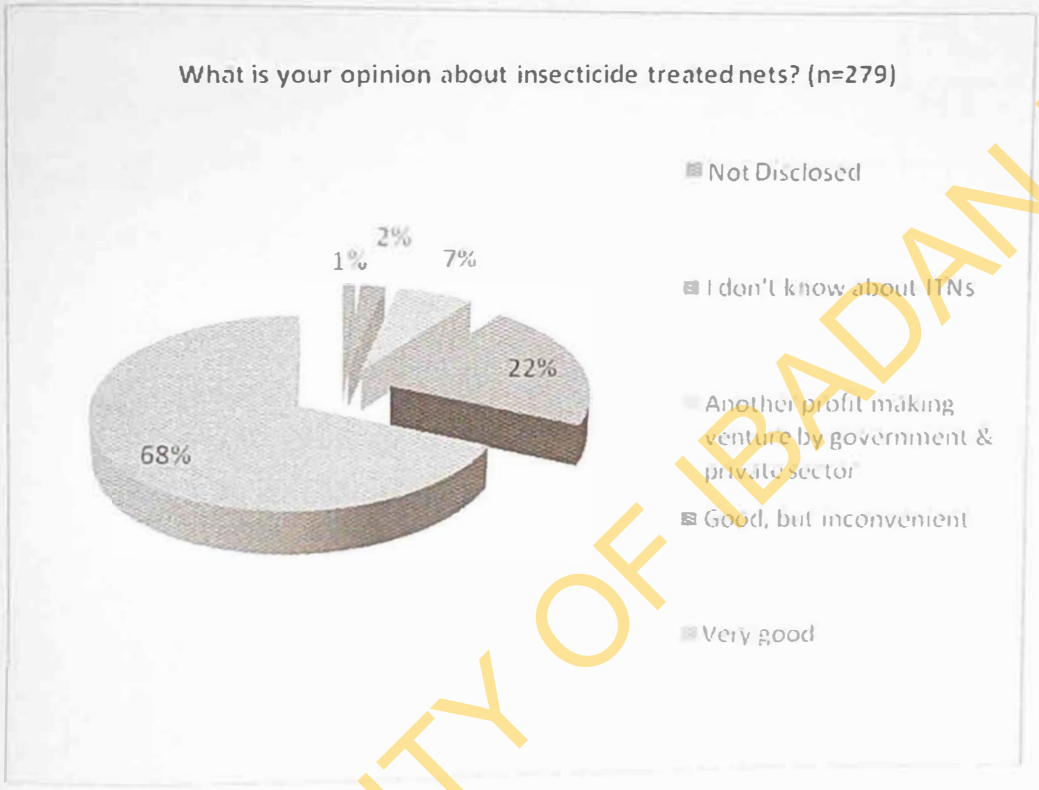


Figure 4.2: Respondents' Attitudes / opinion on ITNs

Respondents who were aware of ITNs were asked why bednets were treated with insecticides, Majority of respondents (78.3%) were of the opinion that it was to kill mosquitoes.

Table 4.14: Respondents' Perceived Reasons for Treating Bednets (n=279)

Perceived Reason for treating bednets	N	%
To kill mosquitoes	219	78.3
To make the net stronger	5	1.8
To repel mosquitoes	41	14.8
Don't know	14	5.1

Interviewers sought responses from respondents before and after reading and explaining the educational text on the treatment of bed net and the types of ITNs available (re-treatable and long-lasting ITNs) to the respondent. A good percentage (64.5%) of the knowledgeable respondents (55.8%), perceived that it was important for pregnant women and children under-5 years old to sleep under an ITN. However, this figure changed considerably (82%) when the concept of a net treated with insecticide was explained to all respondents. The results are summarized in Table 4.15 below.

Table 4.15: Respondents Perception on use of ITNs by pregnant women and children below 5 years

Characteristic	Before explanation Of what ITNs are		After explanation Of what ITNs are	
	n=279	100%	N=500	100%
Very important	180	64.5	410	82
Somewhat important	89	31.9	49	9.8
Neither important nor unimportant/ Not very important	8	2.9	38	7.6
Not Disclosed	2	0.7	3	0.6

Respondents, who felt that a bed net treated with insecticide was very important or somewhat important to their household (459), were asked what price they could afford to pay for large, medium and small sized ITN. A price range from N336 to N2860 was suggested. The mean suggested price for small sized ITNs was N900. Medium-sized ITNs cost between N989 and N1207. Large ITNs were said to cost between N1120 and N2860.

Table 4.16: Respondents' price perceptions for ITNs (n = 459, multiple response)

Size	Appropriate price range (₦)	N
Small	900	20
Medium	989 – 1207	64
Large	1120 - 2860	48

The respondents' opinion on the ITN strategy for malaria prevention was sought. Thirty-eight percent (38%) had positive attitudes to sleeping under ITNs while others were unwilling to use ITNs because of heat (23%), difficulty of movement in and out of bed (23%), presence of window and door nettings (11.9%) and looked untidy (1.6%). Respondents were asked where they obtained their ITNs. About a quarter (%) obtained their ITNs from a health facility, 7.4% from a pharmacy/drug shop and 5.6% from a market. Majority (53.5%) of the respondents who use nets in their household obtained their nets free; while 46.5% claimed they purchased their nets. These findings are summarized in Table 4.17 below

Table 4.17: Respondents' Attitudes on ITNs (N= 279)

Reasons/response	n	%
Very good strategy against mosquitoes	106	38.0
It is too hot sleeping in a net	64	23.0
It is difficult if you want to get up in the night	64	23.0
Presence of door and window nettings is sufficient	33	11.9
It takes time to tuck the net each night	5	1.6
Others/Not disclosed	7	2.5
Respondents sources of ITNs		
A shop/provision shop	1	1.2
A pharmacy	5	6.4
A drug shop (Provision shop)	1	.4
A health center/Hospital/Clinic	17	22.0
A market	4	5.6
Others were	51	64.4

Respondents, who use ITNs (28.4%), were asked how long they had been using ITNs. The distribution of responses in table 30 below, show that majority (51%) had ITNs for more than one year preceding the survey. Thirty-five percent had obtained their nets more than one month preceding the survey, while 13.8% obtained ITNs only weeks before this survey.

On the pattern of ITN usage by children, responses obtained from all respondents indicated that forty-two per cent (n=119), had 329 children under-5 years of age, of which 36.2% of them slept under an ITN the night preceding the survey.

Table 4.18: Distribution of children under 5 years old who slept under a net (n=119)

# of children	Frequency of Respondents	Total # of children (N=329) who slept under a net (36.2%)
0	130	0
1	43	43
2	35	70
3	2	6
Total	210	119

Respondents who were pregnant women (29.6%, n=148) were asked how many used an ITN the night preceding the survey. As can be seen in Table 4.19, only 16 pregnant women belong to this group. This means that only 10.8% of pregnant women used an ITN the night preceding the survey.

Table 4.19: Distribution of pregnant women who slept under a net (n= 16)

# of Pregnant Women	frequency of pregnant respondents (148)	% of Pregnant Women who slept under a net
0	139	0
1	5	5
2	2	4
3	1	3
4	1	4
Total	148	16

4.10 Multivariate Analysis

Multivariate analysis, as seen in table 30 below, shows that use of ITNs was positively associated with preventative knowledge (OR=5.78; 95% CI= 3.62 – 9.36). Respondents who were knowledgeable were six times more likely to use ITNs, compared to those who were not knowledgeable. In addition, those who got their nets free were twice more likely to use ITNs compared with those who purchased it although there was no significant association (OR=2.44, p>0.05). Moreover, those who had nets for more than a year are less likely to use ITNs when compared to those who have only just been using ITNs for some weeks (OR=0.89; 95% CI=0.15 - 5.30). The regression also revealed that use of ITNs was positively associated with educational level: those with primary and tertiary education were about three times more likely to use ITNs compared to those with no education (OR = 2.68 and OR =2.17 respectively).

Table 4.20: Multivariate Analysis showing factors Influencing the Use of ITN

Variable	Odds Ratio (OR)	Confidence Interval (CI)	P-Value
Educational Level			
Not Educated (rc)			
Primary	2.68	0.24 - 30.02	0.423
Secondary Education	0.81	0.17 - 3.85	0.795
Tertiary	2.17	0.99 - 4.72	0.258
Duration of Use			
Weeks (rc)			
Month	0.34	0.47 - 2.53	0.295
Years	0.89	0.15 - 5.30	0.905
Obtain ITNs Free			
No (rc)			
Yes	2.44	0.77 - 7.72	2.438
Preventive Knowledge			
Not knowledgeable			
Knowledgeable	5.78	3.62 – 9.36	0.005

*rc =reference category

Table 4.20: Multivariate Analysis showing factors Influencing the Use of ITN

Variable	Odds Ratio (OR)	Confidence Interval (CI)	P-Value
Educational Level			
Not Educated (rc)			
Primary	2.68	0.24 - 30.02	0.423
Secondary Education	0.81	0.17 - 3.85	0.795
Tertiary	2.17	0.99 - 4.72	0.258
Duration of Use			
Weeks (rc)			
Month	0.34	0.47 - 2.53	0.295
Years	0.89	0.15 - 5.30	0.905
Obtain ITNs Free			
No (rc)			
Yes	2.44	0.77 - 7.72	2.438
Preventive Knowledge			
Not knowledgeable			
Knowledgeable	5.78	3.62 – 9.36	0.005

*rc =reference category

CHAPTER FIVE

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Preamble

Discussions of major findings in this study are presented in sections that relate to the objectives of the study. Findings on some epidemiological factors involved in the use of ITNs for the prevention of malaria, as examined in this study, are discussed. Major observations are:

• The Problem: Malaria is one of the leading causes of mortality for children under five in the developing world, and also has significant non-mortality-related costs.

• The Program: Distribution of insecticide-treated nets (ITNs), aims to protect individuals from bites by infected mosquitoes, which transmit the disease.

• Track record: ITN distribution has a strong track record of significantly reducing mortality in both repeated, randomized controlled trials and in larger-scale, country-level distribution efforts.

• Cost-effectiveness: Estimates imply very strong cost-effectiveness: $182-$1126 to avert a death (in addition to approximately 300 less severe malaria episodes).

• Bottom line: ITN distribution is a proven, cost-effective means for preventing mortality in the developing world.

5.2 Epidemiology of Malaria

The prevalence of malaria can vary widely between neighbouring villages and within different parts of the same village. Environmental factors probably play the major part in explaining differences between villages or settlements visited (Health Centres are situated within these communities). The position of a village in relation to mosquito breeding sites, design of houses and the level at which anti-mosquito measures are used will all influence the degree to which its inhabitants are exposed to infection. These are observed in all locations visited. Attitudes to the treatment of a case of malaria may also contribute to local variations in the prevalence of malaria.

Many factors can influence the level of exposure of individuals to mosquito bites in a malaria endemic area (Tulane, 2011). Some important factors are occupation, the living environment / type of residence and the use of personal anti-mosquito measures. Some of the factors related to residence studied are number of rooms per household characteristics, source of lighting, source of drinking water and type of toilet facility. This was very evident in the course of this study.

In some wards such as Gui, Jiwa, Gwagwa and Kabusa, surroundings were bushy and receptacles were found littering the ground. Most of the houses are made of mud walls which have multiple crevices; the roofs, though mostly made of aluminum sheets, with or without ceilings and there is copious space between the lintel and the roofs. These allow mosquitoes to move freely in and out of the houses. The design of a house as well as its situation, have been shown to be important in protecting its residents from mosquitoes. Greenwood, 1989, in a rural study found fewer mosquitoes in units with closed eaves than in those with open spaces, and children who slept in rooms with closed eaves had fewer attacks of malaria. Education plays a fundamental part in the use of the treated nets, as only about thirty – seven percent of respondents had up to secondary education. Occupational influence on use also is a factor: majority are farmers and traders. The combination of education and occupation have played a great factor in the use of treated nets (ITNs). Mosquitoes especially bite predominantly at night, an example is *A. gambiaens*. Still closeness to the ground may encourage bites by mosquitoes that stay close to the ground (Greenwood, 1989).

5.3 Living Conditions and Malaria

The figures obtained, especially the fact that a large number of respondents stated their source of information as Health workers (37.6%) can be attributed to the fact that this study was a health facility- based study. The prevention practices of the study communities are poor. Only about one third (1/3) of the households use treated net as a form of preventive measure against mosquito bite. Other measure used by about one-fifth of respondents was the use of such measures as insecticide sprays and the use of window screens and mosquito coils, (mentioned by 17.9% and 9.4% of the respondents respectively). Only 3.5% of the households reported having bed nets and these were not [illegible] used. Some of the members of the communities are yet to

endemic area (Tulane, 2011). Some important factors are occupation, the living environment / type of residence and the use of personal anti-mosquito measures. Some of the factors related to residence studied are number of rooms per household characteristics, source of lighting, source of drinking water and type of toilet facility. This was very evident in the course of this study.

In some wards such as Gui, Jiwa, Gwagwa and Kabusa, surroundings were bushy and receptacles were found littering the ground. Most of the houses are made of mud walls which have multiple crevices; the roofs, though mostly made of aluminum sheets, with or without ceilings and there is copious space between the lintel and the roofs. These allow mosquitoes to move freely in and out of the houses. The design of a house as well as its situation, have been shown to be important in protecting its residents from mosquitoes. Greenwood, 1989, in a rural study found fewer mosquitoes in units with closed eaves than in those with open spaces, and children who slept in rooms with closed eaves had fewer attacks of malaria. Education plays a fundamental part in the use of the treated nets, as only about thirty – seven percent of respondents had up to secondary education. Occupational influence on use also is a factor: majority are farmers and traders. The combination of education and occupation have played a great factor in the use of treated nets (ITNs). Mosquitoes especially bite predominantly at night, an example is *A. gambiaens*. Still closeness to the ground may encourage bites by mosquitoes that stay close to the ground (Greenwood, 1989).

5.3 Living Conditions and Malaria

The figures obtained, especially the fact that a large number of respondents stated their source of information as Health workers (37.6%) can be attributed to the fact that this study was a health facility- based study. The prevention practices of the study communities are poor. Only about one third (1/3) of the households use treated net as a form of preventive measure against mosquito bite. Other measure used by about one-fifth of respondents was the use of such measures as insecticide sprays and the use of window screens and mosquito coils, (mentioned by 17.9% and 9.4% of the respondents respectively). Only 3.5% of the households reported having bed nets and these were not treated with insecticides and were hardly used. Some of the members of the communities are yet to

benefit from the ITNs promised by the Federal Ministry of Health as part of the Roll Back Malaria Initiative.

The major source of water for residents was bore hole or well, understandably because the Gurara dam project that will serve AMAC and its environs is still on-going. The significant impact of this is that the quality of the ground water can adversely affect the immunity of the residents who use treated nets. Such could still fall ill and the cause can erroneously be ascribed to the in-effectiveness of the treated net.

5.4 Knowledge about cause of Malaria and Prevention of Malaria

Respondents were found to use a number of methods to protect themselves from mosquitoes. These practices can broadly be categorized as "commercial" or "non-commercial." "Commercial" methods include methods that involve a direct exchange of cash (for example, insecticide sprays and ITNs), while "non-commercial" methods refer to traditional methods or methods that do not involve monetary exchange (such as clearing the surroundings and closing of doors and windows).

Beliefs and knowledge about mosquitoes as well as malaria were nearly universal. Malaria is a prominent problem in the area that deters people from agricultural activities. Similar study conducted in Southern Nations Nationalities and People Region (SNNPR), Amhara and Oromiya revealed that about 93% of respondents knew that malaria could be transmitted through mosquito bite. A study conducted in Uganda revealed that almost all respondents (99.6%) reported having heard of the term "malaria". (Jimma, Tesfaye, Deressa, et al., 2003). Baseline survey for implementation of insecticide treated nets mosquito nets in malaria control in Ethiopia.

Obinna Onwujekwe, et al, 2005- reported that the local terminology for presumptive malaria was "Iba", which denotes fever. Many causes of Iba were identified by people, though as a consensus, most of the participants in all the groups identified mosquitoes as its major cause. The methods given by the participants on mosquito nuisance control included insecticide sprays, keeping doors and windows closed in the night, use of electric fans, applying mosquito repellent cream on the exposed body at night, clearing weeds around the house, wearing long dresses, applying kerosene to the body and physically killing mosquitoes. Other mosquito control

The major source of water for residents was bore hole or well, understandably because the Gurara dam project that will serve AMAC and its environs is still on-going. The significant impact of this is that the quality of the ground water can adversely affect the immunity of the residents who use treated nets. Such could still fall ill and the cause can erroneously be ascribed to the in-effectiveness of the treated net.

5.4 Knowledge about cause of Malaria and Prevention of Malaria

Respondents were found to use a number of methods to protect themselves from mosquitoes. These practices can broadly be categorized as "commercial" or "non-commercial." "Commercial" methods include methods that involve a direct exchange of cash (for example, insecticide sprays and ITNs), while "non-commercial" methods refer to traditional methods or methods that do not involve monetary exchange (such as clearing the surroundings and closing of doors and windows).

Beliefs and knowledge about mosquitoes as well as malaria were nearly universal. Malaria is a prominent problem in the area that deters people from agricultural activities. Similar study conducted in Southern Nations Nationalities and People Region (SNNPR), Amhara and Oromiya revealed that about 93% of respondents knew that malaria could be transmitted through mosquito bite. A study conducted in Uganda revealed that almost all respondents (99.6%) reported having heard of the term "malaria". (Jimma, Tesfaye, Deressa, et al., 2003). Baseline survey for implementation of insecticide treated nets mosquito nets in malaria control in Ethiopia.

Obinna Onwujekwe, et al, 2005- reported that the local terminology for presumptive malaria was "Iba", which denotes fever. Many causes of Iba were identified by people, though as a consensus, most of the participants in all the groups identified mosquitoes as its major cause. The methods given by the participants on mosquito nuisance control included insecticide sprays, keeping doors and windows closed in the night, use of electric fans, applying mosquito repellent cream on the exposed body at night, clearing weeds around the house, wearing long dresses, applying kerosene to the body and in the house, use of mosquito nets and physically killing mosquitoes. Other mosquito control techniques were draining stagnant water and covering [illegible] containers, especially during the rainy

season, and burning or placing local leaves (osigbu) in and around the house. The leaves are good mosquito repellents because of their smell. Some participants said that preventive drugs such as paludrine were used, especially by pregnant women.

5.5 Definition of Malaria, the Symptomatology and Prevalence among Respondents

Thirty-seven percent (37%) of respondents correctly mentioned fever as the main symptom of malaria. The Other symptoms that had a fair level of mention - feeling cold (20.8%), headache (10.8%) and general body weakness (7.8%) show that awareness level for symptoms of malaria is high in the Abuja Municipal Area Council. The results from this study is consistent with the findings of the Malaria Indicator Survey, (MIS 2010). North Central Nigeria, where our study area lies, recorded 87.9% knowledge of malaria among 97.5% of adult respondents. The MIS shows that the results from this study were consistent – 52.7% of adult respondents know that fever, headache, chills/shivering and joint pains are symptoms of malaria. We can deduce that the respondents and residents of Abuja Municipality have a high level of awareness on malaria and its symptoms.

5.6 Perception of (best) Prevention Methods for Malaria

Respondents had many opinions about ways to prevent malaria, however, 11.6% of respondents did not do anything nor had any idea of how to prevent malaria. Thirty-eight percent (38%) of respondents perceived that sleeping under a mosquito net was an effective method of malaria prevention. The use of Insecticide sprays (15%), and keeping the house and surrounding clean (6.0%), were cited by other respondents as the best preventive method. These opinions are typical of the study area as investigated also by the MIS 2010. The MIS 2010 reports that the Use of insecticide-treated nets (ITNs) is one of the most effective measures used to prevent malaria. Between May 2009 and February 2011, the government of Nigeria, with support from several partners, distributed approximately 30 million mosquito nets across the country. In addition, awareness of the importance of net usage has increased leading to a greater demand for the nets, both [illegible]. The Federal Ministry of Health (FMoH) distributed an additional 30

because of their smell. Some participants said that preventive drugs such as paludrine were used, especially by pregnant women.

5.5 Definition of Malaria, the Symptomatology and Prevalence among Respondents

Thirty-seven percent (37%) of respondents correctly mentioned fever as the main symptom of malaria. The Other symptoms that had a fair level of mention - feeling cold (20.8%), headache (10.8%) and general body weakness (7.8%) show that awareness level for symptoms of malaria is high in the Abuja Municipal Area Council. The results from this study is consistent with the findings of the Malaria Indicator Survey, (MIS 2010). North Central Nigeria, where our study area lies, recorded 87.9% knowledge of malaria among 97.5% of adult respondents. The MIS shows that the results from this study were consistent – 52.7% of adult respondents know that fever, headache, chills/shivering and joint pains are symptoms of malaria. We can deduce that the respondents and residents of Abuja Municipality have a high level of awareness on malaria and its symptoms.

