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Assessment of predictors of use of antimalaria drugs for treatment of malaria/fever in the Kilombero and Rufiji valleys in Tanzania

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UNIVERSITY OF THE WITATERSRAND, JOHANNESBURG

FACULTY OF HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH

RESEARCH REPORT

TITLE: ASSESSMENT OF PREDICTORS OF USE OF ANTIMALARIA DRUGS FOR TREATMENT OF MALARIA/FEVER IN THE KILOMBERO AND RUFIJI VALLEYS IN TANZANIA.

DANIEL TINDANBIL

Research report submitted to the Faculty of Health Sciences,

University of the Witwatersrand, Johannesburg, in

Partial fulfilment of the requirements for the Degree of

Master of Science in Medicine in the field of Population Based Field Epidemiology

Johannesburg, South Africa, 2007.

DECLARATION

I, Daniel Tindanbil declare that this report is my own work. It is being submitted for the degree of Master of Science in medicine in the field of population based field epidemiology in the University of Witwatersrand, Johannesburg, South Africa. This report has never been submitted, either in part or in full, for the award of any degree or examination at this or any other university.

Signature: …  …

Full Name: Daniel Tindanbil

June, 2007.

Dedication:

I wish to dedicate this report to my late mother for her undying love and support for my education when she was alive. I will always remember her!

ABSTRACT

Background

The World Health Organisation currently recommends the use of artemisinin-based combination drugs for treatment of uncomplicated malaria in high malaria endemic regions. However, comprehensive understanding of factors affecting treatment of malaria with antimalarials is lacking in many rural communities in Africa. This study seeks to test the following hypothesise:

1. That socio-economic and demographic factors at the household level affect treatment of self reported malaria/fever with antimalarials in the Kilombero/Ulanga and Rufiji valleys in Tanzania
2. Distance of a household to a health facility affects treatment of malaria/fever with antimalarials in the Kilombero/Ulanga and Rufiji valleys in Tanzania.

Methods: Secondary data analysis of a cross- sectional household survey on antimalarials carried out in 2005 in the Kilombero/Ulanga and Rufiji valleys in Tanzania. Geo-referenced health facilities and households' datasets from the Rufiji and Ifakara demographic surveillance systems sites were also used to estimate distance variables.

Results: Out of a total of 1433 participants who reported malaria/fever, 32% (95% CI: 29.29, 34.89) obtained treatment with antimalarials. Among them, 36% obtained treatment with Sulfadoxine Pyreminthamine (SP) as a monotherapy and 44% treated malaria/fever with SP and Artesunate as a combination therapy.8% used quinine while 11 % used Amodiaquine and Artesunate. The remaining 1% used chloroquine. After adjusting for all confounding variables in a multivariate survey logistic regression model, age group, education level of the household head and district of residence were found, with statistical evidence, to be associated with treatment of reported malaria/fever with antimalarials.

Conclusion:

The results suggest that participant's age, education level of household head and location of district are important predictors of treatment of malaria with antimalarials in rural Tanzania. The implementation of any antimalarials policy in Tanzania would therefore, require a careful consideration of these factors.

ACKNOWLEDGEMENT

First, the almighty God deserves praise and thanks for guiding me through this programme. I owe a huge debt of gratitude to my sponsor, the INDEPTH-NETWORK for the financial support which enabled me to pursue this programme at Wits. I also wish to extend my appreciation of the INDEPTH financial support to organizations that have been supporting the INDEPTH - NETWORK financially to implement its programmes.

Special thanks go to the Ifakara Health Research and Development Centre, IHRDC, and the Director, Dr. Mshinda for granting me the permission to use the data to write this report. I wish to also express my profound gratitude to my supervisors, Salim Abdulla of the IHRDC, Tanzania for statistical support and also supervising the entire work, and Dr. Tint of the University of the Witwatersrand, South Africa for her supervision of this report and for her advice throughout the entire MSc programme. I cannot forget Dr. Rose Nathan of the Ifakara demographic surveillance site in Tanzania for hosting me for the field attachment and also playing active role in facilitating my field work. She also provided limited statistical support. The staff in the data entry and management unit of Ifakara DSS site deserves thanks for their support during the extraction of the dataset for this report.