5.6 Perception of (best) Prevention Methods for Malaria

Respondents had many opinions about ways to prevent malaria, however, 11.6% of respondents did not do anything nor had any idea of how to prevent malaria. Thirty-eight percent (38%) of respondents perceived that sleeping under a mosquito net was an effective method of malaria prevention. The use of Insecticide sprays (15%), and keeping the house and surrounding clean (6.0%), were cited by other respondents as the best preventive method. These opinions are typical of the study area as investigated also by the MIS 2010. The MIS 2010 reports that the Use of insecticide-treated nets (ITNs) is one of the most effective measures used to prevent malaria. Between May 2009 and February 2011, the government of Nigeria, with support from several partners, distributed approximately 30 million mosquito nets across the country. In addition, awareness of the importance of net usage has increased, leading to a greater demand for the nets, both treated and untreated. The Federal Ministry of Health (FMoH) distributed an additional 30 million nets across the country by the end of 2011 to achieve universal net coverage, which is

defined as one net for every two people (FMoH, 2008b; NMCP, 2011). Even though, ITNs are best prevention method proffered by respondents, the use is still about 32.1% (CDC, 2011).

Respondents' perception of age group at risk of malaria indicated that children under age 5 years were perceived to be at highest risk of contracting malaria, by 51.6% of respondents. This can be understood, knowing the vulnerability of children and the general perception that they are less able to immediately prevent themselves from malaria. The results is supported by the work of Ali Arazeem, et al, 2013 in North-Central Nigeria, shows that "within the context of the current study, perceived threat and severity of children to malaria was overwhelmingly acknowledged by the majority of the caregivers interviewed. A significant number of the caregivers interviewed were of the opinion that malaria is a serious health problem and a major threat to children. Other studies have reported similar outcome (Musa, et al., 2014; Chirdan, et al., 2008).

5.7 Health – Seeking Behaviour

Health-seeking behaviour refers to all those things humans do to prevent diseases and to detect diseases in asymptomatic stages. In contrast illness behaviour refers to all those activities designed to recognize and explain symptoms after one feels ill, and sick role behaviour refers to all those activities designed to cure diseases and restore health after a diagnosis has been made.

This study sought to examine the health-seeking behaviour of the respondents by identifying their source of treatment of the last malaria episode. Though malaria is endemic, not all the respondents could remember when they had malaria, a situation that warranted the response of not 'ever having malaria". The attitude of attending public health facilities (Government hospitals) is linked to the knowledge/awareness level of the respondents. Health –seeking behaviour of Abuja residents has also been highlighted by UNICEF, 2011 in Situation analysis of children and women in Nigeria, 2011. Delay in seeking treatment has been studied by Tanimola Akade, et al, 2009 and includes the fact that residents of AMAC seek health in treating malaria, howbeit that they sometimes by-pass the primary Healthcare system for the secondary and even tertiary Health Institutions. The health seeking behavior of patients is an issue often ignored by modern health workers (Sobel, 1995) and not even mentioned in widely used textbooks (Reichman and Herschfield, 1993). However, a better

defined as one net for every two people (FMoH, 2008b; NMCP, 2011). Even though, ITNs are best prevention method proffered by respondents, the use is still about 32.1% (CDC, 2011).

Respondents' perception of age group at risk of malaria indicated that children under age 5 years were perceived to be at highest risk of contracting malaria, by 51.6% of respondents. This can be understood, knowing the vulnerability of children and the general perception that they are less able to immediately prevent themselves from malaria. The results is supported by the work of Ali Arazeem, et al, 2013 in North-Central Nigeria, shows that "within the context of the current study, perceived threat and severity of children to malaria was overwhelmingly acknowledged by the majority of the caregivers interviewed. A significant number of the caregivers interviewed were of the opinion that malaria is a serious health problem and a major threat to children. Other studies have reported similar outcome (Musa, et al., 2014; Chirdan, et al., 2008).

5.7 Health – Seeking Behaviour

Health-seeking behaviour refers to all those things humans do to prevent diseases and to detect diseases in asymptomatic stages. In contrast illness behaviour refers to all those activities designed to recognize and explain symptoms after one feels ill, and sick role behaviour refers to all those activities designed to cure diseases and restore health after a diagnosis has been made.

This study sought to examine the health-seeking behaviour of the respondents by identifying their source of treatment of the last malaria episode. Though malaria is endemic, not all the respondents could remember when they had malaria, a situation that warranted the response of not 'ever having malaria". The attitude of attending public health facilities (Government hospitals) is linked to the knowledge/awareness level of the respondents. Health –seeking behaviour of Abuja residents has also been highlighted by UNICEF, 2011 in Situation analysis of children and women in Nigeria, 2011. Delay in seeking treatment has been studied by Taninola Akade, et al, 2009 and includes the fact that residents of AMAC seek health in treating malaria, howbeit that they sometimes by-pass the primary Healthcare system for the secondary and even tertiary Health Institutions. The health seeking behavior of patients is an issue often ignored by modern health workers (Sobel, 1995) and not even mentioned in widely used textbooks (Reichman and Herschfield, 1993). However, a better

understanding of patients' action is essential to understanding a disease. Such insights could possibly help to reduce delays in diagnosis, improve treatment.

Studies have suggested compliance and supply suggestions for improvement of health education (Metcalf et al., 1990; Rubel and Garro, 1992). Also, an understanding of the health and help seeking behavior of a population in relation to the various health service options including traditional healers, government, non-governmental organizations and private providers as well as the predispositions, enabling and provider factors in any given setting, is essential (Phillips, 1990).

Multiple resorts are often used, especially when a treatment fails. In some cases certain illnesses are seen by mothers and caregivers as amenable to treatment by modern practitioners, while others are considered best treated by traditional methods. Self-treatment is widely practiced by as much as 80% of people universally including Nigeria (Adeniyi and Ramakrishna, 1985; Brieger et al, 1986). Sauerborn et al., 1998 demonstrated severity of disease and perceived effectiveness of the treatment to be the most important determinants of health seeking behavior. In Nigeria, the principal strategy for preventing deaths of children from malaria is prompt and effective presumptive treatment with antimalarial drugs (FMOH, 1989). The strategy of early and effective malaria treatment depends mainly on behavior at the individual and household levels. It starts with early recognition of symptoms and signs that are interpreted as a malaria episode. Recognition of malaria based on local concepts forms the framework through which people consider seeking help and care. It is at this stage that decision making with the household occurs and it is here that gender and relations play a crucial role (Tanner and Vlassoff, 1998). Perception of illness, knowledge and understanding of illness are socially and culturally constructed as revealed by existence of gender differences exist (MacIntyre, 1993; Vlassof and Bonilla, 1994).

5.8 Knowledge about ITNs, Attitude and Use

The findings documented knowledge of ITNs as source of malaria prevention among 55.8% of respondents and shows a consistent and generally positive practices in all 9 wards surveyed. Most important, when nets were used, families gave priority to children under 5 and women of

Studies have suggested compliance and supply suggestions for improvement of health education (Metcalf et al., 1990; Rubel and Garro, 1992). Also, an understanding of the health and help seeking behavior of a population in relation to the various health service options including traditional healers, government, non-governmental organizations and private providers as well as the predispositions, enabling and provider factors in any given setting, is essential (Phillips, 1990).

Multiple resorts are often used, especially when a treatment fails. In some cases certain illnesses are seen by mothers and caregivers as amenable to treatment by modern practitioners, while others are considered best treated by traditional methods. Self-treatment is widely practiced by as much as 80% of people universally including Nigeria (Adeniyi and Ramakrishna, 1985; Brieger et al, 1986). Sauerborn et al., 1998 demonstrated severity of disease and perceived effectiveness of the treatment to be the most important determinants of health seeking behavior. In Nigeria, the principal strategy for preventing deaths of children from malaria is prompt and effective presumptive treatment with antimalarial drugs (FMOH, 1989). The strategy of early and effective malaria treatment depends mainly on behavior at the individual and household levels. It starts with early recognition of symptoms and signs that are interpreted as a malaria episode. Recognition of malaria based on local concepts forms the framework through which people consider seeking help and care. It is at this stage that decision making with the household occurs and it is here that gender and relations play a crucial role (Tanner and Vlassoff, 1998). Perception of illness, knowledge and understanding of illness are socially and culturally constructed as revealed by existence of gender differences exist (MacIntyre, 1993; Vlassof and Bonilla, 1994).

5.8 Knowledge about ITNs, Attitude and Use

The findings documented knowledge of ITNs as source of malaria prevention among 55.8% of respondents and shows a consistent and generally positive practices in all 9 wards surveyed. Most important, when nets were used, families gave priority to children under 5 and women of reproductive age. Within the age segment "children under 5," the younger the child, the more likely

he or she was to sleep under a net. Children under 2 years had the highest net-use rates of any family member—a positive finding because younger under-5s are more vulnerable to malaria than older under-5s. It is also good that young boys and girls in the wards surveyed are equally likely to be protected by a net. Within the segment "women of reproductive age," those who were pregnant were more likely to be under a net than those who were not.

5.9 Issues involved in Use of ITNs

Although among respondents using ITNs in households with nets only on some beds, it was discovered that it was primarily the adults and not children who slept under a net. Among users (55.8%), it is worthy of note that only 28.9% cited prevention against malaria as the main reason for its use as against 59.2% that cited prevention against mosquito bites. This shows that even among users there is need for further awareness.

Availability of ITNs was reported as a major reason for not having ITNs on all beds. Discomfort and cost also reported to be a factors mitigating against use of ITNs. These findings have some semblance to a study conducted in Kwara state, North-west Nigeria, by Salaudeen, et al, 2009 showing that cost has been implicated as one of the major reasons for non-ownership of nets even though cost of ITN is not the only factor that hinders ownership and use of nets. Other important factors that affect ownership and / or use of ITN included size and type of the house, available sleeping facilities and sleeping arrangements especially in large family and other competing needs of the individual, family and the communities. Sleeping space and sleeping patterns also determine whether it would be possible to hang and use a net. When the house is too small, it may not be feasible to use a net. Houses in most rural communities are usually old and small in size with high room temperatures at night so that people avoid sleeping under ITN due to unbearable heat. Sometimes the intense heat in some rural homes make some household members to opt for sleeping outside the house thus making it rather difficult to use bed nets. Another obvious finding in this study is the stoppage of ITN use by some respondents who had previously used it. Similar findings have been documented in other studies. Reasons for non-use or cessation in ITN use in this study of ITN to buy, lack of awareness and problem

member—a positive finding because younger under-5s are more vulnerable to malaria than older under-5s. It is also good that young boys and girls in the wards surveyed are equally likely to be protected by a net. Within the segment "women of reproductive age," those who were pregnant were more likely to be under a net than those who were not.

5.9 Issues involved in Use of ITNs

Although among respondents using ITNs in households with nets only on some beds, it was discovered that it was primarily the adults and not children who slept under a net. Among users (55.8%), it is worthy of note that only 28.9% cited prevention against malaria as the main reason for its use as against 59.2% that cited prevention against mosquito bites. This shows that even among users there is need for further awareness.

Availability of ITNs was reported as a major reason for not having ITNs on all beds. Discomfort and cost also reported to be a factors mitigating against use of ITNs. These findings have some semblance to a study conducted in Kwara state, North-west Nigeria, by Salaudeen, et al, 2009 showing that cost has been implicated as one of the major reasons for non-ownership of nets even though cost of ITN is not the only factor that hinders ownership and use of nets. Other important factors that affect ownership and / or use of ITN included size and type of the house, available sleeping facilities and sleeping arrangements especially in large family and other competing needs of the individual, family and the communities. Sleeping space and sleeping patterns also determine whether it would be possible to hang and use a net. When the house is too small, it may not be feasible to use a net. Houses in most rural communities are usually old and small in size with high room temperatures at night so that people avoid sleeping under ITN due to unbearable heat. Sometimes the intense heat in some rural homes make some household members to opt for sleeping outside the house thus making it rather difficult to use bed nets. Another obvious finding in this study is the stoppage of ITN use by some respondents who had previously used it. Similar findings have been documented in other studies. Reasons for non-use or cessation in ITN use in this study varied among the respondents and included: scarcity of ITN to buy, lack of awareness and problem

he or she was to sleep under a net. Children under 2 years had the highest net-use rates of any family member—a positive finding because younger under-5s are more vulnerable to malaria than older under-5s. It is also good that young boys and girls in the wards surveyed are equally likely to be protected by a net. Within the segment "women of reproductive age," those who were pregnant were more likely to be under a net than those who were not.

5.9 Issues involved in Use of ITNs

Although among respondents using ITNs in households with nets only on some beds, it was discovered that it was primarily the adults and not children who slept under a net. Among users (55.8%), it is worthy of note that only 28.9% cited prevention against malaria as the main reason for its use as against 59.2% that cited prevention against mosquito bites. This shows that even among users there is need for further awareness.

Availability of ITNs was reported as a major reason for not having ITNs on all beds. Discomfort and cost also reported to be a factors mitigating against use of ITNs. These findings have some semblance to a study conducted in Kwara state, North-west Nigeria, by Salaudeen, et al, 2009 showing that cost has been implicated as one of the major reasons for non-ownership of nets even though cost of ITN is not the only factor that hinders ownership and use of nets. Other important factors that affect ownership and / or use of ITN included size and type of the house, available sleeping facilities and sleeping arrangements especially in large family and other competing needs of the individual, family and the communities. Sleeping space and sleeping patterns also determine whether it would be possible to hang and use a net. When the house is too small, it may not be feasible to use a net. Houses in most rural communities are usually old and small in size with high room temperatures at night so that people avoid sleeping under ITN due to unbearable heat. Sometimes the intense heat in some rural homes make some household members to opt for sleeping outside the house thus making it rather difficult to use bed nets. Another obvious finding in this study is the stoppage of ITN use by some respondents who had previously used it. Similar findings have been documented in other studies. Reasons for non-use or cessation in ITN use in this study

member - a positive finding because younger under-5s are more vulnerable to malaria than older under-5s. It is also good that young boys and girls in the wards surveyed are equally likely to be protected by a net. Within the segment "women of reproductive age," those who were pregnant were more likely to be under a net than those who were not.

5.9 Issues involved in Use of ITNs

Although among respondents using ITNs in households with nets only on some beds, it was discovered that it was primarily the adults and not children who slept under a net. Among users (55.8%), it is worthy of note that only 28.9% cited prevention against malaria as the main reason for its use as against 59.2% that cited prevention against mosquito bites. This shows that even among users there is need for further awareness.

Availability of ITNs was reported as a major reason for not having ITNs on all beds. Discomfort and cost also reported to be a factors mitigating against use of ITNs. These findings have some semblance to a study conducted in Kwara state, North-west Nigeria, by Salaudeen, et al, 2009 showing that cost has been implicated as one of the major reasons for non-ownership of nets even though cost of ITN is not the only factor that hinders ownership and use of nets. Other important factors that affect ownership and / or use of ITN included size and type of the house, available sleeping facilities and sleeping arrangements especially in large family and other competing needs of the individual, family and the communities. Sleeping space and sleeping patterns also determine whether it would be possible to hang and use a net. When the house is too small, it may not be feasible to use a net. Houses in most rural communities are usually old and small in size with high room temperatures at night so that people avoid sleeping under ITN due to unbearable heat. Sometimes the intense heat in some rural homes make some household members to opt for sleeping outside the house thus making it rather difficult to use bed nets. Another obvious finding in this study is the stoppage of ITN use by some respondents who had previously used it. Similar findings have been documented in other studies. Reasons for non-use or cessation in ITN use in this study varied among the respondents and included: scarcity of ITN to buy, lack of awareness and problem

of re-treatment of expired nets. This is consistent with reasons and explanations reported in other studies where non-availability of ITN, lack of awareness and knowledge of where it can be purchased and problem of affordability were major factors that affect stoppage and / or non-use of ITN. Household economic status has been related to net ownership in a number of studies. As a result of the economic crisis and reforms in the last 5 years in Nigeria, many people especially the rural population are living in extreme poverty. This makes people not to value the need for ITN due to competing essential domestic needs like food. This study showed that among respondents aware of ITNs, benefits of using ITNs was reported to include not getting bitten by mosquito and not getting infected with malaria. These benefits have been reported to help in the utilisation of ITNs (WHO, 2010).

Over a five year period, Nigeria has succeeded in achieving only 2.8% of the 60% expected coverage for under-five children with insecticide-treated nets. Although this is a non-negligible achievement considering the baseline situation of 0%, this progress is much too slow,

Achieving the set goal requires focused and well-informed strategies that are based on scientific evidence generated from local circumstances. This study has identified key issues constituting impediments in the cogwheels of progress; while poverty militates against ownership of net, lack of education curtail its use. This presents the policy makers with the challenge of addressing these issues decisively, if the RBM goal, or indeed the MDGs will be met. Considering the time constraints, the aim must be a rapid scale-up among the target groups, while not neglecting the other members of the population. A pluralistic approach to scaling up, in which several distribution and financing mechanisms are combined has been recommended; this includes commercial sales of nets, social marketing, community-based distribution and targeted subsidies. However, the choice of strategy must be based on evidence of what works in the context of the country to ensure adaptability. These strategies must target not only increasing household ownership but also utilization, which is most important for epidemiologic impact. In addressing poverty as a hindrance to ownership, the government must decide what is workable for it within the limits of its resources; whether to continue giving out the nets free of charge, if it can sustain it, or to highly subsidize the

studies where non-availability of ITN, lack of awareness and knowledge of where it can be purchased and problem of affordability were major factors that affect stoppage and / or non-use of ITN. Household economic status has been related to net ownership in a number of studies. As a result of the economic crisis and reforms in the last 5 years in Nigeria, many people especially the rural population are living in extreme poverty. This makes people not to value the need for ITN due to competing essential domestic needs like food. This study showed that among respondents aware of ITNs, benefits of using ITNs was reported to include not getting bitten by mosquito and not getting infected with malaria. These benefits have been reported to help in the utilisation of ITNs (WHO, 2010).

Over a five year period, Nigeria has succeeded in achieving only 2.8% of the 60% expected coverage for under-five children with insecticide-treated nets. Although this is a non-negligible achievement considering the baseline situation of 0%, this progress is much too slow.

Achieving the set goal requires focused and well-informed strategies that are based on scientific evidence generated from local circumstances. This study has identified key issues constituting impediments in the cogwheels of progress; while poverty militates against ownership of net, lack of education curtail its use. This presents the policy makers with the challenge of addressing these issues decisively, if the RBM goal, or indeed the MDGs will be met. Considering the time constraints, the aim must be a rapid scale-up among the target groups, while not neglecting the other members of the population. A pluralistic approach to scaling up, in which several distribution and financing mechanisms are combined has been recommended; this includes commercial sales of nets, social marketing, community-based distribution and targeted subsidies. However, the choice of strategy must be based on evidence of what works in the context of the country to ensure adaptability. These strategies must target not only increasing household ownership but also utilization, which is most important for epidemiologic impact. In addressing poverty as a hindrance to ownership, the government must decide what is workable for it within the limits of its resources; whether to continue giving out the nets free of charge, if it can sustain it, or to highly subsidize the nets while continuing to use the MCH clinics as distribution points, and continuing the mass ITN

studies where non-availability of ITN, lack of awareness and knowledge of where it can be purchased and problem of affordability were major factors that affect stoppage and / or non-use of ITN. Household economic status has been related to net ownership in a number of studies. As a result of the economic crisis and reforms in the last 5 years in Nigeria, many people especially the rural population are living in extreme poverty. This makes people not to value the need for ITN due to competing essential domestic needs like food. This study showed that among respondents aware of ITNs, benefits of using ITNs was reported to include not getting bitten by mosquito and not getting infected with malaria. These benefits have been reported to help in the utilisation of ITNs (WHO, 2010).

Over a five year period, Nigeria has succeeded in achieving only 2.8% of the 60% expected coverage for under-five children with insecticide-treated nets. Although this is a non-negligible achievement considering the baseline situation of 0%, this progress is much too slow.

Achieving the set goal requires focused and well-informed strategies that are based on scientific evidence generated from local circumstances. This study has identified key issues constituting impediments in the cogwheels of progress; while poverty militates against ownership of net, lack of education curtail its use. This presents the policy makers with the challenge of addressing these issues decisively, if the RBM goal, or indeed the MDGs will be met. Considering the time constraints, the aim must be a rapid scale-up among the target groups, while not neglecting the other members of the population. A pluralistic approach to scaling up, in which several distribution and financing mechanisms are combined has been recommended; this includes commercial sales of nets, social marketing, community-based distribution and targeted subsidies. However, the choice of strategy must be based on evidence of what works in the context of the country to ensure adaptability. These strategies must target not only increasing household ownership but also utilization, which is most important for epidemiologic impact. In addressing poverty as a hindrance to ownership, the government must decide what is workable for it within the limits of its resources; whether to continue giving out the nets free of charge, if it can sustain it, or to highly subsidize the nets while continuing to use the MCH clinics as distribution points and continuing the mass ITN

studies where non-availability of ITN, lack of awareness and knowledge of where it can be purchased and problem of affordability were major factors that affect stoppage and / or non-use of ITN. Household economic status has been related to net ownership in a number of studies. As a result of the economic crisis and reforms in the last 5 years in Nigeria, many people especially the rural population are living in extreme poverty. This makes people not to value the need for ITN due to competing essential domestic needs like food. This study showed that among respondents aware of ITNs, benefits of using ITNs was reported to include not getting bitten by mosquito and not getting infected with malaria. These benefits have been reported to help in the utilisation of ITNs (WHO, 2010).

Over a five year period, Nigeria has succeeded in achieving only 2.8% of the 60% expected coverage for under-five children with insecticide-treated nets. Although this is a non-negligible achievement considering the baseline situation of 0%, this progress is much too slow.

Achieving the set goal requires focused and well-informed strategies that are based on scientific evidence generated from local circumstances. This study has identified key issues constituting impediments in the cogwheels of progress; while poverty militates against ownership of net, lack of education curtail its use. This presents the policy makers with the challenge of addressing these issues decisively, if the RBM goal, or indeed the MDGs will be met. Considering the time constraints, the aim must be a rapid scale-up among the target groups, while not neglecting the other members of the population. A pluralistic approach to scaling up, in which several distribution and financing mechanisms are combined has been recommended; this includes commercial sales of nets, social marketing, community-based distribution and targeted subsidies. However, the choice of strategy must be based on evidence of what works in the context of the country to ensure adaptability. These strategies must target not only increasing household ownership but also utilization, which is most important for epidemiologic impact. In addressing poverty as a hindrance to ownership, the government must decide what is workable for it within the limits of its resources; whether to continue giving out the nets free of charge, if it can sustain it, or to highly subsidize the nets while continuing to use the MCH clinics as distribution points, and continuing the mass ITN

distribution campaign. The most important consideration should be that cost must not be a barrier to access to nets for the vulnerable groups. Other measures of reducing the cost of ITN should be explored to ensure that the rest of the population not covered by subsidy or free distribution can have access to the nets at an affordable cost. Seeking transfer of net manufacturing technology from a sister African country like Tanzania, and removing taxes and tariffs on netting materials and insecticides are some of these measures. These will create an enabling environment for, and encourage local manufacturing of nets, which not only has the potential to substantially reduce the market price of the nets, but also to create employment opportunities and, as such, alleviate poverty.

5.10 The role of primary health workers in influencing the use of ITNs

Table 4 summarizes the responses obtained on the main source of information on malaria. The dominant sources of information on malaria were health workers (37.6%), radio (32.6%), and television (24%). Due to the constant interaction between respondents and the health workers at the primary healthcare level, it is most likely they will share information faster than via any other medium.

5.11 Limitations of the study

Limitations of the study. In interpreting the results of this study, certain issues must be borne in mind. The sampling methodology used in this study (cluster design) is fraught with the problem of high intra-class correlation and taking outcomes to the exact percentage point may be misleading. However, since a large number of clusters were studied in this survey, this effect will be minimal. Also, the survey questionnaire was not translated into local languages, the interviewers interpreted them to the respondents who did not understand English. It is possible for interviewers to misinterpret questions or introduce personal preferences. However, because they were all trained and the hypothesis of this study was generated after data collection, this should probably not have biased the study in a significant way.

5.12 Recommendations

From the current study, the following recommendations are hereby suggested to ensure optimum utilization of ITNs in Nigeria;

1. Use of vector prevention measures for Malaria control should be encouraged

2. Insecticide-treated bed nets (ITNs) are now an important method for controlling malaria. Their protective effect will be strongest if they are used by a high proportion of the population at risk. Mass Distribution Campaigns should be continued to attain high coverage.

3. ITNs should continue be sold as a commodity, using social marketing to stimulate their sale. Sale of ITNs will increase their value to the users and might ensure their sustainability (ITNs would continue to be available after donor agencies have left).

4. ITNs should continue to be provided free of charge to the groups most at risk via continuous distribution channels like Ante-natal clinics, Schools and during Immunization weeks. Like vaccines, ITNs are a public health intervention that decreases death and disease. Thus, like vaccines, ITNs deserve to be given free to those who need them most.

5. Partner Support need to be further encouraged, especially among pregnant women whose use of ITNs will be further increased if their husbands are knowledgeable and also use ITNs.

6. Home Visits by PHC staff to encourage use of ITNs and help in hanging where necessary, will help prevent Malaria among residents of such communities.

7. Seeking transfer of net manufacturing technology from a sister African country like Tanzania, and removing taxes and tariffs on netting materials and insecticides is also recommended. These will create an enabling environment for, and encourage local manufacturing of nets, which not only has the potential to substantially reduce the market price of the nets, but also to create employment opportunities and, as such, alleviate poverty.

5.13 Conclusion

Nigeria has adopted a combination of approaches, where ITNs are sold through the private market and also distributed free or heavily subsidized to groups at risk of severe malaria (pregnant women and children under 5) via mass campaigns and continuous distribution channels. Balancing these strategies so that they complement each other may prove to be the best way to rapidly increase coverage among vulnerable populations while ensuring that this very effective malaria control intervention is sustained over the long term. ITNs are generally effective when used appropriately and consistently by the people who face high risk of malaria mortality. Greater enlightenment, commitment by the people to ITNs and sustained procurement drive will ensure that this commodity is readily available to support the war against malaria in Abuja Municipal Area Council and Nigeria at large.

REFERENCES

Tayles N: Anemia, genetic diseases, and malaria in Southeast Asia. Am J Phys Anthropol 1996, 101:11-27.

Lindsay SW, Gibson ME: Bed nets Revisited – Old Idea, New Angle. Parasitol Today 1988, 4:270-272.

Poser CM, Bruyn GW: The General History of Malaria. In An illustrated history of malaria. Edited by: Poser CM, Bruyn GW. New York: Parthenon Publishing Group; 1999:121-125.

Diallo DA, Cousens SN, Cuzin-Ouattara N, Nebié I, Ilboudo-Sanogo E, Esposito F: Child mortality in a West African population protected with insecticide-treated curtains for a period of up to 6 years. Bull World Health Organ 2004, 82:85-91.

Lindblade KA, Eisele TP, Gimnig JE, Alaii JA, Odhiambo F, ter Kuile FO, Hawley WA, Wannemuehler KA, Philipps-Howard PA, Rosen DH, Nahlen BL, Terlouw DJ, Adazu K, Vulule JM, Slutsker L: Sustainability of reductions in malaria transmission and infant mortality in Western Kenya with use of insecticide-treated bed nets. J Am Med Assoc 2004, 291:2571-2580.

Lengeler C: Insecticide-treated nets for malaria control: real gains. Bull World Health Organ 2004, 82:84.

Müller O, Traoré C, Kouyaté B, Yé Y, Frey C, Coulibaly B, Becher H: Effects of insecticide-treated bed nets during early infancy in an African area of intense malaria transmission: a randomized controlled trial. Bull World Health Organ 2006, 84:120-126.

Curtis C, Maxwell C, Lemnge M, Kilama WL, Steketee RW, Hawley W, Bergevin Y, Campbell CC, Sachs J, Teklehaimanot A, Ochola S, Guyatt H, Snow RW: Scaling-up coverage with insecticide-treated nets against malaria in Africa: who should pay? Lancet Infect Dis 2003, 3:304-307.

Goodman C, Coleman P, Mills A: Cost-effectiveness of malaria control in sub-Saharan Africa. Lancet 1999, 354:378-385

D'Alessandro U: Insecticide-treated bed nets to prevent malaria. The challenge lies in implementation. BMJ 2001, 322:249-250.

Guillet P, Alnwick D, Cham MK, Neira M, Zaim M, Heymann D: Long-lasting treated mosquito ... Bull World Health Organ 2001, 79:998.

Tayles N: Anemia, genetic diseases, and malaria in Southeast Asia. Am J Phys Anthropol 1996, 101:11-27.

Lindsay SW, Gibson ME: Bed nets Revisited – Old Idea, New Angle. Parasitol Today 1988, 4:270-272.

Poser CM, Bruyn GW: The General History of Malaria. In An illustrated history of malaria. Edited by: Poser CM, Bruyn GW. New York: Parthenon Publishing Group; 1999:121-125.

Diallo DA, Cousens SN, Cuzin-Ouattara N, Nebié I, Ilboudo-Sanogo E, Esposito F: Child mortality in a West African population protected with insecticide-treated curtains for a period of up to 6 years. Bull World Health Organ 2004, 82:85-91.

Lindblade KA, Eisele TP, Gimnig JE, Alaii JA, Odhiambo F, ter Kuile FO, Hawley WA, Wannemuehler KA, Philipps-Howard PA, Rosen DH, Nahlen BL, Terlouw DJ, Adazu K, Vulule JM, Slutsker L: Sustainability of reductions in malaria transmission and infant mortality in Western Kenya with use of insecticide-treated bed nets. J Am Med Assoc 2004, 291:2571-2580.

Lengeler C: Insecticide-treated nets for malaria control: real gains. Bull World Health Organ 2004, 82:84.

Müller O, Traoré C, Kouyaté B, Yé Y, Frey C, Coulibaly B, Becher H: Effects of insecticide-treated bed nets during early infancy in an African area of intense malaria transmission: a randomized controlled trial. Bull World Health Organ 2006, 84:120-126.

Curtis C, Maxwell C, Lemnge M, Kilama WL, Steketee RW, Hawley W, Bergevin Y, Campbell CC, Sachs J, Teklehaimanot A, Ochola S, Guyatt H, Snow RW: Scaling-up coverage with insecticide-treated nets against malaria in Africa: who should pay? Lancet Infect Dis 2003, 3:304-307.

Goodman C, Coleman P, Mills A: Cost-effectiveness of malaria control in sub-Saharan Africa. Lancet 1999, 354:378-385

D'Alessandro U: Insecticide-treated bed nets to prevent malaria. The challenge lies in implementation. BMJ 2001, 322:249-250.

Guillet P, Alnwick D, Cham MK, Neira M, Zaim M, Heymann D: Long-lasting treated mosquito nets: a breakthrough in malaria prevention. Bull World Health Organ 2001, 79:998.

Nabarro DN, Tayler EM: The 'Roll Back Malaria' Campaign. Science 1998, 280:2067-2068.

Rashed S, Johnson H, Dongier P, Gbaguidi C, Laleye S, Tchobo S, Gyorkos TW, Maclean JD, Moreau R: Determinants of the Permethrin Impregnated Bed nets (PIB) in the Republic of Benin: the role of women in the acquisition and utilization of PIBs. Soc Sci Med 1999, 49:993-1005.

Binka FM, Adongo P: Acceptability and use of insecticide impregnated bed nets in northern Ghana. Trop Med Int Health 1997, 2:499-507.

Winch PJ, Makemba AM, Kamazima SR, Lwihula GK, Lubega P, Minjas JN, Shiff CJ: Seasonal variation in the perceived risk of malaria: implications for the promotion of insecticide-impregnated bed nets. Soc Sci Med 1994, 39:63-75.

Miguel CA, Tallo VL, Manderson L, Lansang MA: Local knowledge and treatment of malaria in Agusan del Sur, The Philippines. Soc Sci Med 1999, 48:607-618.

Ahorlu CK, Dunyo AK, Afari EA, Koram KA, Nkrumah FK: Malaria-related beliefs and behaviour in southern Ghana: implications for treatment, prevention and control. Trop Med Int Health 1997, 2:488-498.

Brieger WR, Nwankwo E, Ezike VI, Sexton JD, Breman JG, Parker KA, Ekanem OJ, Robinson T: Social and behavioural baseline for guiding implementation of an efficacy trail of insecticide impregnated bed nets for malaria control at Nsukka, Nigeria. Intern Quarterly Comm Health Educ 1996, 16:47-61.

Vundule C, Mharakurwa S: Knowledge, practices and perceptions about malaria in rural communities of Zimbabwe: relevance to malaria control. Bull World Health Organ 1996, 74:55-60.

Klein RE, Weller SC, Zeissig R, Richards FO, Ruebush TK II: Knowledge, beliefs and practices in relation to malaria transmission and vector control in Guatemala. Am J Trop Med Hyg 1995, 52:383-388.

Ettling M, Steketee RW, Macheso A, Schultz LJ, Nyasulu Y, Chitsulo L: Malaria knowledge, attitudes and practices in Malawi: survey population characteristics. Trop Med Parasitol 1994, 45:57-60.

Kynast-Wolf G, Hammer GP, Müller O, Kouyaté B, Becher H: Season of death, and of birth, predict

Rashed S, Johnson H, Dongier P, Gbaguidi C, Laleye S, Tchobo S, Gyorkos TW, Maclean JD, Moreau R: Determinants of the Permethrin Impregnated Bed nets (PIB) in the Republic of Benin: the role of women in the acquisition and utilization of PIBs. Soc Sci Med 1999, 49:993-1005.

Binka FM, Adongo P: Acceptability and use of insecticide impregnated bed nets in northern Ghana. Trop Med Int Health 1997, 2:499-507.

Winch PJ, Makemba AM, Kamazima SR, Lwihula GK, Lubega P, Minjas JN, Shiff CJ: Seasonal variation in the perceived risk of malaria: implications for the promotion of insecticide-impregnated bed nets. Soc Sci Med 1994, 39:63-75.

Miguel CA, Tallo VL, Manderson L, Lansang MA: Local knowledge and treatment of malaria in Agusan del Sur, The Philippines. Soc Sci Med 1999, 48:607-618.

Ahorlu CK, Dunyo AK, Afari EA, Koram KA, Nkrumah FK: Malaria-related beliefs and behaviour in southern Ghana: implications for treatment, prevention and control. Trop Med Int Health 1997, 2:488-498.

Brieger WR, Nwankwo E, Ezike VI, Sexton JD, Breman JG, Parker KA, Ekanem OJ, Robinson T: Social and behavioural baseline for guiding implementation of an efficacy trail of insecticide impregnated bed nets for malaria control at Nsukka, Nigeria. Intern Quarterly Comm Health Educ 1996, 16:47-61.

Vundule C, Mharakurwa S: Knowledge, practices and perceptions about malaria in rural communities of Zimbabwe: relevance to malaria control. Bull World Health Organ 1996, 74:55-60.

Klein RE, Weller SC, Zeissig R, Richards FO, Ruebush TK II: Knowledge, beliefs and practices in relation to malaria transmission and vector control in Guatemala. Am J Trop Med Hyg 1995, 52:383-388.

Ettling M, Steketee RW, Macheso A, Schultz LJ, Nyasulu Y, Chitsulo L: Malaria knowledge, attitudes and practices in Malawi: survey population characteristics. Trop Med Parasitol 1994, 45:57-60.

Kynast-Wolf G, Hammer GP, Müller O, Kouyaté B, Becher H: Season of death, and of birth, predict patterns of mortality in Burkina Faso. Int J Epidemiol 2005, 34:1-9.

Traoré C: Epidemiology of malaria in a holoendemic area of rural Burkina Faso. In PhD Thesis. Ruprecht-Karls-University Heidelberg, Department for Tropical Hygiene and Public Health; 2003.

Müller O, Ido K, Traoré C: Evaluation of a prototype long-lasting insecticide-treated mosquito net under field conditions in rural Burkina Faso. Trans R Soc Trop Med Hyg 2002, 96:483-484.

Rodríguez AD, Penilla RP, Henry-Rodríguez M, Hemingway J, Betanzos AF, Hernández-Avila JE: Knowledge and beliefs about malaria transmission and practices for vector control in Southern Mexico. Salud Pública de México 2003, 45:110-116.

Hewitt SE, Farhan M, Urhaman H, Muhammad N, Kamal M, Rowland MW: Self-protection from malaria vectors in Pakistan: an evaluation of popular existing methods and appropriate new techniques in Afghan refugee communities. Ann Trop Med Parasitol 1996, 90:337-344.

Aikins MK, Pickering H, Alonso PL, D'Alessandro U, Lindsay SW, Todd J, Greenwood BM: A malaria control trial using insecticide-treated bed nets and targeted chemoprophylaxis in a rural area of The Gambia, West Africa. Perceptions of the causes of malaria and of its treatment and prevention in the study area. Trans R Soc Trop Med Hyg 1993, 87(Suppl 2):25-30.

Sexton JD, Ruebush TK II, Brandling-Bennett AD, Breman JG, Roberts JM, Odera JS, Were JBO: Permethrin-impregnated curtains and bed-nets prevent malaria in Western Kenya. Am J Trop Med Hyg 1990, 43:11-18.

Linhua T, Manderson L, Da D, Kaichen W, Xianzheng C, Changxiong L, Zhengcheng G, Ke-an W: Social Aspects of Malaria in Heping, Hainan. Acta Trop 1995, 59:41-53.

Okrah J, Traoré C, Palé A, Sommerfeld J, Müller O: Community factors associated with malaria prevention by mosquito nets: an exploratory study in rural Burkina Faso. Trop Med Int Health 2002, 7:40-248.

Ziba C, Slutsker L, Chitsulo L, Steketee RW: Use of malaria prevention measures in Malawian households. Trop Med Intern Health 1994, 45:70-73.

Guyapong M, Guyapong JO, Amankwa JA, Asedem J, Sory E: Introducing insecticide impregnated bed nets in an area of low bed net usage: an exploratory study in northwest Ghana. Trop Med Int Health 1996, 1:328-333.

Rhee M, Sissoko M, Perry S, McFarland W, Parsonnet J, Doumbo O: Use of insecticide-treated nets (ITNs) following a malaria education intervention in Piron, Mali: a control trial with systematic allocation of households. Malar J 2005, 4:35.

Kachur SP, Phillips-Howard PA, Odhacha AM, Ruebush TK, Oloo AJ, Nahlen BL: Maintenance and sustained use of insecticide-treated bed nets and curtains three years after a controlled trial in western Kenya. Trop Med Int Health 1999, 4:728-735.

Nuwaha F: People's perception of malaria in Mbarara, Uganda. Trop Med Int Health 2002, 7:462-470.

Jamjoom GA, Mahfouz AAR, Badawi IA, Omar MS, Al-Zoghaibi OS, Al-Amari OM, Ibrahim M, Siam I: Acceptability and usage of permethrin-impregnated mosquito bed nets in rural southwestern Saudi Arabia. Trop Geogr Med 1994, 46:355-357.

MacCormack CP: Human ecology and behaviour in malaria control in tropical Africa. Bull World Health Organ 1984, 62(Suppl):81-87.

Onwujekwe O, Uzochukwu B, Ezumah N, Shu E: Increasing coverage of insecticide-treated nets in rural Nigeria: implications of consumer knowledge, preferences and expenditures for malaria prevention. Malar J 2005, 4:29.

MacCormack CP, Snow RW: Gambian cultural preferences in the use of insecticide-impregnated bed nets. J Trop Med Hyg 1986, 89:295-302.

Lindsay SW, Snow RW, Armstrong JRM, Greenwood BM: Permethrin-impregnated bed nets reduce nuisance arthropods in Gambian houses. Med Vet Entomol 1989, 3:377-383.

Richards FO Jr, Klein RE, Zea Flores R, Weller S, Gatica M, Zeissig R, Sexton J: Permethrin-impregnated bed nets for malaria control in northern Guatemala: epidemiologic impact and community acceptance. Am J Trop Med Hyg 1993, 49:410-418.

Beiersmann C: Malaria in rural Burkina Faso: local concepts, health seeking behaviour and patterns of traditional treatment. In Master Thesis. Ruprecht-Karls-University Heidelberg,Department of Tropical Medicine and Public Health; 2005.

Adongo PB, Kirkwood B, Kendall C: How local community knowledge about malaria affects

(ITNs) following a malaria education intervention in Piron, Mali: a control trial with systematic allocation of households. Malar J 2005, 4:35.

Kachur SP, Phillips-Howard PA, Odhacha AM, Ruebush TK, Oloo AJ, Nahlen BL: Maintenance and sustained use of insecticide-treated bed nets and curtains three years after a controlled trial in western Kenya. Trop Med Int Health 1999, 4:728-735.

Nuwaha F: People's perception of malaria in Mbarara, Uganda. Trop Med Int Health 2002, 7:462-470.

Jamjoom GA, Mahfouz AAR, Badawi IA, Omar MS, Al-Zoghaibi OS, Al-Amari OM, Ibrahim M, Siam I: Acceptability and usage of permethrin-impregnated mosquito bed nets in rural southwestern Saudi Arabia. Trop Geogr Med 1994, 46:355-357.

MacCormack CP: Human ecology and behaviour in malaria control in tropical Africa. Bull World Health Organ 1984, 62(Suppl):81-87.

Onwujekwe O, Uzochukwu B, Ezumah N, Shu E: Increasing coverage of insecticide-treated nets in rural Nigeria: implications of consumer knowledge, preferences and expenditures for malaria prevention. Malar J 2005, 4:29.