I would like to also thank my lecturers at Wits, especially Edmond Marinda for his inputs into this report. The support of Lawrence and Lindy has also been very much invaluable. Last but not least, I would like to thank the director of the Navrongo Health Research Centre, Dr. Abraham Hodgson, The head of the malaria unit of Navrongo Health research centre, Dr. Rexford Oduro for giving me the opportunity to apply for the MSc programme in population based field epidemiology programme at Wits.

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Definition of Key Terms

Anti-malaria drug resistance: the ability of the malaria parasite strain to survive and/or multiply despite the administration and absorption of a drug given in doses equal to or higher than those usually recommended, but within the limits of tolerance of the subject. (The use of antimalarial drugs. A WHO report of an informal consultation, Geneva 2000[33]).

Antimalarial: A drug that can be used to treat or prevent malaria.

Artemisinin-based combination therapy: Treatment of uncomplicated malaria that combines several antimalarial drugs, one of which is a derivative of artemisinin. (Francis Nosten, FAQs on Artemisinin based Combination Therapy).

Monotherapy: The use of a single antimalarial to treat or prevent malaria (The use of antimalarial drugs. A WHO report of an informal consultation, Geneva, 2000).

1km block, 5km block and 10km block: Study participants whose households fall within 1 kilometre, 5 kilometres or 10 kilometres from the nearest health facility.

Facility was defined as health centre, clinic or any drug shop, licensed or unlicensed, selling either antimalarials or any type of drug.

Geo-referenced health facilities and households: Facilities and households that can be described by latitudes and longitudes i.e. the latitudes and longitudes passing through these structures are known.

Wealth quintiles: Using wealth index based on ownerships of household and characteristics of housing materials to categorize study participants into five socio-economic status groups; most poor, very poor, poor, less poor, and least poor.

Multinomial model: A statistical model that examines several risk factors to a single outcome variable.

Parsimonious model: A statistical model that is simple and can satisfactorily explain the relationship between the independent variable and the explanatory variables.

"Abiku": Children from the spirit world.

KVIP: Kumasi Ventilation Improved Pit- A type of toilet facility (INDEPTH Monograph on causes of death).

ABREVATIONS AND ACRONYMS

DSS : Demographic Surveillance System

ACT : Artemisinin -based Combination therapy.

WHO : World Health Organisation

SP : Sulfadoxine Pyreminthamine

INDEPTH: International Network for Continuous Demographic Evaluation of Populations and their impact on Health in Developing Countries

IMPACT : Interdisciplinary Monitoring Project on Artemisinin based Combination Therapy.

SQL : Structured Query Language.

KVIP: Kumasi Ventilation Improved Pit (INDEPTH monograph)

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CHAPTER 1

INTRODUCTION

1.1 Background

Malaria remains a leading global public health problem. Despite efforts by public health systems of malaria endemic countries to control the disease the World Health Organisation (WHO) annual malaria reports have, over the years, consistently presented unacceptable high levels of malaria morbidity and mortality in malaria endemic countries. An estimated 3.2 billion people; representing about 50% of the world population are at risk of malaria infection.[1] Between 350 and 500 million people are infected with malaria annually resulting in annual mortality of between 1.5 and 2.7 million worldwide[1.] Children and pregnant women are more at risk of malaria infection and mortality[1].

About 60% of all clinical cases and 80% of all deaths due to malaria occur in African countries, south of the Sahara.[1]. To change this situation, African countries pledged at a meeting in Abuja in 2000, to ensure that, at least: 1) 60% of those suffering from malaria, have prompt access to, and are able to correctly use, affordable and appropriate treatment within 24 hours of the onset of symptoms, 2) 60% of those at risk of malaria, particularly children under five years of age and pregnant women, benefit from the most suitable combination of personnel and community protective measures such as insecticide treated mosquito nets and other interventions which are accessible and affordable to prevent infection and suffering and 3) 60% of all pregnant women who are at risk of malaria, especially those in their first pregnancies, have access to chemoprophylaxis or presumptive intermittent treatment 2005[2].