MacCormack CP, Snow RW: Gambian cultural preferences in the use of insecticide-impregnated bed nets. J Trop Med Hyg 1986, 89:295-302.

Lindsay SW, Snow RW, Armstrong JRM, Greenwood BM: Permethrin-impregnated bed nets reduce nuisance arthropods in Gambian houses. Med Vet Entomol 1989, 3:377-383.

Richards FO Jr, Klein RE, Zea Flores R, Weller S, Gatica M, Zeissig R, Sexton J: Permethrin-impregnated bed nets for malaria control in northern Guatemala: epidemiologic impact and community acceptance. Am J Trop Med Hyg 1993, 49:410-418.

Beiersmann C: Malaria in rural Burkina Faso: local concepts, health seeking behaviour and patterns of traditional treatment. In Master Thesis. Ruprecht-Karls-University Heidelberg,Department of Tropical Medicine and Public Health; 2005.

Adongo PB, Kirkwood B, Kendall C: How local community knowledge about malaria affects insecticide-treated net use in northern Ghana. Trop Med Int Health 2005, 10:366-378.

Winch PJ, Makemba AM, Makame VR, Mfaume MS, Lynch MC, Premji Z, Minjas JN, Shiff CJ: Social and cultural factors affecting rates of regular retreatment of mosquito nets with insecticide in Bagamoyo District, Tanzania. Trop Med Int Health 1997, 2:760-770.

Alaba A.Olufunke Malaria and Rural Household productivity in Oyo State. A PhD thesis submitted in the Department of Economics, University of Ibadan, 2005.

Gilles HM, Warrell DA. Essential malariology. Fouth Edition. London/Sydney/Auckland, Arnold, 2002. ISBN 0 340 81622 8.

World Health Organization/UNICEF. The Africa malaria report 2003.WHO/CDS/MAL/2003.

Sachs J, Malaney P. The economic and social burden of malaria. Nature 2002; 415(6872):680-5.

WHO/UNICEF. The World Malaria Report. Geneva, World Health Organization, 2005 (WHO/HTM/MAL/2005.1102).

WHO/UNICEF. The Africa Malaria Report. Geneva, World Health Organization, 2003 (WHO/CDS/MAL/2003.1093).

The African Summit on Roll Back Malaria. Abuja, Nigeria, 25 April 2000. Geneva, World Health Organization, 2000 (WHO/CDS/RBM/2000.17).

Rowland M (1999). Malaria control: bednets or spraying? Malaria control in the Afghan refugee camps of western Pakistan. Transactions of the Royal Society of Tropical Medicine and Hygiene, 93:458--459

Guidelines for the treatment of malaria. Geneva, World Health Organization, 2005 (ISBN 978 92 4 154694 2; WHO/HTM/MAL/2006.1108).

Handbook for integrated management of childhood illness. Geneva, World Health Organization, United Nations Children's Fund, 2000 (WHO/FCH/CAH/00.12).

NetMark. NetMark: Public-Private Partnership for Sustainable Malaria Prevention: NetMark,

Clarke SE, Bogh C, Brown RC, Pinder M, Walraven GE, Lindsay SW. Do untreated bednets protect against malaria? Trans R Soc Trop Med Hyg 2001; 95(5):457-62.

Hii JL, Smith T, Vounatsou P, et al. Area effects of bednet use in a malaria-endemic area in Papua New Guinea. Trans R Soc Trop Med Hyg 2001; 95(1):7-13.

Malaria Consortium . Supporting the design and implementation of the net retreatment system. Kampala: Malaria Consortium East and Southern Africa Office, 2004.

Miller J, Korenromp, E., Nahlen, B.L., Lines, J., Cham, M.K. Monitoring the number of mosquito nets in African households south of the Sahara. In prep. 2005.

Hanson K, Kikumbih N, Armstrong Schellenberg J, et al. Cost-effectiveness of social marketing of insecticide-treated nets for malaria control in the United Republic of Tanzania. Bull World Health Organ 2003; 81(4):269-76.

Lengeler, C. (2004). Insecticide treated bednets and curtains for preventing malaria: A Cochrane review. Basel, Switzerland: Swiss Tropical Institute, Department of Public Health and Epidemiology.

Steketee, R.W., et al. (2001). The burden of malaria in pregnancy in malaria-endemic areas. American Journal of Tropical Medicine and Hygiene, 64 (Supplement 1-2), 28-35

Abyan, I.M. and Osman, A.A. (1993) Social and behavioral factors affecting malaria in Somaila. World Health Organization, Tropical Disease Research Social and Economic Research Project Report No. 11, 1993.

Adeniyi JD,; Falade Co; Oladepo O; Ajayi IO; Fawole OI; Akinboye Do; Bolaji MO; Asa S; Elemile ITA and Dare FO (2001). Incorporating socio-cultural and economic characteristics of mothers and caregivers in the home management of malaria in children. A WHO/TDR/UNDP sponsored project. Report submitted to WHO/TDR. Project ID No 980048.

Adeniyi, J.D. and Ramakrishna, J. (1985) Opinion, attitudes and beliefs about self-treatment practices in a Nigerian urban setting: Implications for health education. International Quarterly of Community Health Education 5(2): 115-127.

Adera TD (2003) Beliefs and traditional treatment of malaria in Kishe settlement area South West Ethiopia. Ethiop Med J 41(1):25-34.

Afenyadu, G.Y.; Gyapong, J.O. and Adejei, S. (1997) School treatment of malaria using primary school teachers as care providers – a trial in the Nzema East District of Ghana. Project Report, Ministry of Health, Ghana.

Agyepong (1992) Malaria: Ethnomedical perceptions in an Adangbe farming community and implication for control Social Science and Medicine 35:131-137.

Agyepong IA, Manderson L. (1994) The diagnosis and management of fever at household level in the greater Accra region, Ghana. Acta Tropica 58(3-4):317-30.

Ajaiyeoba EO, Falade CO, Fawole O, Akinboye Do, Gbotosho GO, Bolaji OM, Ashidi JS, Abiodun OO, Osowole OS, Itiola OA, Oladepo O, Sowunmi A, Oduola AM (2004) Efficacy of herbal remedies used by herbalist in Oyo State Nigeria for treatment of Plasmodium falciparum infections – a survey and an observation. Afr J Med Med Sci 33(2): 115-9

Ajayi IO, Falade CO, Adeniyi JO, Bolaji MO. (2002-2003) Role of patent medicine sellers in home management of malaria. International Quarterly of Community Health Education 21(3): 271-81

Ajayi, I.O (1994) Evaluation of nutritional status of 1st year primary school children in Ibadan, Oyo State. A dissertation submitted to the National Postgraduate Medical College of Nigeria.

Akazilli Uj (2002) Costs to households of seeking malaria care in the Kessema-Nankana district of Northern Ghana. In third MIM Pan-African Conference on Malaria, Arusha, Tanzania 17-22 Nov 2002. Bethseda MD. MIM abstract 473

Ahorlu CK, Dunyo SK, Afari EA, Koram KA, Nkrumah FK (1997) Malaria related beliefs and behavior in Southern Ghana: Implications for treatment, prevention and control. Trop Med & Intl Health 2(5): 488-99.

Altman DG (1995) Multiple regression. In practical Statistics for Medical Research. Published by Chapman and Hall, London, Uk. Chapter 12; pg 344-345

Attaran A, Barness KI, Curtis C, D' Alessandro U, Fanelllo CJ, Galinski MR, et al., (2004) WHO, the Global Fund, and medical malpractice in malaria treatment Lancet 363: 237-240

Baume C, Helitzer D, Kachur SP (2000) Patterns of care for childhood malaria in Zambia. Social Science and Medicine 51(10):1491-1503

Baume, C. And Kachur, S.P. (1999) Improving Community case management of childhood malaria; How behavioural research can help. A publication by The Academy for Educational Development USAID, Bureau for Africa, Office of Sustainable Development.

Bedu-Addo G and Bates I (2002). Causes of massive tropical splenomegaly in Ghana. Lancet 360(9331):449-54

Beier JC, Killeen GF, Githure JI (1999) Short report: Entomologic inoculation rates and plasmodium falciparum malaria prevalence in Africa. Am J Trop Med Hyg 61(1): 109-113

Binka FN, Mensah OA, Mills A, (1997) The cost effectiveness of permethrim impregnated bed nets in preventing child mortality in Kassena-Nankana distric of Northern Ghana. Health Policy 41(3):229-239

Binka Fn, Kubaye A, Adjuk M, Williams LA, Lengeler C, Mande GH, Armah GE, Kajihara B, Adiamah JH, Smith PG (1996) Impact of permethrin impregnated bed nets on child mortality in Kassena-Nankassa distric Ghana – a randomized controlled trial. Trop Med Int Health 1(2): 147-54

Blair S, Carmona J, Correa A (2002) Malaria in children: Links between nutrition and immunity Rev Panam Salud Publica 11(1): 5-14

Blenkinsopp A and Bradley C. (1996). Over the counter drug; patients, society and the in crease in self medication. BMJ 312: 629-32.

Bloland PB, Boriga DA, Ruebush TK, Mccormick Jb, Roberts Jm, Oloo Aj, Hawley W, Lal A, Nahlen B, Campbell CC (1999). Longitudinal cohort study of the epidemiology of malaria transmission II. Descriptive epidemiology of malaria infection and disease among children. Am J Trop Med Hyg 60(4):641-648

Bouton ME (2000) A learning theory perspective on lapse, relapse and the maintenance of behavior change. Health Psychol 19(Suppl): 57-63

Brabin BJ, Romagossa C, Abdelgalil S, Menendez C, Verhoeff TH et al., (2004) The sick placenta – the role of malaria. Placenta 25 (5):359-78

Brandley –Moore, AK, Greenwood B, Bradley DJ (1985) Malaria chemoprophy lazis with chloroquine in young Nigerian children. Annals of Tropical Medicine and Parasitology 79:563-73

Baume, C. And Kachur, S.P. (1999) Improving Community case management of childhood malaria; How behavioural research can help. A publication by The Academy for Educational Development USAID, Bureau for Africa, Office of Sustainable Development.

Bedu-Addo G and Bates I (2002). Causes of massive tropical splenomegaly in Ghana. Lancet 360(9331):449-54

Beier JC, Killeen GF, Githure JI (1999) Short report: Entomologic inoculation rates and plasmodium falciparum malaria prevalence in Africa. Am J Trop Med Hyg 61(1): 109-113

Binka FN, Mensah OA, Mills A, (1997) The cost effectiveness of permethrim impregnated bed nets in preventing child mortality in Kassena-Nankana distric of Northern Ghana. Health Policy 41(3):229-239

Binka Fn, Kubaye A, Adjuk M, Williams LA, Lengeler C, Mande GH, Armah GE, Kajihara B, Adiamah JH, Smith PG (1996) Impact of permethrin impregnated bed nets on child mortality in Kassena-Nankassa distric Ghana – a randomized controlled trial. Trop Med Int Health 1(2): 147-54

Blair S, Carmona J, Correa A (2002) Malaria in children: Links between nutrition and immunity Rev Panam Salud Publica 11(1): 5-14

Blenkinsopp A and Bradley C. (1996). Over the counter drug; patients, society and the in crease in self medication. BMJ 312: 629-32.

Bloland PB, Boriga DA, Ruebush TK, Mccormick Jb, Roberts Jm, Oloo Aj, Hawley W, Lal A, Nahlen B, Campbell CC (1999). Longitudinal cohort study of the epidemiology of malaria transmission II. Descriptive epidemiology of malaria infection and disease among children. Am J Trop Med Hyg 60(4):641-648

Bouton ME (2000) A learning theory perspective on lapse, relapse and the maintenance of behavior change. Health Psychol 19(Suppl): 57-63

Brabin BJ, Romagossa C, Abdelgalil S, Menendez C, Verhoeff TH et al., (2004) The sick placenta – the role of malaria. Placenta 25 (5):359-78

Brandley –Moore, AK, Greenwood B, Bradley DJ (1985) Malaria chemoprophy lazis with chloroquine in young Nigerian children. Annals of Tropical Medicine and Parasitology 79:563-73

Brieger WR, Akpovi SU (1982-83) A health education approach to training village health workers. Internation quarterly of Community Health Education: 3:145-152.

Brieger W.R.; Ramakrishna J.; Adeniyi J.D. (1986) Self treatment in rural Nigeria: a community health education diagnosis. Hygie(Int. J. Hlth. Ed.) 5:41-6.

Brieger WR, Onyido AE, Sexton JD, Ezike VI, Breman JG, Ekanem OJ (1996) Monitoring community response to malaria control using insecticide – impregnated bed nets, curtains and residual spray at Nsukka, Nigeria. Health Education Research Theory & Practice 11(2):133-145.

Brieger WR, Nwankwo E, Ezike et al., (1996-1997) Social and behavioural baseline for implementing the strategy of insecticide impregnated bednets and curtains for malaria control at Nsukka, Nigeria. Internation Quarterly of Community Health Education 16:47-46

Brieger WR, Osamor PE, Salami KK, Oladepo O, Otusanya SA (2004) Interaction between patent medicine vendors and customers in urban and rural Nigeria. Health Policy and Planning. 19(3):177-182

Brinkman U. and Brinkman A (1991). Malaria and health in Africa. The present situation and epidemiological trends. Tropical Medicine and Parasitology 42(3):204-13.

Brown GV. (1999). Progress in the development of malaria vaccines: Context and context and constraints. Parasitologia 41(1-3): 429-432

Bull PC, Lowe BS, Kortok M, Molyneux CS, Newbold CI, Marsh K (1998). Parasite antigens on the infected red cell surface are targets for naturally acquired immunity to malaria. Nature Med. 4:358-368

Bundy DAP, Lwin S, Osika JS, Mclaughlin J, Pannenberg CO (2000). What should schools do about malaria? Parasitology Today 16: 181-182.

Carrasquilla G (2001). An ecosystem approach to malaria control in an urban setting. Cad Saude Publica 17 suppl: 171-9

Carter R, Mendis KN, Roberts D (2001). Spatial target of interventions against malaria. Bull World Health Organ. 179(4):375-6

Cockburn IA, Mackinnon MJ, O'Donnell A, Allens J, Moulds JM, Baisor M, Bockarie M, Reeder JC, Rowe JA. (2004) A human complement receptor 1 polymorphism that reduces Plasmodium falciparum resetting confers protection against severe malaria. Proc Natl Acad Sci 101(1):271-7

Connor SJ, Thomson MC, Molyneux DH (1999) Forecasting and prevention of epidemic malaria: new perspectives on an old problem. Parasitologia 41:439-448

Cooper KA, Adelekan DA, Esimai AO, Northro-Clewes CA, Thurnham DI. (2002) Lack of influence of red palm oil on severity of malaria infection in preschool Nigerian children. Transaction of the Royal Socity of Tropical Medicine and Hygiene 96(2):216-23

Deen JL, Wellraven GE, Vonseidlein L. (2002) Chronically malnuourished children may be at higher risk for developing malaria episodes. J. Trop Pediatr 48(2): 78-83

Delacollette C.; Van der Stuyft P. and Molima K. (1996) Using community health workers for malaria control experience in Zaire. Bulletin of the WHO 74(4): 423-430.

Deming M; Gayibor A.; Murphy K; Jones T.S. and Karsa T. (1989). The home treatment offebrile children with antimalaria drugs in Togo. Bulletin of the WHO 67:695-700.

Demissie P (1985). The role of community participation in the control of malaria. Ph.D theseis, Department of Preventive and Community Medicine, College of Medicine, University of Ibadan, Nigeria.

Diallo AB; De serres G; Beavogui AH, Lapointec C; Viens P (2001). Home care of malaria – infected children of less than 5 years of age in a rural area of the Republic of Guinea Bulletin of the WHO 79(1): 28-31

Doak CC; Doak LG; Root JH (1985). Teaching patients with low literacy skill. Philadephia: Jb Lippincott

Dobson MJ (1999). The malariology Centenary. Parasitologia 4:21-32

Dunyo SK, Afari EA, Koran KA, Ahorlu CK, Abubakar F, Nkurumah FK (2000) Health centre versus home presumptive diagnosis of malaria in southern Ghana: Implications for home based care policy. Transactions of the Royal Society of Tropical Medicine and Hygiene 94:285-288.

Ejezie G.C.; Ezedinachi, E.N. U.; Usanga E.A.; Gemade, E.I.; Ipatt N.W. and alaribe A.A. (1990) Malaria and its treatment in rural villages of Aboh, Mbaise, Imo State, Nigeria. Acta Tropica 48(1): 17-24.

Ekanem O.J.; Weishfield J.S.; Salako S.A; Nahlen B.L.; Ezedinachi E.W.; Walker O.; Breman J.E.; Laoye O.J. and Hedkeg K. (1990) In vitro sensitivity of plasmodium falciparum to chloroquine and sulfadoxine pyrimethamine in Nigerian children. Bulletin of the WHO 68(1): 45-51.

Ekanem OJ, Ezedinachi EN, Molta NB, Watila IM, Chukwuani CM, Meremikwu MM, Akpede G, Ojar EA. (2000) Treatment of malaria in North-eastern and South-eastern Nigeria: a population study of mefloquine, sulphadoxine-pyrimethamine combination(MSP) versus chloroquine (CQ). West afr J Med 19(4):293-7.

Espino E (1992). Socio behavioural research of endemic malaria in the Phillipines. Implications for control. WHO/TDR/SER Progress Report, 520/181/85.

Evans C and Lambert H (1997) Health – seeking strategies and sexual health among femal sex workers in Urban India: Implications for research and service provision. Social Science and Medicine 44(12): 1791-1803

Falade CO; Salako LA; Sowunmi A; Oduola AmJ and Larcier P (1997). Comparative efficacy of halofantrine, chloroquine and sulfadoxine pyrimethamine in treatment of acute uncomplicated falciparum malaria in Nigerian children. Transactions of the Royal Society of tropical Medicine and Hygiene 91:46-52

Fawole O and Onadeko MO (2001). Knowledge and home management of malaria fever by mothers and caregivers for under-five children. West Afr J Med 20(2):152-7

Fawole O. (1995). Knowledge and management of malaria fever in the under fives by carers and health workers in Ibadan South-east Local Government Area. A dissertation submitted to the National Postgraduate Medical College of Nigeria.

Feyisetan BJ, Asa S, Ebigbola O (1997) Mothers management of childhood diseases in Yoruba land. The influence of cultural beliefs. Health Transit Rev. 7(2):221-34

Filteau SM and Tomkins AM (1994) Micronutrients and tropical infections. Transactions of the

Malaria and its treatment in rural villages of Aboh, Mbaise, Imo State, Nigeria. Acta Tropica 48(1): 17-24.

Ekanem O.J.; Weishfield J.S.; Salako S.A; Nahlen B.L.; Ezedinachi E.W.; Walker O.; Breman J.E.; Laoye O.J. and Hedkeg K. (1990) In vitro sensitivity of plasmodium falciparum to chloroquine and sulfadoxine pyrimethamine in Nigerian children. Bulletin of the WHO 68(1): 45-51.

Ekanem OJ, Ezedinachi EN, Molta NB, Watila IM, Chukwuani CM, Meremikwu MM, Akpede G, Ojar EA. (2000) Treatment of malaria in North-eastern and South-eastern Nigeria: a population study of mefloquine, sulphadoxine-pyrimethamine combination(MSP) versus chloroquine (CQ). West afr J Med 19(4):293-7.

Espino E (1992). Socio behavioural research of endemic malaria in the Phillipines. Implications for control. WHO/TDR/SER Progress Report, 520/181/85.

Evans C and Lambert H (1997) Health – seeking strategies and sexual health among femal sex workers in Urban India: Implications for research and service provision. Social Science and Medicine 44(12): 1791-1803

Falade CO; Salako LA; Sowunmi A; Oduola AmJ and Larcier P (1997). Comparative efficacy of halofantrine, chloroquine and sulfadoxine pyrimethamine in treatment of acute uncomplicated falciparum malaria in Nigerian children. Transactions of the Royal Society of tropical Medicine and Hygiene 91:46-52

Fawole O and Onadeko MO (2001). Knowledge and home management of malaria fever by mothers and caregivers for under-five children. West Afr J Med 20(2):152-7

Fawole O. (1995). Knowledge and management of malaria fever in the under fives by carers and health workers in Ibadan South-east Local Government Area. A dissertation submitted to the National Postgraduate Medical College of Nigeria.

Feyisetan BJ, Asa S, Ebigbola O (1997) Mothers management of childhood diseases in Yoruba land. The influence of cultural beliefs. Health Transit Rev. 7(2):221-34

Filteau SM and Tomkins AM (1994) Micronutrients and tropical infections. Transactions of the Royal Society of Tropical Medicine and Hygiene 88:1-3

FMOH (1989). Federal Ministry of Health. National Malaria Therapy Surveillance Network. Executive Summary, July 1987-December 1989.

FMOH (1991) Focus on Malaria – New guidelines (Editorial). Nig Bull Epid 1(3):1

FMOH (1997) National Malaria Control Policy for Nigeria. National Malaria and Vector Control Division, Federal Ministry of Health, Yaba, Lagos.

FMOH (Dec, 2000) Federal Ministry of Health Strategic plan for rolling back malaria in Nigeria 2001-2010. Federal Ministry of Health, Abuja Nigeria.

FMOH (April, 2000). Malaria control in Africa in the new millennium. Working document prepared for the African Summit on Roll back Malaria Initiative. African Summit Abuja, Nigeria 25 April 2000.

FMOH (2001a). Strategic plan for Rolling Back Malaria in Nigeria 2001-2005. Federal Ministry of Health, Abuja, Nigeria April 2001.

FMOH (2004). Federal Ministry of Health. Malaria Control Policy. Document by Malaria Control Programme, Federal Ministry of Health, Abuja.

Fonn S. and Xaba M. (1995). Health workers for change. WHO/TDR Geneva.

Foster S. (1991). The distribution and use of antimalarial drugs – not a pretty picture. In malaria: waiting for the vaccine. Ed. G.A.T. Targett, Chichester. John Wiley and Sons. Pp 123 – 140.

Foster S. (1998) Economics and its contribution to the fight against malaria. Annals of Tropical Medicine and Parasitology 92(4):391-398

Gbadegesin, R.A.; Sodeinde, O.; Adeyemo, O.O.; Ademowo, O.G. (1997) Body temperature is a poor predictor of malaria parasitaemia in children with acute diarrhea. Ann Trop Paediatr; 17;89-94.

Ghebreyesus TA, Alemayehu T, Bosman A, Witten KH, Teklehaimamot A (1996) Community participation in malaria control in Tigray region in Ethiopia. Acta Tropical 61:145-156.

Ghosh SK, Yadav RS, Das BS, Sharma VP (1995) Influence of nutritional and haemoglobin status on malaria infection in children. Indian J Pediatr 62(3): 321-6

Gilk, D.C.; Ward, W.B.; Gordon; A. and Haba, E. (1989) Malaria treatment Practices among mothers in Guinea. Journal of Health and Social Behaviour 30:421-435.

Glanz K, Lewis FM, Rimer BK (2002) Health behavior and health education: Theory; Research and Practice, 3rd edition, jossy-Bass, San Francisco, California

Green, LW. And Kreuter, MW. (1999) Health promotion planning: An educational and environmental approach, Mountain View, CA: Mayfield.

Greenwood BM (1989) Impact of culture and environmental changes on epidemiology and control of malaria and babesiosis. Transactions of the Royal Society of Tropical Medicine and Hygiene 83(Suppl):25-29

Greenwood BM, David PH, Otooforbes LN et al. (1995) Mortality and morbidity from malaria after stopping malaria chemoprophylaxis. Transactions of the Royal Society of Tropical Medicine and Hygiene 89:629-33.

Greenwood BM (1997). The epidemiology of malaria. Annals Tropical Medicine and Parasitology 91;763-769

Greenwood BM. (1999) what can the residents of malaria endemic countries do to protect themselves against malaria? Parassitologia 41(1-3):295-9

Gruber J, Caffrey M (2005) HIV/AIDs and community conflict in Nigeria: implications and challenges. Social Science and Medicine 60(6): 1209-18

Guyatt HC, Snow RW, Evans DB (1999) Malaria epidemiology and economics: effect of delayed immune acquisition on the cost effectiveness of insecticide treated bed nets. Philos Trans R Soc London B Biol Sci 29(1384): 827-35

Gyapong, J.O. (1999) Improving malaria control to save the African child. Health in the Commonwealth, sharing solutions 1999/2000. Eds. Bell, K.; Gale, J.; Draper, S. Kensington Publications Limited for the Commonwealth Secretariat. Publisher Ivan Couchman pp. 152-154.

Hamel MJ, Odhacha A, Roberts JM, Deming MS (2001) Malaria control in Bungoma District, Kenya: A survey of home treatment of children with fever, bednet use and attendance at antenatal clinics. Bulletin of the WHO 79(1):1014-1023.

Happi CT, Thomas S, Gbotosho GO, Falade CO, Akinboye DO, Gerena L, Hudson T, Sowunmi A, Kyle DE, Milhous W, Dyann FW, \Oduola AMJ (2003). Point mutations in the PFcrt and pfmdr 1

genes of P. falciparum and clinical response to chloroquine among malaria patients from Nigeria. Annals of Tropical Medicine and Parasitology 97(5): 439-451

Harrison NE, Odunukwe NN, Ijoma CK, Mafe AG (2004) Current clinical presentation of malaria in Enugu, Nigeria. Niger postgrad Med J 11(4):240-5

Haynes RB; Wang E; Da Morta Gomes M (1987). Critical review of interventions to improve compliance with prescribed medications. Patient Educ Couns 10:155-166

Hellgren V.; Erickson O.; Kihanz C.M. and Rambo L. (1994) Malaria parasites and chloroquine concentration in Tanzanian School Children. Tropical Medicine and Parasitology 45:293-297.

Hess FI, Nukuro E, Judson L, Rodgers J, Nothdurft HD and Rieckmann KH (1997). Antimalarial drug resistance, malnutrition and socio-economic status. Tropical Medicine and International Health 2(8): 721-728

Hoff W (1970). The importance of training for effective performance. Public Health Reports 85(9):760-765

Holt TH (2001) Health care seeking behavior and home treatment of febrile illness in Biantyre District, Malawi, 2000. American Society of Tropical Medicine and Hygiene, 50th Annual Meeting November 11-15, 2001, Atlanta, GA: abstract 536

Hoofman S, Edeiman R, Bryan JP, Schnelder I, Davis J, Sedegan M, Gordon D, Church P, Gross M, Silverman C et al. (1994). Safety immunogenicity and efficacy of a malaria sporozoite vaccine administered with monophosphoryl lipit A, cell wall skeleton of mycobacteria and squalene as adjuvant. Am J Trop Hyg 51:603-612

Horder J (1983) Alma Ata Declaration. BMJ (United States) 286 (6360): 191-194

Horowitz CR, Avniella A, Jame S, Bickel NA (2004). Using community based participatory research to reduce health disparities in East and Central Harlem. Mt Sinai J. Med 71(6): 368-74

Howart P, Jones S, Hall Mall, Cross D, Stevenson M (1997) The PRECEDe-PROCEED model: application to planning a child pedestrian injury prevention programme Inj Prev 3(4): 282-7

Human Development Report (HDR) (2001). Human Development Indicator 2003. UNDP Website www.undp.org/hdr2003/indicators/indc_2_1_1.html

Hussey CL and Gilliland K (1989). Compliance, low literacy and locus of control. Nurs Clin North Am 24:605-611

Ijiyera A, Adeniyi JD and Osiname FO (1993). As cited in Malaria control in Africa in the new millennium. African Summit, Abuja. April 2000. Working document prepared by the African Summit on Roll Back Malaria Initiative.

Jackson, L.C. (1985) Malaria in Liberian children and mothers biocultural perspective of illness vs clinical evidence of disease. Social Science and Medicine. 20(12): 1281-1287.

Jimmy EO, Achelonu E, Orji S (2000) Antimalarials dispensing pattern by patent medicine dealers in rural settlements in Nigeria. Public Health 114(4):282-5

Johnson AH, Leke RG, Mendell NR, Shon D, Suh YJ, Bomba-Nkolo D, Tchinda V, Kounontchou S, Thuita LW, Vander Wel AM, Thomas A, et al., (2004) Human leukocyte antigen class II alleles influence levels of antibodies to plasmodium falciparum asexual stage apical membrane antigen I but not to merozoite surface antigen 2 and merozoites surface protein. J Infect Immum 72(5):2762-71

Kassankogno Y (2000). WHO declares total war on Malaria? African Health Monitor, A magazine of the WHO Regional Office for Africa. Vol1 (1):7

Kengeya-Keyondo J. (1993) Rural women's recognition of malaria their treatment seeking behavior and how the latter is influenced by perception of cause. WHO/TDR/SER Final report, S20/181/SER/73.

Khattab, H. (1993) The silent endurance: Social conditions of women's reproductive health in rural Egypt. UNICEF, Amman.

Kidane G. and Morrow R.H. (2000) Teaching mothers to provide home treatment of malaria in Tigray, Ethiopia: a randomized trial. Lancet 356:550-55.

Klein RE, Weller SC, Zeissing R, Richards FO, Ruebush TK (1995) knowledge, beliefs and practices in relation to malaria transmission and vector control in Guatemala. Am J of Trop Med Hyg 52:383-388.

Kondrasen F, Vanderhoek W, Amerasingbe PH, Amerasingbe FP, Fonseka KT (1997) Household responses to malaria and their costs: A study from rural Sri Lanka. Transactions of the Royal Society

Hussey CL and Gilliland K (1989). Compliance, low literacy and locus of control. Nurs Clin North Am 24:605-611

Ijiyera A, Adeniyi JD and Osiname FO (1993). As cited in Malaria control in Africa in the new millennium. African Summit, Abuja. April 2000. Working document prepared by the African Summit on Roll Back Malaria Initiative.

Jackson, L.C. (1985) Malaria in Liberian children and mothers biocultural perspective of illness vs clinical evidence of disease. Social Science and Medicine. 20(12): 1281-1287.

Jimmy EO, Achelonu E, Orji S (2000) Antimalarials dispensing pattern by patent medicine dealers in rural settlements in Nigeria. Public Health 114(4):282-5

Johnson AH, Leke RG, Mendell NR, Shon D, Suh YJ, Bomba-Nkolo D, Tchinda V, Kounontchou S, Thuita LW, Vander Wel AM, Thomas A, et al., (2004) Human leukocyte antigen class II alleles influence levels of antibodies to plasmodium falciparum asexual stage apical membrane antigen I but not to merozoite surface antigen 2 and merozoites surface protein. J Infect Immum 72(5):2762-71

Kassankogno Y (2000). WHO declares total war on Malaria? African Health Monitor, A magazine of the WHO Regional Office for Africa. Vol I (1):7

Kengeya-Keyondo J. (1993) Rural women's recognition of malaria their treatment seeking behavior and how the latter is influenced by perception of cause. WHO/TDR/SER Final report, S20/181/SER/73.

Khattab, H. (1993) The silent endurance: Social conditions of women's reproductive health in rural Egypt. UNICEF, Amman.

Kidane G. and Morrow R.H. (2000) Teaching mothers to provide home treatment of malaria in Tigray, Ethiopia: a randomized trial. Lancet 356:550-55.

Klein RE, Weller SC, Zeissing R, Richards FO, Ruebush TK (1995) knowledge, beliefs and practices in relation to malaria transmission and vector control in Guatemala. Am J of Trop Med Hyg 52:383-388.

Kondrasen F, Vanderhoek W, Amerasingbe PH, Amerasingbe FP, Fonseka KT (1997) Household responses to malaria and their costs: A study from rural Sri Lanka. Transactions of the Royal Society

Am 24:605-611

Ijiyera A, Adeniyi JD and Osiname FO (1993). As cited in Malaria control in Africa in the new millennium. African Summit, Abuja. April 2000. Working document prepared by the African Summit on Roll Back Malaria Initiative.

Jackson, L.C. (1985) Malaria in Liberian children and mothers biocultural perspective of illness vs clinical evidence of disease. Social Science and Medicine. 20(12): 1281-1287.

Jimmy EO, Achelonu E, Orji S (2000) Antimalarials dispensing pattern by patent medicine dealers in rural settlements in Nigeria. Public Health 114(4):282-5

Johnson AH, Leke RG, Mendell NR, Shon D, Suh YJ, Bomba-Nkolo D, Tchinda V, Kounontchou S, Thuita LW, Vander Wel AM, Thomas A, et al., (2004) Human leukocyte antigen class II alleles influence levels of antibodies to plasmodium falciparum asexual stage apical membrane antigen I but not to merozoite surface antigen 2 and merozoites surface protein. J Infect Immum 72(5):2762-71

Kassankogno Y (2000). WHO declares total war on Malaria? African Health Monitor, A magazine of the WHO Regional Office for Africa. Vol1 (1):7

Kengeya-Keyondo J. (1993) Rural women's recognition of malaria their treatment seeking behavior and how the latter is influenced by perception of cause. WHO/TDR/SER Final report, S20/181/SER/73.

Khattab, H. (1993) The silent endurance: Social conditions of women's reproductive health in rural Egypt. UNICEF, Amman.

Kidane G. and Morrow R.H. (2000) Teaching mothers to provide home treatment of malaria in Tigray, Ethiopia: a randomized trial. Lancet 356:550-55.

Klein RE, Weller SC, Zeissing R, Richards FO, Ruebush TK (1995) knowledge, beliefs and practices in relation to malaria transmission and vector control in Guatemala. Am J of Trop Med Hyg 52:383-388.

Kondrasen F, Vanderhoek W, Amerasingbe PH, Amerasingbe FP, Fonseka KT (1997) Household responses to malaria and their costs: A study from rural Sri Lanka. Transactions of the Royal Society of Tropical Medicine and Hygiene 91(2):127-30

Kondrasen F, Vanderhoek W, Amerasingbe PH, Amerasingbe FP (1997) Measuring the economic cost of malaria to household in Sri Lanka. Am J. Trop Med Hyg 56(6): 656-60.

Konradsen F, Amerasinghe P, Vander Hock N, Amerasinghe F, Perara D, Piyaratne M (2003) Strong association between House characteristics and malaria vector in Sri Lanka. Am J Trop Med Hyg 68(2): 177-81

Koo MM, Krass I, Aslani P (2003) Factors influencing consumer use of written drug information. Ann Pharmacother 37(2): 259-67

Kroeger A, Meyer R, Mancheno M, Gonzalez Martha (1996) Health education for community-baed malaria control: and intervention study in Ecuador, Colombia and Nicaragua. Trop Med & Int Health 1(6):836-846.

Kwawu J. (1994) Gender and household health seeking behaviours, in gender, health and sustainable development, proceedings of workshop in Nairobi 5-8 October 1993 eds. P. Wijeyaratne, L.J. Arsenault, J. Hatcher-Roberts and J. Kilts pp. 225-229. International Development Research Centre, Ottawa.

Laing AB (1984) The impact of malaria chemoprophylazis in Africa with special reference to Madagscar, Cameroon and Senegal. Bulletin of the WHO 62 (suppl):41-48

Le-Brass J and Aurand R. (2003) The mechanisms of resistance to antimalarial drugs in Plasmodium falciparum. Fundam Clin Pharmacol 17(2): 147-53

Leighton C. (1993). Economic impact of malaria in Kenya and Nigeria, Major Applied Research Paper, No 6, Health Financing and Sustainability (HFS) Project, Abt Associates Inc.

Lubanga RG, Norman S, Ewbink D, Karamagi C (1997) Maternal diagnosis and treatment of children's fever in an endemic malaria zone of Uganda: Implications for the malaria control programme. Acta Tropica 68(1): 53-64

Luxemburger C; Nosten F; Kyle DE; Kiricharoen L; Chongsuphajaisiddhi T; White NJ (1998). Clinical features cannot predict a diagnosis of malaria or differentiate the infecting species in children living in an area of low transmission. Transactions of the Royal Society of Tropical Medicine and Hygiene 92(1):45-49

cost of malaria to household in Sri Lanka. Am J. Trop Med Hyg 56(6): 656-60.

Konradsen F, Amerasinghe P, Vander Hock N, Amerasinghe F, Perara D, Piyaratne M (2003) Strong association between House characteristics and malaria vector in Sri Lanka. Am J Trop Med Hyg 68(2): 177-81

Koo MM, Krass I, Aslani P (2003) Factors influencing consumer use of written drug information. Ann Pharmacother 37(2): 259-67

Kroeger A, Meyer R, Mancheno M, Gonzalez Martha (1996) Health education for community-baed malaria control: and intervention study in Ecuador, Colombia and Nicaragua. Trop Med & Int Health 1(6):836-846.

Kwawu J. (1994) Gender and household health seeking behaviours, in gender, health and sustainable development, proceedings of workshop in Nairobi 5-8 October 1993 eds. P. Wijeyaratne, L.J. Arsenault, J. Hatcher-Roberts and J. Kilts pp. 225-229. International Development Research Centre, Ottawa.

Laing AB (1984) The impact of malaria chemoprophylazis in Africa with special reference to Madagscar, Cameroon and Senegal. Bulletin of the WHO 62 (suppl):41-48

Le-Brass J and Aurand R. (2003) The mechanisms of resistance to antimalarial drugs in Plasmodium falciparum. Fundam Clin Pharmacol 17(2): 147-53

Leighton C. (1993). Economic impact of malaria in Kenya and Nigeria, Major Applied Research Paper, No 6, Health Financing and Sustainability (HFS) Project, Abt Associates Inc.

Lubanga RG, Norman S, Ewbink D, Karamagi C (1997) Maternal diagnosis and treatment of children's fever in an endemic malaria zone of Uganda: Implications for the malaria control programme. Acta Tropica 68(1): 53-64

Luxemburger C; Nosten F; Kyle DE; Kircharoen L; Chongsuphajaisiddhi T; White NJ (1998). Clinical features cannot predict a diagnosis of malaria or differentiate the infecting species in children living in an area of low transmission. Transactions of the Royal Society of Tropical Medicine and Hygiene 92(1):45-49

Lynton RP and Pareek A (1978). Training for development. Kumarian Press. Connecticut

MacDonald G (1952). The objectives of residual insecticides campaigns. Transactions of the Royal Society of tropical Medicine and Hygiene 45:227-235

Magnussen P, Ndawi B, Sheshe AK, Byskov J, Mbwana K (2001) Malaria diagnosis and treatment administered by teachers in primary schools in Tanzania. Tropical Medicine and Internaltional Health 6(4):273-79.

Mancheno M, Kroeger A, Ruinz W. (1994) Materiales de enzenanza de malaria. Pan American Health Organisation Serie PALTEX para Ejecutores de salud No 36. Washington.

Marsh K and Snow RW (1999) Malaria transmission and morbidity. Parassitologia 41(13):241-6

Marsh V. M.; Mutemi W.M.; Muturi J.; Haaland A.; Watkins W.M.; Otieno G. and May J, Mockenhaupt P, Ademowo OG, Falusi AG, Olumese PE, Bienzle U, Meyer CG. (1999) High rate of mixed and subpatent malarial infection in southwest Nigeria. Am J Trop Med Hyg (6192):339-343

McCombie S.C. (1996). Treatment seeking for malaria: A review of recent research. Social Science and. Medicine 41(6): 933-945.

McCormack D (2003). An examination of the self-care concept uncovers a new direction for health care reform Can J Nurs Leadersh 16(4): 48-62

McIntyre, S. (1993) Gender differences in the perception of common cold symptoms. Social Science and Medicine 36:15.

Menendez C, Kahigwa E, Hirt R. et al. (1997) Randomized placebo controlled trial of iron supplementation and malaria chemoprophylaxis for prevention of severe anaemia and malaria in Tanzanian infants. Lancet 350: 844-49.

Menon A, Snow RW, Byass D. Greenwood BM (1994) Sustained protection against mortality and morbidity from malaria in ruaral Gambian children by chemoprophylaxis given by village health workers. Transactions of the Royal Society of Tropical Medicine and Hygiene 84:768-72

Metcalf C.A.; Bradshaw D.; Stindt W.W. (1990) Knowledge and beliefs about tuberculosis among non workers women in Ravensmead, Cape Town, South African Medical Jornal 77:408-411.

Miguel CA, Manderson L, Lansang MA (1998) Patterns of treatment for malaria in Tayabas, The Phillipines: Implications for control. Trop Med & Intl Health 3(5):413-21.

Miller LH (1999). Evolution of the human genome under selective pressure from malaria: applications for control. Parasitologia 41: 77-82

Miller LH, McAuliffe FM and Mason SJ (1977). Erythrocyte receptors for malaria merozoites. Am J Trop Med Hyg 26 Supplement: 204-208.

Molineaux I (1997) Malaria and mortality: some epidemiological considerations. Ann Trop Med Parasitol 91(7): 811-825

Molyneux CS, Mung' Ala-Odera V, Harpham T, Snow RW (1999) Maternal responses to childhood fevers: a comparison of rural and urban residents in costal Kenya. Trop Med Int Health 4(12): 836-45.

Montanari RM, Bangali AM, Talukder KR, Baqui A, Maheswany Np, Gosh A, Rahman M, Mahmood AH. (2001) Three case definitions of malaria and their effect on diagnosis, treatment and surveillance in COX'S Bazar district, Bangladesh, Buletin of the WHO 79: 648-656

Morrell RW, Park DC; Poon LW (1990). Effects of labeling techniques on memory and comprehension of prescription information in young and old adults. J Gerontol Psychol Sci Spec Issues 45:166-172

Munguti KJ (1998) Community perceptions and treatment seeking for malaria in Baringo district, Kenya. Social Science and Medicine 40: 1271-1277

Mwenesi H.; Harpham T. and Snow R.W. (1995). Child malaria treatment among mothers in Kenya Social Science and Medicine 40: 1271-1277.