Tanzania is malaria endemic country and transmission of the disease in the country varies regionally with the pattern of seasonal factors such as rainfall. About 28 million people in Tanzania (80% of total population) are at risk of malaria infection.16 million episodes of malaria cases are recorded annually in Tanzania[3]. Malaria is the main cause of health services attendance in Tanzania. It is reported that 38%of children and 32% of adults seen at the out patient departments of hospitals in Tanzania are diagnosed with malaria. Malaria is also the single largest cause of child morbidity and mortality in Tanzania. About 100, 000 children die annually of malaria in Tanzania, representing 25% of all deaths[3] .

The negative economic impact of malaria on Tanzania is enormous. One percent, (1%) of Tanzania's GDP and 39% of its total health expenditure is spent on fighting malaria[4] . According to the annual cause of death of both the Ifakara and Rufiji demographic surveillance sites, malaria is the leading cause of infant morbidity and mortality in the respective coverage areas of the surveillance sites.[5]

Malaria mostly affects the economically marginalised, poorly educated and those who lack access to quality health care[6]. The resistance of the malaria parasite, especially, plasmodium falciparum, against chloroquine has not help the course of the poor to fight the disease. Chloroquine is widely available and comparatively cheaper. Therefore, the increasing ineffectiveness of chloroquine against malaria is severely limiting efforts to fight the disease[6]

To address the growing malaria drug resistance problem the World Health Organisation recommends artemisinin- based combination therapy, ACT[1]. The recommendation is based on a valid scientific reason that if two drugs, with independent working mechanisms, are

used in combination for treatment of the disease, the probability of the malaria parasite developing resistance against the two drugs simultaneously is very small[7]. Artemisinin -based combination therapy, ACT, has been recommended to be the most promising alternative for the treatment of malaria in areas where the malaria parasite has become resistant against monotherapies such as chloroquine and Sulfadoxine Pyreminthamine (SP)[8].But the question is whether drug efficacy alone is sufficient to control the resurging incidence of malaria morbidity and mortality in Africa. Drug efficacy is necessary but not sufficient for tackling the growing malaria problem[6]. The socio-cultural, economic, technical and political environment need to be considered in tackling this problem [6].

Thus, to ensure successful up-scaling of artemisinin -based combination therapy, factors that may possibly affect uptake of the recommended antimalarials will have to be fully explored and understood so as to inform policy formulation and implementation of the WHO recommended combination therapy programme.

1.2 STATEMENT OF THE PROBLEM

There is paucity of information on the prevalence of use of antimalarials for treatment of malaria in rural communities that could inform effective malaria drug policy such as up-scaling of combination therapy. Also factors that influence treatment of the disease in poor and remote areas in many parts of Africa are diverse and poorly understood, especially at the household level. Lack of vital information relating to treatment of malaria in rural populations will impede successful implementation of the recommended combination therapy currently being considered by malaria endemic countries including Tanzania.

1.2 JUSTIFICATION

One of the most effective ways of improving the quality of treatment of malaria in rural communities is by monitoring the use of anti-malaria drugs. Monitoring the use of antimalarials prevents drugs resistance which will eventually improve the efficacy of the recommended antimalarials.

This study will explore factors that explain the difference between people who experienced episodes of malaria/fever in the Kilombero/Ulanga and Rufiji valleys in Tanzania in 2005, and sought treatment with any antimalarial and those who experienced malaria/fever but did not seek treatment with antimalarials. This information will be key to a successful up-scaling of the WHO recommended artemisinin- based combination therapy in Tanzania and many African countries planning to implement this policy.

Further discussions could also be generated from the findings of this study that will be useful, not only to the government of Tanzania, but other malaria endemic countries in Africa for implementation of artemisinin- based combination therapy. To improve coverage and quality of treatment against malaria it is also relevant to know the prevalence of treatment for the disease. This will be useful for any drug policy planning. Also information on the pattern of consumption of antimalarials across age groups will throw light into the segment of the population in most need of attention.