Nacher M, Singhasivanon P, Treeprasertsuk S, Vannaphan S, Traore B, Looareesuwan S, Gay F. (2002) Intestinal helminthes and malnutrition are independently associated with protection from cerebral malaria in Thailand. Annals of Tropical Medicine and Parasitology 96(1): 5-13

Namusobya et al. (1998) Factors associated with high morbidity and mortality due to malaria in Iganga district – Uganda; Iganga District Medical Office – cited in scaling up home-base management of malaria: From research to implementation WHO 2004. RBM/UNICEF/UNDP/World Bank WHO Special programme for Research and Training in Tropical Diseases. Pg 82.

applications for control. Parasitologia 41: 77-82

Miller LH, McAuliffe FM and Mason SJ (1977). Erythrocyte receptors for malaria merozoites. Am J Trop Med Hyg 26 Supplement: 204-208.

Molineaux I (1997) Malaria and mortality: some epidemiological considerations. Ann Trop Med Parasitol 91(7): 811-825

Molyneux CS, Mung' Ala-Odera V, Harpham T, Snow RW (1999) Maternal responses to childhood fevers: a comparison of rural and urban residents in costal Kenya. Trop Med Int Health 4(12): 836-45.

Montanari RM, Bangali AM, Talukder KR, Baqui A, Maheswany Np, Gosh A, Rahman M, Mahmood AH. (2001) Three case definitions of malaria and their effect on diagnosis, treatment and surveillance in COX'S Bazar district, Bangladesh, Buletin of the WHO 79: 648-656

Morrell RW, Park DC; Poon LW (1990). Effects of labeling techniques on memory and comprehension of prescription information in young and old adults. J Gerontol Psychol Sci Spec Issues 45:166-172

Munguti KJ (1998) Community perceptions and treatment seeking for malaria in Baringo district, Kenya. Social Science and Medicine 40: 1271-1277

Mwenesi H.; Harpham T. and Snow R.W. (1995). Child malaria treatment among mothers in Kenya Social Science and Medicine 40: 1271-1277.

Nacher M, Singhasivanon P, Treeprasertsuk S, Vannaphan S, Traore B, Looareesuwan S, Gay F. (2002) Intestinal helminthes and malnutrition are independently associated with protection from cerebral malaria in Thailand. Annals of Tropical Medicine and Parasitology 96(1): 5-13

Namusobya et al. (1998) Factors associated with high morbidity and mortality due to malaria in Iganga district – Uganda; Iganga District Medical Office – cited in scaling up home-base management of malaria: From research to implementation WHO 2004. RBM/UNICEF/UNDP/World Bank WHO Special programme for Research and Training in Tropical Diseases. Pg 82.

National Population Commission (1991). Final result of 1991 population census of Nigeria.

Nicoll A (2000) Integrated management of childhood illness in resource-poor countries: an initiative from the World Health Organization. Transactions of the Royal Society of Tropical Medicine and Hygiene 94(1): 9-11

Nwanyanwu OC, Redd SC, Ziba C, Luby SP, Moint DL, Franco, C, Nyasutu Y, Chitsulo L (1996) Validity of mothers' history regarding antimalaria drug use in Malawian children under five years old. Transactions of the Royal Society of Tropical Medicine and Hygiene 90(1): 66-8

Nicoll A. (2000) Integrated management of childhood illness (IMCI) in resource-poor countries: an initiative of the World Health Organisation. Transactions of the Royal Society of tropical Medicine and Hygiene. 94(1):9-11

O' Dempsey, T.J.D.; McArdle, T.F.; Lawrence, B.E. et al (1993) Overlap in the clinical features of pneumonia and malaria in African children. Transactions Royal Society of Tropical Medicine and Hygiene. 87:662-665

Oaks S.C.; Mitchell V.S; Person G.W and Carpenter C.C (1991) Malaria: obstacles and opportunities. National Academy Press, Washington C.C 1991

Odebiyi A.A. (1992) Perception/treatment/prevention of malaria among the Yoruba: a case of two selected villages in Oyo State, Nigeria. WHO/TDR/SER Report 520/181/63, 1992.

Oduola, A.MJ.; Sowunmi, A.; Muhows, W.K.; Kyle, D.E.; Martin, R.K.; Walker, O. and Salako, L.A. (1992) Inmate resistance to new antimalarial drug in plasmodium falciparum from Nigeria. Transactions Royal Society of Tropical Medicine and Hygiene 86:123-126.

Ofori-Adejei D. and Arhinful D.K. (1996) Effect of training on the clinical management of malaria by medical assistants in Ghana. Social Science and Medicine 42:1169-1176.

Ogbudimkpa et. Al. (1988 -89). As cited in Malaria control in Africa in the new millennium. African Summit, Abuja. April 2000. Working document prepared by The African Summit on Roll Back Malaria Initiative

Okanurak K. and Sommani S. (1993) Utilization pattern of antimalaria drugs in rural areas of Thailand. WHO/TDR/SER Report, S20/181/25.

Okonkwo, P.O; Akpala, C.O.; Okafor H.U.; Mbah A.U. and Nwaiwu O. (2001) Compliance to [illegible] correlates with improvement in the condition

from the World Health Organization. Transactions of the Royal Society of Tropical Medicine and Hygiene 94(1): 9-11

Nwanyanwu OC, Redd SC, Ziba C, Luby SP, Moint DL, Franco, C, Nyasutu Y, Chitsulo L (1996) Validity of mothers' history regarding antimalaria drug use in Malawian children under five years old. Transactions of the Royal Society of Tropical Medicine and Hygiene 90(1): 66-8

Nicoll A. (2000) Integrated management of childhood illness (IMCI) in resource-poor countries: an initiative of the World Health Organisation. Transactions of the Royal Society of tropical Medicine and Hygiene. 94(1):9-11

O' Dempsey, T.J.D.; McArdle, T.F.; Lawrence, B.E. et al (1993) Overlap in the clinical features of pneumonia and malaria in African children. Transactions Royal Society of Tropical Medicine and Hygiene. 87:662-665

Oaks S.C.; Mitchell V.S; Person G.W and Carpenter C.C (1991) Malaria: obstacles and opportunities. National Academy Press, Washington C.C 1991

Odebiyi A.A. (1992) Perception/treatment/prevention of malaria among the Yoruba: a case of two selected villages in Oyo State, Nigeria. WHO/TDR/SER Report 520/181/63, 1992.

Oduola, A.MJ.; Sowunmi, A.; Muhows, W.K.; Kyle, D.E.; Martin, R.K.; Walker, O. and Salako, L.A. (1992) Inmate resistance to new antimalarial drug in plasmodium falciparum from Nigeria. Transactions Royal Society of Tropical Medicine and Hygiene 86:123-126.

Ofori-Adejei D. and Arhinful D.K. (1996) Effect of training on the clinical management of malaria by medical assistants in Ghana. Social Science and Medicine 42:1169-1176.

Ogbudimkpa et. Al. (1988 -89). As cited in Malaria control in Africa in the new millennium. African Summit, Abuja. April 2000. Working document prepared by The African Summit on Roll Back Malaria Initiative

Okanurak K. and Sornmani S. (1993) Utilization pattern of antimalaria drugs in rural areas of Thailand. WHO/TDR/SER Report, S20/181/25.

Okonkwo, P.O; Akpala, C.O.; Okafor H.U.; Mbah A.U. and Nwaiwu O. (2001) Compliance to correct dose of chloroquine in uncomplicated malaria correlates with improvement in the condition

of rural Nigerian children. Transaction of the Royal Society of Tropical Medicine and Hygiene 95:320-324

Olaleye BO, Williams CA, D' Allensandro et al., (1998) Clinical predictors of malaria in Gambia children or a history of fever. Transactions of the Royal Society of Tropical Medicine and Hygiene 92:300-304.

Olanrewaju WI and Johnson AW (2001) Chloroquine-resistant Plasmodium Falciparum malaria in Ilorin, Nigeria: prevalence and rist factors for treatment failure. Afr J Med Sci 30(5): 165-9

Olliaw, P.L. and trigg PI (1995). Status of antimalarial drugs under development. Bulletin of the WHO 73(5):565-571

Olukoya CA and Ogedengbe O (1988) As cited by Osiname FO (1991). In: Developing Primary Care Training for Patent Medicine Vendors in Rural Nigeria. M.P.H thesis submitted to the Department of Preventive and Social Medicine, College of Medicine, University of Ibadan, Nigeria.

Olumese, P.E.; Sodeinde, O.; Gbadegesin, R.A. et al (1995) Respirtory distress adversely affects the outcome of childhood cerebral malaria. Transactions Royal Society of Tropical Medicine and Hygiene 89:634.

Olumide Ea, Brieger WR, Oyejide Co, Akinkugbe FM, Olayinka IA, Oladepo O, and Osinusi K (1986) Federal Ministry of Health, Primary Health Care Pilot Survey, Ibarapa Local Government Area Oyo State.

Onwujekwe O, Chima R, Okonkwo P (2000). Economic burden of malaria illness on households versus that of all other illness episodes: a study in five malaria holo-endemic Nigeria communities. Health Policy 54(2):143-59

Ongore D, Kamuni F, Knight R, minawa A. (1989) A study of knowledge, attitudes and practices (KAP) of a rural community on malaria and the mosquito vector. East African Med J. 66(2):79.

Orogade AA, Ogala WN and Aikhionbare HA (2002). Asymptomatice malaria parasitaemia – A suitable index for evaluation of malaria vector control measures. Nigerian Jornal of Paediatrics 29(2): 23-26.

of rural Nigerian children. Transaction of the Royal Society of Tropical Medicine and Hygiene 95:320-324

Olaleye BO, Williams CA, D' Allensandro et al., (1998) Clinical predictors of malaria in Gambia children or a history of fever. Transactions of the Royal Society of Tropical Medicine and Hygiene 92:300-304.

Olanrewaju WI and Johnson AW (2001) Chloroquine-resistant Plasmodium Falciparum malaria in Ilorin, Nigeria: prevalence and rist factors for treatment failure. Afr J Med Sci 30(5): 165-9

Olliaw, P.L. and trigg PI (1995). Status of antimalarial drugs under development. Bulletin of the WHO 73(5):565-571

Olukoya CA and Ogedengbe O (1988) As cited by Osiname FO (1991). In: Developing Primary Care Training for Patent Medicine Vendors in Rural Nigeria. M.P.H thesis submitted to the Department of Preventive and Social Medicine, College of Medicine, University of Ibadan, Nigeria.

Olumese, P.E.; Sodeinde, O.; Gbadegesin, R.A. et al (1995) Respirtory distress adversely affects the outcome of childhood cerebral malaria. Transactions Royal Society of Tropical Medicine and Hygiene 89:634.

Olumide Ea, Brieger WR, Oyejide Co, Akinkugbe FM, Olayinka IA, Oladepo O, and Osinusi K (1986) Federal Ministry of Health, Primary Health Care Pilot Survey, Ibarapa Local Government Area Oyo State.

Onwujekwe O, Chima R, Okonkwo P (2000). Economic burden of malaria illness on households versus that of all other illness episodes: a study in five malaria holo-endemic Nigeria communities. Health Policy 54(2):143-59

Ongore D, Kamuni F, Knight R, minawa A. (1989) A study of knowledge, attitudes and practices (KAP) of a rural community on malaria and the mosquito vector. East African Med J. 66(2):79.

Orogade AA, Ogala WN and Aikhionbare HA (2002). Asymptomatice malaria parasitaemia – A suitable index for evaluation of malaria vector control measures. Nigerian Jornal of Paediatrics 29(2): 23-26.

Pagnoni F.; Convelbo N.; Tiendrebeogo J.; Cousens S.; and Esposito Fulvio (1997) A community based programme to provide prompt and adequate treatment of presumptive malaria in children. Transaction of the Royal Socity of Tropical Medicine and Hygiene 91:512-517.

Patton MQ ed. (1997). Qualitative Evaluation and Research Methods. SAGE PUBLICATIONS.

Pesse K. & Castro C (eds) (1994) Para que no pique la turula: Control de la malaria. Communidad campesina San juan Bautista, Catacaos, Peru.

Phillips D.R. (1990) Health and health care in the third world. Longman Developmental studies and John Wiley and Sons, Hong Kong, New York.

Plimpton S, Root J (1994). Materials and strategies that work in low literacy health communication. Public Health Rep 109:86-92.

Pouniotis DS, Proudfoot O, Minigo G, Hanley JL, Plebanski M. (2004). Malaria parasite interacting with the human host. J. Postgrad Med. 50(1):30-4

Ramakrishna J.; Bieger W.R. and Adeniyi J.D. (1989). Treatment of malaria and febrile convulsions: and educational diagnosis of Yoruba beliefs. International Quarterly in Community Health Education 9:305-319.

RBM, Zambia (2001) Report on the Zambia Roll Back Malaria Baseline Study undertaken in 10 sentinel districts, July – August 2001, Zambia. RBM National Secretariat: As cited in World Health Organization / UNICEF (2003) Africa malaria report 2003. WHO doc WHO/CDS/MAL/2003. 1093, Geneva: WHO, 2003

Redd, S.C.; Kazembe, P.N.; Buby, S.P.; Nwanyanmu, O.; Hightower, A.W.; Ziba, C. et all (1996) Clinical algorithm for treatment of plasmodium falciparum lalaria in children. Lancet, 347:223-226.

Rihet P, Flori L, Tall F, Traore AS, Fumoux F. (2004) HB C is associated with reduce Plasmodium falciparum parasitaemia and low risk of mild malaria attack. Hum Mol Genet 13(1):1-6

Roberts DJ and Williams TN. (2003) Haemoglobinopathies and resistance of malaria. Redox Rep 8(5):304-10

Rogier C (2003). Childhood malaria in endemic areas: Epidemiology, acquired immunity and control strategies. Med Trop (Mars) 63(4-5): 449-464

Rubel A.J.; Garro L.C. (1992) Social and cultural factors in the successful control of T.B. Public Health Reports 107:626-636.

Rueben R (1993) Women and malaria – Special ristks and appropriate control strategy. Social Science and Medicine 37:473-480.

Ruwende C and Hill A. (1998). Glucose -6- phosphatase dehydrogenase deficiency and malaria. J.Mol Med 76(8):581-8

Salako LA; Ajayi FO; Sowunmi A and Walker O (1990). Malaria in Nigeria: A revisit. Annals of Tropical Medicine and Parasitology 84(5): 435-445

Salako L.A.; Brieger W.R.; Afolabi B.M.; Umeh, R.E.; Agomo P.U.; Asa S.; Adeneye A.K.; Nwankwo B.O. and Akinlade C.O. (2001). Tratment of childhood fevers and other illnesses in three rural Nigerian communities. Journal of Tropical Paediatrics 47:230-238

Salako LA, Afolabi BM, Agomo RE, Umeh RE, Brieger WR and Feyisatan B. (2001a) Early and appropriate treatment of childhood fevers in Nigeria. Report submitted to UNDP/World Bank/WHO ID No. 990656. September 2001.

Sauerborn, R.; Nougtara, A. and Diesfield, H.J. (1998). Low utilization of community health workers; Results from a household interview survey in Burkina Faso. Social Science and Medicine 29(10): 1163-1174.

Schapira A. (1994) A standard protocol for assessing the proportion of children presenting with febrile diseases who suffer from malarial disease. WHO/MAL 94, 1069 World Health Organization, Geneva.

Schellenberg D, Menendez C, Kahigwa E, Aponte J, Vidal J, Tanner M, Mshinda H, Pedro A. (2001) Intermittent treatment for malaria and anaemia control at time of routine vaccinations in Tanzania infants: a randomized, placebo controlled trial. Lancet 357:1471-77.

Shiff C, Checkley W, Winch P, Premji Z, Minias J, Lubega P (1996) Changes in weight gain and anaemia attributable to malaria in Tanzanian children living under holoendemic conditions. Transactions of the Royal Society of Tropical Medicine and Hygiene 90:262-65.

Schultz LJ; Ettling M; Chitsulo L; Steketee RW; Nyasulu Y; Macheso A; Nwanyanwu OC (1994). A nation-wide malaria knowledge, attitudes and practices survey in Malawi: objectives and methodology. Tropical Medicine and Parasitology. 45:54-56.

Sirima SB, Konate A, Tiono AB, Convelbo N, Cousens S, Pagnoni F (2003) Early Treatment of childhood fevers with pre-package antimalarial drugs in the home reduces severe malaria mordidity in Burkina Faso. Trop Med Int Health 8(2): 133-9

Smith JC, Haggerty J (2003) Literacy in primary care populations: is it a problem? Can J Public Health 94(6): 408-12.

Smith PG and Morrow RH eds (1991). Methods for field trials of interventions against tropical diseases. A Tool Box. Oxford University Press, Oxford. Pp. 1-9

Snow RW and Marsh K. (2002). The consequences of reducing transmission of plasmodium falciparum in Africa. Adv. Parasitol 52:235-64

Snow RW, Onunbo J, Lowe B, Molyneux CS, Obierojo JO, Palmer A, Weber MW, Pinder MI, Nahlen B, Obonyo C, Newbold C, Gupta S, Marsh K (1997) Relation between severe malaria morbidity in children and level of plasmodium falciparum transmission in Africa. Lancet 349 (9066): 1650-4

Sobel, D.S. (1995) Rethinking medicine: improving health outcomes with cost effective psychosocial interventions. Psychosomatic Medicine 57(3): 239-244.

Sowunmi, A. And Salako, L.A. (1992) Evaluation of the relative efficacy of various antimalarial drugs in Nigeria children under five years of age suffering from acute uncomplicated falciparum malaria. Annals of tropical Medicine and Parasitology 86:1-8.

Sowunmi A (2002) A randomized comparison of chloroquine, amodiaquine and their combination with pyrimethamine-sulfadoxine in the treatment of acute uncomplicated plasmodium falciparum malaria in children. Annals of Tropical Medicine and Parasitology 99(3); 227-238

Suh KN, Kain KC, Keyston JS (2004). Malaria CMAJ 170(11): 1693-1702 (doc: 1503/cmaj. 1030418).

Sutherst RW (2004) Global change and human vulnerability to vector-borne diseases. Clint

A nation-wide malaria knowledge, attitudes and practices survey in Malawi: objectives and methodology. Tropical Medicine and Parasitology. 45:54-56.

Sirima SB, Konate A, Tiono AB, Convelbo N, Cousens S, Pagnoni F (2003) Early Treatment of childhood fevers with pre-package antimalarial drugs in the home reduces severe malaria mordidity in Burkina Faso. Trop Med Int Health 8(2): 133-9

Smith JC, Haggerty J (2003) Literacy in primary care populations: is it a problem? Can J Public Health 94(6): 408-12.

Smith PG and Morrow RH eds (1991). Methods for field trials of interventions against tropical diseases. A Tool Box. Oxford University Press, Oxford. Pp. 1-9

Snow RW and Marsh K. (2002). The consequences of reducing transmission of plasmodium falciparum in Africa. Adv. Parasitol 52:235-64

Snow RW, Onunbo J, Lowe B, Molyneux CS, Obierojo JO, Palmer A, Weber MW, Pinder MI, Nahlen B, Obonyo C, Newbold C, Gupta S, Marsh K (1997) Relation between severe malaria morbidity in children and level of plasmodium falciparum transmission in Africa. Lancet 349 (9066): 1650-4

Sobel, D.S. (1995) Rethinking medicine: improving health outcomes with cost effective psychosocial interventions. Psychosomatic Medicine 57(3): 239-244.

Sowunmi, A. And Salako, L.A. (1992) Evaluation of the relative efficacy of various antimalarial drugs in Nigeria children under five years of age suffering from acute uncomplicated falciparum malaria. Annals of tropical Medicine and Parasitology 86:1-8.

Sowunmi A (2002) A randomized comparison of chloroquine, amodiaquine and their combination with pyrimethamine-sulfadoxine in the treatment of acute uncomplicated plasmodium falciparum malaria in children. Annals of Tropical Medicine and Parasitology 99(3); 227-238

Suh KN, Kain KC, Keyston JS (2004). Malaria CMAJ 170(11): 1693-1702 (doc: 1503/cmaj. 1030418).

Sutherst RW (2004) Global change and human vulnerability to vector-borne diseases. Clint Microbiol Rev 17(1): 136-73.

Tanner M. and Vlassoff C. (1998) Treatment seeking behavior for malaria: a typology based on endemicity and gender. Social Science and Medicine 46(4-5): 523-532.

Tavrow P, Shabahang J, Makama S (2003) Vendor to Vendor education to improve malaria treatment by private drug oulets in bangore districts, Kenya. Malaria Jornal 2:10 http://www/malariajornal.com/content/2/1/10

TDR (2000) Home management of malaria: linking with the formal health care system. TDR News 63: 11

Teklehaimanot A. and Bosman A. (1999). Opportunities, problems and perspective for malaria control in sub-Saharan Africa. Parasitologia 41:335-338.