1.3 LITERATURE REVEW

Global strategy for malaria control focuses on case management through early detection and effective treatment of all malaria cases[9]. As part of the integrated management of

childhood illness, the World Health Organization advocates presumptive treatment of malaria in febrile children less than five years in intense malaria transmissions areas[10]. Surveys in many African countries have revealed that half African children who experienced fever are treated with an antimalarial, mostly chloroquine.[10] Studies in Madagascar and Tanzania on providing prompt access to antimalarials for treatment of malaria demonstrated significant reduction in malaria related mortality.[10]

Until recently chloroquine was the most effective and widely used first line antimalarial for the treatment of uncomplicated malaria in malaria endemic countries[10.] It was also affordable to the poor, the segment of the population who bear the brunt of the malaria pandemic[1]. By the year 2000, chloroquine resistance had been widely reported in many malaria endemic countries in Africa[11]. Chloroquine resistance is responsible for increased morbidity and mortality attributable to malaria in sub-Saharan Africa in the past decade[6.] Two to three fold increase in malaria morbidity and mortality has been attributed to chloroquine resistance. Significant rise in malaria mortality in children under five years coinciding with chloroquine resistance has been observed in Senegal, West Africa[11] .

As a result of the declining effectiveness of chloroquine against malaria, it has been replaced as a first line drug for the treatment of uncomplicated malaria in almost all malaria endemic countries in Africa[11]. In 1993, Malawi replaced chloroquine with Sulfadoxine Pyreminthamine as a first line drug for the treatment of uncomplicated malaria[11.]Chloroquine resistant *Plasmodium falciparum* malaria had been recognised in united republic of Tanzania since the early 1990s[12]. Monitoring studies in the 1990s showed that most malaria related deaths (48%-88%) occur in homes even though more than 80% of Tanzanians live close to drugs shops that sell chloroquine.[12]

Tanzania changed its malaria treatment policy from Chloroquine to Sulfadoxine Pyreminthamine in the year, 2000 after it was established that chloroquine was no longer effective against uncomplicated malaria[11.] Kenya and South Africa also modified their malaria treatment policies and has introduced Sulfadoxine Pyreminthamine, SP, as a first line drug for treatment of uncomplicated malaria[11]. However, resistance of the malaria parasite, mostly *Plasmodium falciparum*, against SP has also been reported in the eastern and southern parts of Africa including Tanzania[13]. Quinine is recommended for the treatment of severe malaria. However, the WHO recommends the use of parenteral artemeter/artesunate for the treatment of severe malaria in areas where the malaria parasite, *plasmodium falciparum,* resistance or sensitivity to quinine is not known [9].

Because of the increasing resistance of the malaria parasite against monotherapy, the WHO current policy on malaria treatment is combination therapy; the use of two or more antimalarials with, at least one of them, containing a derivative of artemisinin[7]. The WHO further recommends that the two antimalarials should also have independent working mechanisms. This will be necessary to fight resistant malaria parasites as the different pharmacodynamic properties of the drugs is able to deal with the various elusive mechanisms of the malaria parasite[7.] The aim of this recommendation is to improve efficacy and retard the development of resistance of the malaria parasite against components of the combination drugs[8].Artemisinin-based Combination Therapy is now generally considered to be the best option for the treatment of uncomplicated malaria in endemic areas[14] .

However, the WHO initiative to fight malaria using combination therapy could be thwarted by retail trade in monotherapies in rural communities.

In a survey in Dar-Es-Salaam, nineteen different Artemisinin-containing oral Pharmaceutical products, including one co-formulated product, one co-packaged product, and 17 monotherapies were found to be displayed in chemical shops with inconsistent dosing instructions and inadequate internationally recommended dosage[15].It was also established that none of the monotherapies mentioned the potential benefits of combining one drug with other antimalarials for treatment of malaria. Thus, despite the call by the WHO for the voluntary withdrawal of these monotherapies from the market these drugs are likely to coexist with the recommended combination therapies[15.]

Many factors affect the use of antimalarials for treatment against malaria. Accessibility and affordability play significant part in accessing antimalarials especially in rural populations[16]. Rural populations may resort to inexpensive but less effective antimalarials for treatment against malaria. Chloroquine, Sulfadoxine Pyreminthamine and Amodiaquine cost about US $0.13, US$0.14 and US$ 0.20 respectively per dose. However, artemisinin based- combination drugs cost between US$1 and US$3 [2]. The total cost of treating an episode of malaria could even reach 8.67 dollars if one adds the indirect cost of travelling to a health centre and the time spent waiting to receive service[17]. Thus, Even though combination therapy looks promising to fight drug resistant malaria the cost of these drugs will be an obstacle to acceptance and effective utilization of combination therapy by the poor who are mostly affected by the disease. This may adversely affect up-scaling of the WHO new treatment policy on malaria.