Thomas CJ, Lindsay SW (2000) Local-scale variation in malaria infection amongst rural Gambian children estimated by satellite remote sensing. Transactions of the Royal Society of Tropical Medicine and Hygiene 94(2): 159-63

Thomson MC, D'Alessandro U, Bennett S, Connor SJ, Langerock P, Jawara M, Todd J, Greenwood BM (1994) Malaria prevalence is inversely related to vector density in The Gambia, West Africa. Transactions of the Royal Society of Tropical Medicine and Hygiene 88(6): 638-43

Traore, S.; Coulibaly, S. and Sidibe, M.C. (1993) Comportments et counts liei au paladisme cluz les femmes de campements de pecheurs dans la zone de selingue au mali: SER project reports No 12. World Health Organisation, Geneva

Trape JF, Rogiera C (1996) Combating malaria morbidity and mortality by reducing transmission. Parasitol Today 12: 236-240

Tursz, A. and Crost, M. (2000) An epidemiologic study of health care seeking behavior of children under 5 years of age by sex in developing countries. Revue d Epidemiologie et de Sante Publique 47 (suppl. 2; 25:133-56).

Vlassoff, C. and Bonilla, E. (1994) Gender differences in tropical diseases: what do we know? Journal of Biosocial Science 26:37.

Vlassoff, C.; Hardy, R. and Rathgeber, E. (1995) Towards the healthy women counseling guide. WHO/TDR, Geneva.

Vundule C, Mharakurwa S (1996) Knowledge, practices and perceptions about malaria in rural communities of Zimbabwe: relevance to malaria control. Bulletin of the WHO 74(1):55-60.

White MA, Verhoef MJ (2005) Toward a patient-centerd approach: Incorporating principles of participatory action research into clinical studies. Integr Cancer Ther 4(1):21-4

Wilbur H (1970). Importance of training for effective performance. Pub. Hlth Rep. 85 (9): 760-766

Wileman RE (1993). Visual communicating. Englewood Cliffs: New Jersey Educational Technology Inc.

Winch DY, Makemba AM, Kamazina SR, Lurie M, Lwihula GK, Premji Z. et al. (1996) Local terminology for febrile illness in Bagamoyo District, Tanzania and its impact on the design of a community based malaria control programme. Social Science and Medicine 42: 1057-1067.

World Health Organisation (1983) Health education in self-care, possibilities and limitations. Report of a scientific consultation. Geneva 21-25 November, 1983. H. ED/84 (English only)

World Health Organisation (1995). Vector control for malaria and other mosquito borne diseases. WHO Tech Rep Ser. 857:1-91

World Health Organisation (1998). The Global Malaria Control Strategy. The Malaria Network. Division of Control of Tropical Diseases (CTD) and the World Bank. 1998. www.malarianetwork.org.

World Health Organisation (2000) The African Summit on Roll Back Malaria, Abuja, Nigeria. 25 April 2000. Geneva. World Health Organisation 2000 (document WHO/CDS/RBM/2000.17)

World Health Organisation (2000a). Severe falciparum malaria. Transactions of the Royal Society of Tropical Medicine and Hygiene (94 suppl1): 1-90

World Health Organisation (WHO) Malaria Unit (1993a). Global malaria control. Bulletin of the WHO 71 (3/4): 281-284.

World Health Organisation / UNICEF (2003) Africa malaria report 2003. WHO doc WHO/CDS/MAL/2003. 1093, Geneva: WHO, 2003 http://mosquito.who.int/amd2003/amr2003/pdf/amr2003.pdf

World Health Organisation Report (2002) Reducing risk. Promoting healthy life. Geneva. World

communities of Zimbabwe: relevance to malaria control. Bulletin of the WHO 74(1):55-60.

White MA, Verhoef MJ (2005) Toward a patient-centerd approach: Incorporating principles of participatory action research into clinical studies. Integr Cancer Ther 4(1):21-4

Wilbur H (1970). Importance of training for effective performance. Pub. Hlth Rep. 85 (9): 760-766

Wileman RE (1993). Visual communicating. Englewood Cliffs: New Jersey Educational Technology Inc.

Winch DY, Makemba AM, Kamazina SR, Lurie M, Lwihula GK, Premji Z. et al. (1996) Local terminology for febrile illness in Bagamoyo District, Tanzania and its impact on the design of a community based malaria control programme. Social Science and Medicine 42: 1057-1067.

World Health Organisation (1983) Health education in self-care, possibilities and limitations. Report of a scientific consultation. Geneva 21-25 November, 1983. H. ED/84 (English only)

World Health Organisation (1995). Vector control for malaria and other mosquito borne diseases. WHO Tech Rep Ser. 857:1-91

World Health Organisation (1998). The Global Malaria Control Strategy. The Malaria Network. Division of Control of Tropical Diseases (CTD) and the World Bank, 1998. www.malarianetwork.org.

World Health Organisation (2000) The African Summit on Roll Back Malaria, Abuja, Nigeria. 25 April 2000. Geneva. World Health Organisation 2000 (document WHO/CDS/RBM/2000.17)

World Health Organisation (2000a). Severe falciparum malaria. Transactions of the Royal Society of Tropical Medicine and Hygiene (94 supp11): 1-90

World Health Organisation (WHO) Malaria Unit (1993a). Global malaria control. Bulletin of the WHO 71 (3/4): 281-284.

World Health Organisation / UNICEF (2003) Africa malaria report 2003. WHO doc WHO/CDS/MAL/2003. 1093, Geneva: WHO, 2003

http://mosquito.who.int/amd2003/amr2003/pdf/amr2003.pdf

World Health Organisation Report (2002) Reducing risk. Promoting healthy life. Geneva. World Health Organisation

Wyss, K. and Nandjinger, M. (1995) Problems of utilization of nutritional reliabilitation services by mothers of malnourished children in N'Djameta (Chad). In the female client and the health provider, eds J. Hatcher Roberts and C. Vlassoff, pp. 138-153. International Research Centre, Ottawa.

Yeboah-Antwi; Gyapong J.O.; Asare I.K.; Barnish G.; Evans D.B and Adjei S. (2001) Impact of prepackaging antimalarial drugs on cost to patients and compliance with treatment. Bulletin of the WHO 79:394-399.

Zibac, Slutsker L, Chitsulo L, Steketee RW (1994) Use of malaria prevention measures in Malawian households. Trop Med Parasitol 45:70-73

Wyss, K. and Nandjinger, M. (1995) Problems of utilization of nutritional reliabilitation services by mothers of malnourished children in N'Djameta (Chad). In the female client and the health provider, eds J. Hatcher Roberts and C. Vlassoff, pp. 138-153. International Research Centre, Ottawa.

Yeboah-Antwi; Gyapong J.O.; Asare I.K.; Barnish G.; Evans D.B and Adjei S. (2001) Impact of prepackaging antimalarial drugs on cost to patients and compliance with treatment. Bulletin of the WHO 79:394-399.

Zibac, Slutsker L, Chitsulo L, Steketee RW (1994) Use of malaria prevention measures in Malawian households. Trop Med Parasitol 45:70-73

Phylum: Protozoa Subphylum: Apicomplexa

Class: Sporozoa Subclass: Coccidia

Order: Coccidiida Suborder: Haemosporina

Family: Plasmodiidae

Genus: Plasmodia

Subgenera: Plasmodium, Laverania

Species: (affecting man)

Quartan group: P. (Plasmodium) malariae, P. (P.) brasilianum

Benign tertian group: P. (P.) vivax, P. (P.) cynomolgi, P. (P.) cynomolgi bastianellii

Malignant tertian group: P. (Laverania) falciparum

Ovale group: P. (P.) ovale, P. (P.) simium

Knowlesi group: P. (P.) knowlesi

- **Family Tree of Protozoa Phylum**

- **Global Distribution of P. Falciparum**

P. falciparum	
Global Distribution	80-90% of cases in Africa, 40-50% of cases in western pacific and SE Asia, 4-30% in S Asia, S America and rest of tropics
Tissue schizogony	5-6 days
Erythrocytic phase	48 hours
Red cells affected	All
Merozoites per tissue schizont	40000
Merozoites per red cell schizont	8 - 32
Relapse from persistent liver forms	No
Fever pattern	Tertian, sub tertian
Severe malaria	Up to 24%
Drug resistance	Yes

Loss from the economic growth penalty of malaria endemicity in 31 African countries, 1980-1995

Country	Aggregate loss (millions of PPP-adjusted 1987 $)	Per person loss (PPP-adjusted 1987 $)	As a fraction of actual 1995 income
Benin	1172	214	18%
Botswana	503	347	5%
Burkina Faso	1684	162	18%
Burundi	730	117	18%
Burundi	730	117	18%
Cameroon	4227	318	18%
Central African Republic	884	270	18%
Chad	995	154	17%
Congo	759	288	18%
Congo, Dem. Rep.	7125	162	18%
Cote d'Ivoire	4107	294	18%
Gabon	1389	1290	17%
Gambia	251	226	18%
Ghana	5355	314	18%
Guinea Bissau	152	142	14%
Kenya	5272	198	18%
Lesotho	0	0	0%
Lesotho	0	0	0%
Madagascar	2280	167	18%
Malawi	1072	110	18%
Mali	1222	125	17%
Mauritania	611	269	15%
Mauritius	0	0	0%
Namibia	832	539	10%
Niger	1457	161	17%
Nigeria	17315	156	18%
Rwanda	656	102	18%
Rwanda	656	102	18%
Senegal	2426	286	18%
Sierra Leone	366	87	17%
South Africa	4056	98	1%
Togo	1166	285	18%
Zambia	1359	151	18%
Zimbabwe	4214	383	18%
Total	***73 638***	***185***	***10%***

Based on results in John Luke Gallup and Jeffrey D. Sachs, "The Economic Burden of Malaria" in *Economics of Malaria* (forthcoming).

Please note that these figures are reported in purchasing power parity (PPP) adjusted dollars held constant at 1987 prices. This corrects for the effects of price inflation, as well as the fact that in Africa, non-traded goods and services (for example, health services or land) are cheaper relative to internationally traded goods than they are in the United States. In order to convert these units into current US dollar terms, it would be necessary to divide by a factor of about 3, then multiply by the rate of price inflation between 1987 and 1995.

Map of AMAC, showing pre-test district

ANNEX A

List of All PHC Facilities in AMAC by Geographical Locations* (As at Aug., 2006)

Geographical Ward	Name Of Health Facility	Total # of PHC Centres
Garki	Dutsen Garki PHC Post	3
	Kobi PHC Post	
	Garki Village PHC Post	
Gui	Gui PHC Post	3
	Iddo Pada PHC Health Post	
	Tungan Madaki PHC Post	
Gwagwa	Gwagwa PHC Health Post	2
	Kagini PHC Post	
Jiwa	Hulumi PHC Post	3
	Idu – Karmo PHC Health Post	
	Jiwa PHC Health Post	
Kabusa	Burum PHC Post	6
	Ketti PHC Health Post	
	Kabusa PHC Health Post	
	Lugbe PHC Post	
	Pyakasa PHC Health Post	
	Sherreti PHC Post	
Karshi	Karshi PHC Health Post	2
	Kuseki PHC Health Post	
Karu	Karu PHC Health Post	2
	Jikwoyi PHC Post	
Orozo	Gidan Mangoro PHC Post	4
	Gugugu PHC Post	
	Kurudu PHC Post	
	Orozo PHC Post	
Gwarinpa	Mabushi PHC Health Post	3
	Piwoyi PHC	
	Utako Health Post	
Total		**28**

List of All PHC Facilities in AMAC by Geographical Locations* (As at Aug., 2006)

Geographical Ward	Name Of Health Facility	Total # of PHC Centres
Garki	Dutsen Garki PHC Post	3
	Kobi PHC Post	
	Garki Village PHC Post	
Gui	Gui PHC Post	3
	Iddo Pada PHC Health Post	
	Tungan Madaki PHC Post	
Gwagwa	Gwagwa PHC Health Post	2
	Kagini PHC Post	
Jiwa	Hulumi PHC Post	3
	Idu – Karmo PHC Health Post	
	Jiwa PHC Health Post	
Kabusa	Burum PHC Post	6
	Ketti PHC Health Post	
	Kabusa PHC Health Post	
	Lugbe PHC Post	
	Pyakasa PHC Health Post	
	Sherreti PHC Post	
Karshi	Karshi PHC Health Post	2
	Kuseki PHC Health Post	
Karu	Karu PHC Health Post	2
	Jikwoyi PHC Post	
Orozo	Gidan Mangoro PHC Post	4
	Gugugu PHC Post	
	Kurudu PHC Post	
	Orozo PHC Post	
Gwarinpa	Mabushi PHC Health Post	3
	Piwoyi PHC	
	Utako Health Post	
Total		**28**

*Source: Health Department, AMAC, Abuja, 2006

List of Selected PHC Centres Used For Study and Geographical Locations

Serial # of PHC Centre	Serial # of Questionnaire	Geographical Ward	Name Of Health Facility	Total Quantity of Questionnaires
1.	001 – 035	Garki	Garki Village Primary Health Care (PHC) Health Post	35
2.	036 – 050	"	Kobi PHC Health Post	15
3.	051 – 102	Gui	Iddo Pada PHC Health Post	52
4.	103 – 156	Gwagwa	Gwagwa PHC Health Post	54
5.	157 – 186	Jiwa	Idu – Karmo PHC Health Post	30
6.	187 – 212	"	Jiwa PHC Health Post	26
7.	213 – 237	Kabusa	Kabusa PHCHealth Post	25
8.	238 – 252	"	Ketti PHC Health Post	15
9.	253 – 276	"	Pyakasa PHC Health Post	24
10.	277 - 301	Karshi	Karshi PHC Health Post	26
11	302 – 327	Orozo	Gidan Mangoro PHC Post	25
12.	328 – 382	Karu	Karu PHC Health Post	55
13	383 – 429	Gwarinpa	Utako Health Post	47
14.	430 – 500	"	Mabushi PHC Health Post	71
TOTAL				500

ANNEX C

QUESTIONNAIRE

Dear Respondent,

Introduction and consent: My name is .....I am part of a team of postgraduate students who are carrying out a survey on people's health with focus on malaria and Insecticide – treated nets in Abuja Municipal Area Council (AMAC) of the FCT. I would like to briefly ask you some questions. Your answers will remain confidential and we will not take down your name or address so that no one will know who gave us these answers. There are no correct answers; each of your answers will depend on your views and your situation.

Thank you in advance for sparing time to complete this questionnaire.

QUESTIONNAIRE NUMBER: (Use 3 Digits- e.g.: 004)

***WARD: (TICK)

GUI———	01	*JIWA*———	02	*GARKI*———————	03	*KABUSA*———————	04
GWAGWA——	05	*KARU*———	06	*GWARINPA*———	07	*KARSHI*———————	08

SECTION 1: GENERAL INFORMATION/BASIC DEMOGRAPHIC DATA OF RESPONDENTS

1. **Gender of Respondent**

Male	1
Female	2

2. **Respondent's age**

3. **What is your relationship to the head of your household?**

Self	1
Wife	2
Husband	3
Daughter	4
Son	5
Sister	6
Brother	7
Cousin	8
Other relative , specify_____	9

4. **What is your occupation (whatever you do to earn money)?**

Farmer	1
Trader	2
Artisan (Skilled craftsperson)- Please specify _____	3
Student	4
Civil Servant	5
Professional, in private sector (specify)_____	6
Professional in public sector (specify)_____	7
Others(Please specify)_____	8

5. **What is the highest standard of education you have attained?**

Primary education	1
Secondary	2
Post-secondary	3
Never attended school	5
Refused to disclose	6
Other (Specify)_____	7

SECTION 2: LIVING CONDITIONS

6. How many bedrooms do you have in your house (not including the toilet/ bathroom and kitchen)?

Interviewer, write with leading zeros

7. Do the doors and windows of your house have netting?

Yes	1
No	2

8. What source of lighting do you use in your house?

Electricity	1
Kerosene/Paraffin Lamp	2
Wax candle	3
Others,(specify)_____	4

9. Where do you obtain drinking water from?

In-house tap	1
Stand-pipe in street/local area	2
Bore-hole	3
Well	4
Other (please specify_____	5

10. What type of toilet facility does your household have?

Own flush toilet	1
Shared flush toilet	2
Own pit latrine	3
Shared pit latrine	4
No toilet	5
Others(specify)_____	6

11. **What is your source of health information? (Where do you see or hear malaria messages from?)**

Radio	1
TV	2
Newspaper/magazine	3
Posters/notices	4
Friends/Relative	5
Health workers/ Hospitals /Health Centres	7
Government officials	8
Church/Mosque	9

SECTION 3: MALARIA

12. **Have you ever heard of a disease called Malaria?**

Yes	1
No	2

►IF NO, GO TO SECTION 4

13. **Can you please tell me what the MAIN SYMPTOM or sign of this illness is?**

☼☼☼- MAIN SYMPTOM (ONE ANSWER ONLY) ☼☼☼

Fever	1
Feeling cold	2
Headache	3
Vomiting	4
Diarrhoea	5
General body weakness	6
Loss of appetite	7
Body pain/Joint pain	8
Eyes become yellow	9
Don't know	10

Radio	1
TV	2
Newspaper/magazine	3
Posters/notices	4
Friends/Relative	5
Health workers/ Hospitals /Health Centres	7
Government officials	8
Church/Mosque	9

SECTION 3: MALARIA

12. **Have you ever heard of a disease called Malaria?**

Yes	1
No	2

►IF NO, GO TO SECTION 4

13. **Can you please tell me what the MAIN SYMPTOM or sign of this illness is?**

☼☼☼- **MAIN SYMPTOM (ONE ANSWER ONLY)** ☼☼☼

Fever	1
Feeling cold	2
Headache	3
Vomiting	4
Diarrhoea	5
General body weakness	6
Loss of appetite	7
Body pain/Joint pain	8
Eyes become yellow	9
Don't know	10

14. What OTHER SYMPTOMS or signs of malaria are you aware of?

☼☼☼- OTHER SYMPTOMS – (MULTIPLE ANSWERS POSSIBLE)

Fever	1
Feeling cold	2
Headache	3
Vomiting	4
Diarrhoea	5
General body weakness	6
Loss of appetite	7
Body pain/Joint pain	8
Eyes become yellow	9
Don't know	10

15. Which categories/groups of people are MOST AFFECTED by malaria in your home or neighbourhood in this year?

Adult Men	1
Adult Women	2
Children under 5 years old	3
Pregnant women	4
Children above 5 years old	5
Elderly people	6
Others(Please specify)_____	7

16. What is the MAIN CAUSE of malaria that you know of?

☼☼☼- (ONE ANSWER ONLY) ☼☼☼

Working in the sun	1
From being in the rain	2
From getting cold	3
From drinking dirty water	4
From another person with malaria	5
From being bitten by mosquitoes	6
Don't know	8

Fever	1
Feeling cold	2
Headache	3
Vomiting	4
Diarrhoea	5
General body weakness	6
Loss of appetite	7
Body pain/Joint pain	8
Eyes become yellow	9
Don't know	10

15. **Which categories/groups of people are MOST AFFECTED by malaria in your home or neighbourhood in this year?**

Adult Men	1
Adult Women	2
Children under 5 years old	3
Pregnant women	4
Children above 5 years old	5
Elderly people	6
Others(Please specify)_____	7

16. **What is the MAIN CAUSE of malaria that you know of?**

☼☼☼- **(ONE ANSWER ONLY)** ☼☼☼

Working in the sun	1
From being in the rain	2
From getting cold	3
From drinking dirty water	4
From another person with malaria	5
From being bitten by mosquitoes	6
Don't know	7
Others(Please specify)_____	8

17. e there any OTHER WAY you can get the disease?