Low malaria treatment has been identified to be associated with low socioeconomic status in Ifakara, a rural community in Tanzania[18] while a study in Malawi identified access to media, place of residence and care givers age to be associated with treatment of self-reported malaria/fever[19].

National surveys in twenty eight African countries in Africa indicated an average of 42% of children less than fives with fever were treated; more than 80% of the treatment involved the use of chloroquine[20.] It is even possible effective treatment in the surveyed communities could even be lower as low level of education could make dosing instructions difficult to follow.

Other surveys in 21 African countries revealed that those who treated febrile illness with antimalarials, 46% obtained treatment at a health facility, 44% at home and 10% at both home and health facility20.Treatment of self diagnosed fever has also been found to be low in many Africa countries. A community based household survey in central Ethiopia revealed that 33% of people with self-diagnosed malaria sought treatment from community based health facility workers, 23% attended public health facility and 17% sought help from private clinic.[20] Another household survey in Togo on treatment received by febrile children showed that, 20% (95% CI: 15%-25%) had sought treatment from a health facility, while 83% (95% CI: 76%-90%) were treated at home with antimalarials. Among them, 94% of those who treated at home used chloroquine.[21] Coupled with this undesirable coverage of treatment for the disease is the lack of compliance to dosing instructions by care-givers of children who are affected by the disease[22].

Other factors that affect quality treatment of malaria include indiscriminate and inappropriate use of drugs. Dysfunctional health systems and poor quality of antimalarials have also been identified to affect the quality of treatment of malaria[6]

In the midst of what has been revealed to affect treatment of malaria with antimalarials in rural populations, it is not extensively understood how the socio-economic conditions of households, the relative distance of households to the nearest health facilities, the personal demographics of people such as age, sex and education level affect access to antimalarials for treatment of malaria with antimalarials. Therefore, before up-scaling of the WHO new treatment policy on malaria-combination therapy, especially in rural populations, it is relevant to explore how these factors may affect treatment of self reported malaria/fever with antimalarials.

1.4. Study Question:

1) What factors predict the use of antimalarials for treatment of malaria in the Kilombero/Ulanga and Rufiji valleys in Tanzania?

Hypothesises

1**.** Socio-economic and demographic factors affect treatment of malaria with anti-malaria drugs in the Kilombero/Ulanga and Rufiji valleys in Tanzania

2. Distance of a household from a health facility affects treatment of malaria with antimalarials in the Kilombero/Ulanga valleys in Tanzania.

1.5 Aim:

The general aim of this study is to determine factors that predict the use of antimalarials for treatment of malaria in the Kilombero/Ulanga and Rufiji valleys in Tanzania.

1.6 Specific Objectives.

1. To estimate the prevalence of anti-malarials use for the treatment of malaria in the Kilombero/Ulanga and Rufiji valleys.
2. To determine the pattern of antimalarials use for treatment of malaria across age groups.
3. To assess factors predicting the use of antimalarials in the Kilombero/Ulanga and Rufiji valleys in Tanzania for treatment against malaria.

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CHAPTER 2

METHODOLOGY

2.1 Demographic characteristic of the study area

The study covered three administrative districts in rural Tanzania. The Kilombero and Ulanga districts in the Morogoro region and Rufiji district in the coast region. (Appendix 1). The communities of the Kilombero and Ulanga districts are mostly subsistence farmers residing in the valley of the Udzungwa chain of mountains. Parts of these areas are covered by the Ifakara demographic surveillance system. The Ifakara demographic surveillance system, which was established in 1996, covers twenty five villages (25) in the two districts. The system monitors longitudinal demographic characteristic of about 80,000 (2004 census) people across the two districts. Data on migration, (in-and-out), births, deaths and changes in marital status are collected and updated every four months in a year. Socio-economic status or household assets data is collected once annually. All health facilities and drug shops in the two districts are geo-referenced. Households of all residents in the two districts are also geo-referenced.