☼☼☼-OTHER WAYS – (MULTIPLE ANSWERS POSSIBLE)

Working in the sun	1
From being in the rain	2
From getting cold	3
From drinking dirty water	4
From another person with malaria	5
From being bitten by mosquitoes	6
Don't know	7
No Other way	8
Others(Please specify)_____	9

18. Do you think a person can die from malaria?

Yes	1
No	2

19. Are you aware of any way (or ways) to prevent getting malaria?

Yes	1
No	2

20. Have you ever had an attack of malaria?

Yes	1
No	2

► IF NO, GO TO Q. 27; If YES, go to Q. 21

21. How long ago did you last have malaria?

_____ Days ago	1
_____ Months ago	2
_____ Years ago	3

22. **When you last had malaria did you get treatment for it?**

Yes	1
No	2

■► **IF NO, GO TO Q. 25**

23. **Where did you get the treatment? (Circle all response)**

A Pharmacy	1
Drug Shop (Patent Medicine Shop)	2
A general merchandize (Provision) shop	3
A traditional healer	4
Government Hospital/Clinic	5
Private Hospital/Clinic	6
Others (Please specify)_____	7

24. **What treatment were you given?** (Circle all responses)

Traditional Medicine (Specify) _____	1
Nivaquine/chloroquine tablet	2
Fansidar tablets	3
Quinine tablets	4
Camoquine tablets	5
Metakelfin tablets	6
Aspirin/Panadol	7
Tablets, unspecified	8
Chloroquine injection	9
Artesunate	10
Artemisinin-Based Combination Therapy (ACTs) drugs_____	11
Others(Specify)_____	12
Don't Know	13

25. **During your last malaria attack, did you go to work?**

Yes	1
No	2

26. **Which of the following statements best describes what you do when you have malaria: do you *always seek treatment, sometimes seek treatment or never seek treatment*?**

Always seek treatment	1
Sometimes seek treatment	2
Never seek treatment	3

27. **In the past 3 months, how many people in your household have suffered from malaria?**

28. **In the past 3 months, how many pregnant women in your household have suffered from malaria?**

29. **In the past 3 months, how many under-5 children in your household have suffered from malaria?**

30. **What is the MOST IMPORTANT (BEST) thing you do in your household to prevent getting malaria? (ONE ANSWER ONLY)**

Sleeping under a mosquito net	1
Take nivaquine/ chloroquine	2
Avoid being bitten by mosquitoes	3
Use mosquito coil	4
Use insecticide sprays	5
Avoid going out in the cold	6
Avoid staying under sunshine for a long time	7
Close the doors and windows at night	8
Keep the house and surrounds clean	9
Use repellant cream	10
Use nettings on Windows and Doors	11
Metaprim/preventive drugs	12

Yes	1
No	2

26. **Which of the following statements best describes what you do when you have malaria: do you *always seek treatment, sometimes seek treatment or never seek treatment*?**

Always seek treatment	1
Sometimes seek treatment	2
Never seek treatment	3

27. **In the past 3 months, how many people in your household have suffered from malaria?**

28. **In the past 3 months, how many pregnant women in your household have suffered from malaria?**

29. **In the past 3 months, how many under-5 children in your household have suffered from malaria?**

30. **What is the MOST IMPORTANT (BEST) thing you do in your household to prevent getting malaria? (ONE ANSWER ONLY)**

Sleeping under a mosquito net	1
Take nivaquine/ chloroquine	2
Avoid being bitten by mosquitoes	3
Use mosquito coil	4
Use insecticide sprays	5
Avoid going out in the cold	6
Avoid staying under sunshine for a long time	7
Close the doors and windows at night	8
Keep the house and surrounds clean	9
Use repellant cream	10
Use nettings on Windows and Doors	11
Take daraprim/ Metaprim/preventive drugs	12

Drinking clean water	13
Don't do anything	14
Others(Specify)_____	15

31. **What OTHER THINGS do you do to prevent malaria? (MULTIPLE ANSWER)**

Sleeping under a mosquito net	1
Take nivaquine/ chloroquine	2
Avoid being bitten by mosquitoes	3
Use mosquito coil	4
Use insecticide sprays	5
Avoid going out in the cold	6
Avoid staying under sunshine for a long time	7
Close the doors and windows at night	8
Keep the house and surrounds clean	9
Use repellant cream	10
Use nettings on Windows and Doors	11
Take daraprim/ Metaprim/preventive drugs	12
Drinking clean water	13
Don't do anything	14
Others(Specify)_____	15

SECTION 4: MOSQUITOES

32. **Do mosquitoes cause any trouble to you?**

Yes	1
No	2

▶IF NO, Answer Q 34 but SKIP Q 33, 35 & 36

33. **In what ways do mosquito cause you trouble?**

They bite	1
Their bites are itchy	2
They carry disease	3
They make noise	4

Don't do anything	14
Others(Specify)_____	15

31. **What OTHER THINGS do you do to prevent malaria? (MULTIPLE ANSWER)**

Sleeping under a mosquito net	1
Take nivaquine/ chloroquine	2
Avoid being bitten by mosquitoes	3
Use mosquito coil	4
Use insecticide sprays	5
Avoid going out in the cold	6
Avoid staying under sunshine for a long time	7
Close the doors and windows at night	8
Keep the house and surrounds clean	9
Use repellant cream	10
Use nettings on Windows and Doors	11
Take daraprim/ Metaprim/preventive drugs	12
Drinking clean water	13
Don't do anything	14
Others(Specify)_____	15

SECTION 4: MOSQUITOES

32. **Do mosquitoes cause any trouble to you?**

Yes	1
No	2

▶ IF NO, Answer Q 34 but SKIP Q 33, 35 & 36

33. **In what ways do mosquito cause you trouble?**

They bite	1
Their bites are itchy	2
They carry disease	3
They make noise	4
Others(Specify)_____	5

34. **During what season do you notice a lot of mosquitoes?**

During the dry season	1
During the rainy season	2
Throughout the year	3
Do not experience a lot	4
Don't know	5
Others(specify)_____	6

35. **At what time of the day do mosquitoes bite most?**

The morning	1
The afternoon	2
The evening	3
At night in bed	4
All day	5
Don't know	6
Others(Please specify)_____	7

36. **What method(s) are you currently using to protect your household from mosquitoes?**

Use a mosquito net	1
Use insecticide spray	2
Clean the area around the house	3
Close windows and doors	4
Light fire in the house	5
Use coils	6
Apply mosquito repellant to skin	7
Use traditional plants	8
Light Candle	9
Use nettings on Windows and Doors	10
Burn cow Dung/Traditional Plants	11
Other Traditional(Please specify)_____	12
Other Commercial(Please specify)_____	13

During the dry season	1
During the rainy season	2
Throughout the year	3
Do not experience a lot	4
Don't know	5
Others(specify)_____	6

35. At what time of the day do mosquitoes bite most?

The morning	1
The afternoon	2
The evening	3
At night in bed	4
All day	5
Don't know	6
Others(Please specify)_____	7

36. What method(s) are you currently using to protect your household from mosquitoes?

Use a mosquito net	1
Use insecticide spray	2
Clean the area around the house	3
Close windows and doors	4
Light fire in the house	5
Use coils	6
Apply mosquito repellant to skin	7
Use traditional plants	8
Light Candle	9
Use nettings on Windows and Doors	10
Burn cow Dung/Traditional Plants	11
Other Traditional(Please specify)_____	12
Other Commercial(Please specify)_____	13
No Method	14

37. **Why don't you protect your household against mosquitoes?**

I don't know how to	1
I don't have the money	2
I don't have the time	3
Protection materials are not available to me	4
I can't be bothered	5
Others(Please specify)_____	6

SECTION 5: BEDNETS

38. **Which of the following do you sleep under?**

Ordinary bed net	1
ITN – (Insecticide-Treated Nets)	2
I do not use nets	3

39. **Do you currently use bednets?**

Yes	1
No	2

►IF NO GO TO 51, ; IF YES,PROCEED TO Q 40

40. **Do you have bed net on all beds your household?**

Yes, all beds	1
No, not all beds	2

►IF YES, GO TO Q 42; IF NO, ASK Q 41

41. **Why don't you have nets on all beds in your household?**

Bednets are too expensive	1
I am not interested in putting them on every bed	2
I don't know how to fit the net on all the beds	3
Only children need nets	4

Only adults need nets	5
Some beds are not occupied	6
Nets not available	7
We have Window & door nettings	8
Don't know	9
Others(Please specify)_____	10

42. On whose bed is/are the net(s)?

Head of household	1
Spouse	2
Bed shared with spouse	3
Children under-5 years old	4
Children above 5 years old	5
Visitors	6
Others (Please Specify)_____	7

43. On whose bed is/are there no net(s)?

Head of household	1
Spouse	2
Bed shared with spouse	3
Children under-5 years old	4
Children above 5 years old	5
Relative	6
Visitors	7
Others (Specify)_____	8

44. Last night, did you personally sleep under a bed net?

Yes	1
No	2

IF YES, SKIP Q45; IF NO, GO TO Q45

Only adults need nets	5
Some beds are not occupied	6
Nets not available	7
We have Window & door nettings	8
Don't know	9
Others(Please specify)_____	10

42. On whose bed is/are the net(s)?

Head of household	1
Spouse	2
Bed shared with spouse	3
Children under-5 years old	4
Children above 5 years old	5
Visitors	6
Others (Please Specify)_____	7

43. On whose bed is/are there no net(s)?

Head of household	1
Spouse	2
Bed shared with spouse	3
Children under-5 years old	4
Children above 5 years old	5
Relative	6
Visitors	7
Others (Specify)_____	8

44. Last night, did you personally sleep under a bed net?

Yes	1
No	2

IF YES, SKIP Q45; IF NO, GO TO Q45

Only adults need nets	5
Some beds are not occupied	6
Nets not available	7
We have Window & door nettings	8
Don't know	9
Others(Please specify)_____	10

42. On whose bed is/are the net(s)?

Head of household	1
Spouse	2
Bed shared with spouse	3
Children under-5 years old	4
Children above 5 years old	5
Visitors	6
Others (Please Specify)_____	7

43. On whose bed is/are there no net(s)?

Head of household	1
Spouse	2
Bed shared with spouse	3
Children under-5 years old	4
Children above 5 years old	5
Relative	6
Visitors	7
Others (Specify)_____	8

44. Last night, did you personally sleep under a bed net?

Yes	1
No	2

IF YES, SKIP Q45; IF NO, GO TO Q45

45. **Why did you not use a net last night?**

It is too hot	1
Mosquitoes still bite though the net	2
It is difficult if you want to get up in the night	3
It takes time to tuck the net each night	4
We have Window & door nettings	5
There is not enough air	6
Others(specify)_____	7

46. **What is the main reason you use bed- nets in your house?**

To Prevent against mosquito bites	1
To prevent malaria	2
To prevent annoyance from mosquitoes	3
Others (Please specify)_____	4
Don't Know	5

47. **For how long have you had bednets in your house?**

Weeks_____	1
Months_____	2
Years_____	3

48. **What type of bed net(s) do you have in your house?**

PROMPT IF NECESSARY. MULTIPLE ANSWERS POSSIBLE

Manufactured net	1
Cotton net, home made	2
Nylon net, home made	3
Others(Specify)_____	4
Don't know	5

49. **How did you obtain your bednet(s) Multiple answer possible**

It was/they were given to me for free	1
I bought it/them	2
I can't remember	3
	4

It is too hot	1
Mosquitoes still bite though the net	2
It is difficult if you want to get up in the night	3
It takes time to tuck the net each night	4
We have Window & door nettings	5
There is not enough air	6
Others(specify)_____	7

46. What is the main reason you use bed- nets in your house?

To Prevent against mosquito bites	1
To prevent malaria	2
To prevent annoyance from mosquitoes	3
Others (Please specify)_____	4
Don't Know	5

47. For how long have you had bednets in your house?

Weeks_____	1
Months _____	2
Years _____	3

48. What type of bed net(s) do you have in your house?

PROMPT IF NECESSARY. MULTIPLE ANSWERS POSSIBLE

Manufactured net	1
Cotton net, home made	2
Nylon net, home made	3
Others(Specify)_____	4
Don't know	5

49. How did you obtain your bednet(s) Multiple answer possible

It was/they were given to me for free	1
I bought it/them	2
I can't remember	3
Other, (specify)_____	

50. Where did you obtain/buy your bednet(s) from?

A shop (Provision shop)	1
A pharmacy	2
A drug shop (Patent Medicine shop)	3
A health centre/Hospital/Clinic	4
A market	5
Other (Specify)_____	6

☼☼☼ **(Refer to Q39).Ask Questions 51 – 53 ONLY TO RESPONDENTS WHO DO NOT CURRENTLY USE BEDNETS in their households.**

51. Why are you not using a bed net of any type, nowadays?

MULTIPLE ANSWERS POSSIBLE

I am not bothered by mosquitoes	1
Nets are too expensive	2
I feel uncomfortable sleeping under a mosquito net (not convenient)	3
I don't know where to buy a net from	4
Nets are too hot	5
Nets are not available in this area	6
I have no bed to use nets on	7
Others(please specify)_____	8

52. Where in this area can someone obtain a bed net? Ask all:

General (Provision) shop	1
Open air market	2
Market stall/kiosk	3
Drug (Patent Medicine) Shop	4
Pharmacy	5
Clinic/Hospital	6
Other (specify)_____	7
Not available	8
	9

A shop (Provision shop)	1
A pharmacy	2
A drug shop (Patent Medicine shop)	3
A health centre/Hospital/Clinic	4
A market	5
Other (Specify)_____	6

☆☆☆ **(Refer to Q39).Ask Questions 51 – 53 ONLY TO RESPONDENTS WHO DO NOT CURRENTLY USE BEDNETS in their households.**

51. Why are you not using a bed net of any type, nowadays?

MULTIPLE ANSWERS POSSIBLE

I am not bothered by mosquitoes	1
Nets are too expensive	2
I feel uncomfortable sleeping under a mosquito net (not convenient)	3
I don't know where to buy a net from	4
Nets are too hot	5
Nets are not available in this area	6
I have no bed to use nets on	7
Others(please specify)_____	8

52. Where in this area can someone obtain a bed net? Ask all:

General (Provision) shop	1
Open air market	2
Market stall/kiosk	3
Drug (Patent Medicine) Shop	4
Pharmacy	5
Clinic/Hospital	6
Other (specify)_____	7
Not available	8
Don't know	9

53. **On average, what is the cost of buying a net in Naira (₦)?**

BRAND	*SIZE*	*COST*
	Small	
	Medium	
	Large	

54. **What do you think is/are the benefit(s) of sleeping under a bednet?**

Don't get bitten by mosquitoes	1
Don't get malaria	2
Don't get bothered by other insects	3
Sleep better	4
It was warmer	5
Other(Please specify)_____	6

55. **What then do you think are the problems associated with sleeping under a bednet?**

It is too hot sleeping in a net	1
Mosquitoes can still bite through the net	2
It is difficult if you want to get up in the night	3
It takes time to tuck the net each night	4
There is not enough air	5
None / No difficulty	6
Other, specify	7

SECTION 6: INSECTICIDE-TREATED NETS

56. **Have you ever heard about or seen bednet(s) treated with insecticides?**

Yes	1
No	2

IF NO, GO TO Q65

57. **Are any of your bednets treated with insecticide?**

Yes	1
No	2

58. **Is it important for a pregnant woman and children under-5 years old to ALWAYS sleep under treated nets?**

Very important	1
Somewhat important	2
Neither important nor unimportant	3
Not very important	4
Not important at all	5

59. **What do think is the reason for treating bed nets?**

To kill mosquitoes	1
To make the net stronger	2
To repel mosquitoes	3
Don't know	4
Others(Specify)_____	5

60. **What is your opinion about Insecticide- treated nets?**

Another profit making venture by government & private sector	1
Good, but inconvenient	2
Very good	3
I don't know about ITNs	4

61. **Where can you buy a bednet treated with insecticide in this area?**

General (Provision) shop	1
Pharmacy	2
Health center/clinic/Hospital	3
Markets	4
Others(specify)_____	5
Don't know	6
No Place to buy	7

62. **Where did you see it being treated?**

A general merchandise (Provision) shop	1
Pharmacy	2
Drug (Patent Medicine) Shop	3
Health center/Clinic/Hospital	4
Markets	5
At home	6
Others(specify)_____	7

63. **Do bednets have to be re-treated?**

Yes	1
No	2

IF NO, GO TO Q. 65

64. **After how long does net have to be treated?**

Every _____months	1
Every _____years	2
Don't know	3

Interviewer read & explains the text BELOW about the treatment of bednet to the respondent before asking the next two questions:

USE OF TREATED NET FOR MALARIA PREVENTION AMONG PRIMARY HEALTH-CARE CENTRE ATTENDEES IN ABUJA MUNICIPAL AREA COUNCIL, NIGERIA

ADDENDUM TO THE QUESTIONNAIRE

TO BE USED FOR QUESTIONS 65 - 69 BY THE INTERVIEWER AT EACH HEALTHCARE CENTRE

*** *Interviewer read the following text about a treated bed net to the respondent before asking the questions 65- 69 in the Questionnaire.*

I am now going to explain to you what a treated net is. This explanation will help you to answer the next two questions that I am going to ask you.

(1.) = A treated bed net is almost like any other ordinary bed net. The only difference is that it is treated with insecticides. These insecticides are safe to people, but effective kill mosquitoes. The treatment is done by dipping a clean net into a recommended dosage of insecticides solution until it is completely wet. The wet net is then dried on a clean surface.

Treating Nets with Insecticide (Source: *Global Strategic Plan 2005 - 2015, WHO, 2005*)

Re-treatment can be done twice or more times a year depending on how frequently the net is washed.

(2.) =The other type is the pre-treated nets. In this case, the nets are treated with insecticides from the factory, at the time of producing the nets. They are then packaged. This type lasts for 2-4 years, depending on the type of insecticide used.

65. How important do you think an INSECTICIDE-TREATED NET would be to you and your household? Would you say it would be *very important, somewhat important, neither important nor unimportant, not very important or not important at all?*

Very important	1
Somewhat important	2
Neither important nor unimportant	3
Not very important	4
Not important at all	5

66. Last night, how many children under the age of 5 slept under a treated bed net?

67. Last night how many pregnant women slept under a bednet?

68. Last night how many adult women (15 years & above), slept under a net?

69. Last night how many adult men (15 years & above), slept under a bed net?

SECTION 7: UNDER-5 INFORMATION

***Ask the following questions only to households with children aged 5 years and below. If there are no children of that age, close the interview and thank the respondent. If there are children, fill each column with relevant codes (1, or 2, or 3 ... e. t. c.)

Particulars	Child from the same family				
	1st	2nd	3rd Child	4th Child	5th Child
70.Sex of child - M or F					
71.Age (exact dates, if possible) *(0 - 12 Months)* – 1					

unimportant, not very important or not important at all?

Very important	1
Somewhat important	2
Neither important nor unimportant	3
Not very important	4
Not important at all	5

66. **Last night, how many children under the age of 5 slept under a treated bed net?**

67. **Last night how many pregnant women slept under a bednet?**

68. **Last night how many adult women (15 years & above), slept under a net?**

69. **Last night how many adult men (15 years & above), slept under a bed net?**

SECTION 7: UNDER-5 INFORMATION

*****Ask the following questions only to households with children aged 5 years and below. If there are no children of that age, close the interview and thank the respondent. If there are children, fill each column with relevant codes (1, or 2, or 3 ... e. t. c.)**

Particulars	Child from the same family				
	1st	2nd	3rd Child	4th Child	5th Child
70.Sex of child - M or F					
71.Age (exact dates, if possible) *(0 - 12 Months)* – 1					

(Between 1 & 2 yrs) – 2 *(Between 2 & 3yrs)* – 3 *(Between 3 & 4yrs)* – 4 *(Between 4 & 5yrs)* – 5						
72. Has the child had malaria in the last month? – YES or NO						
73. Was the child treated for Malaria? – **YES or NO** ***(if NO thank respondent and close interview). If YES, proceed to Q.74***						
74. Where was the child treated? ▶ Pharmacy -1 ▶ A government hospital/clinic -2 ▶ A private hospital/clinic -3 ▶ A Patent Medicine Shop – 4 ▶ A Traditional Healer - 5 ▶ Other(Specify) - 6						

(Between 2 & 3yrs)

– 3

(Between 3 & 4yrs)

– 4

(Between 4 & 5yrs)

– 5

72. Has the child had malaria in the last month? – YES or NO

73. Was the child treated for Malaria? – **YES or NO**

(if NO thank respondent and close interview). If YES, proceed to Q.74

74. Where was the child treated?

▶ Pharmacy -1

▶ A government hospital/clinic -2

▶ A private hospital/clinic –3

▶ A Patent Medicine Shop – 4

▶ A Traditional Healer - 5

▶ Other(Specify) - 6

▶ Don't know - 7

75. What treatment was given?

◙ Fill each box accordingly as follows:

▶ Traditional Medicine -1					
▶ Chloroquine -2					
▶ Fansidar - 3					
▶ Quinine tabs -4					
▶ Quinine inj. - 5					
▶ Aspirin/Pcm- 6					
▶ Artesunate - 7					
▶ Artemisinin-based Combination Therapy - ACTs, (Coartem tab, G-sunate tab, Artequine tab, e.t.c.) - 8					
▶ Don't Know - 9					
▶ Other - 10					

END OF INTERVIEW.THANK YOU!

▶ Don't know - 7						

75. What treatment was given?

◙ Fill each box accordingly as follows:

▶ Traditional Medicine -1						
▶ Chloroquine -2						
▶ Fansidar - 3						
▶ Quinine tabs -4						
▶ Quinine inj. - 5						
▶ Aspirin/Pcm- 6						
▶ Artesunate - 7						
▶ Artemisinin-based Combination Therapy - ACTs, (Coartem tab, G-sunate tab, Artequine tab, e.t.c.) - 8						
▶ Don't Know - 9						
▶ Other - 10						

END OF INTERVIEW THANK YOU!