The Rufiji district is one of six districts in the coast region of Tanzania. It has a population of about 182,000 of which 47% (85,000/182,000) is under the Rufiji demographic surveillance system. The system covers 31 villages and monitors the same demographic information as the Ifakara demographic system. Health facilities, drug shops and households are also geo-referenced in this district.

The district is rural and the people are mostly subsistence farmers. A prominent feature in the district is the Rufiji River which divides the district into roughly two halves. The three

districts were selected based on their peculiar nature of representing a rural population setting with intense and perennial malaria transmission. The fact that the areas are severed by demographic surveillance systems makes it possible and convenient to use the surveillance systems as sampling frames for the study to ensure collection of quality data. This study covered areas only under the demographic surveillance systems.

2.2 Study population

The study population includes all the resident population under coverage of the Rufiji and Ifakara demographic surveillance systems in 2005.

2.3 Study design

The study design is secondary data analysis of a cross- sectional household survey known as Interdisciplinary Monitoring Project on Artemisinin-based Combination Therapy (IMPACT) study in Tanzania that was carried out in 2005, in the Kilombero/Ulanga and Rufiji valleys in Tanzania to determine the level of usage of antimalarials for treatment of malaria at the household level.

2.4 Inclusion and exclusion criteria

The study was limited to only those who reported malaria or fever among the participants who took part in the antimalarials household survey in 2005. There was no restriction on age and sex in the selection of participants. However, participants were required to have agreed and consented to take part in the IMPACT household survey before being included in this analysis. Participants below 12 years had their parents or legal guardian consented on their behalf. Participants who fulfilled the above criteria and were also verified to have

a complete set of records with regard to the investigated variables were included in the final analysis of this report.

The IMPACT household survey

The Ifakara Health Research and Development Centre in Tanzania carried out a household survey in 2005 in the Rufiji and Kilombero/Ulanga valleys, areas under coverage of demographic surveillance systems, to assess antimalarials usage levels in the communities living in these valleys. The survey was also meant to determine the prevalence of the malaria parasite genes that confers resistance against Sulfadoxine Pyreminthamine, SP. However, analysis in this report did not include aspect of the dataset on SP genes resistance.

Sample size and sampling strategy

The sample size of the household survey study was chosen based on the level of use of antimalarials in the study; where level of use was conceived as the extend to which people in the study area used antimalarials, not only for treatment of malaria, but for other diseases. This was necessary for estimating the prevalence of the malaria parasite genes that confer resistance to the antimalarial,Sulfadoxine Pyreminthamine, SP.

At the protocol development phase of the IMPACT study there was no information, either published or unpublished, on the level of use of anti-malarials, either in Tanzania or elsewhere, to use as a reference for calculating sample size. Therefore, an estimated convenient sample size of about 3700 households was chosen for the survey. With an average household size of about 5.3 persons, potential participants for the study were 19610. However, 12831 from the 3700 selected households were available at the time of visit and consented to take part in the household survey. Parents or legal guardians of

minors below 12 years answered questions on behalf of their wards. Those absent in the household at the time of the interview were missed for interview and therefore not recruited for the study.

Cluster sampling strategy was used in selecting the households in the study areas. Rufiji district was chosen as a cluster while Kilombero and Ulanga districts were combined as another cluster and named Ifakara.Households were the primary sampling units. The probability of selection of the primary sampling units for each cluster was proportional to the estimated sample size of the primary study. From each cluster, households were then chosen using simple random selection.

Data collection instruments were organised into modules: Module A was meant for collection of household assets and demographic characteristics of the household head. Module B was for collection of personal information of the study participant and then Module C was meant for collection of medical information including the history of malaria episodes based on two weeks recall period of the study participant.

Participants were interviewed on whether they had experienced malaria/fever within the last 14 days preceding the interview. The local people call fever ‘homa’, in Kiswahili, the national language of Tanzania. Fever was used as a proxy for malaria. Those who reported ‘’homa’’, were further asked whether they had treated the disease. For those who obtained treatment were further asked where they sort treatment. The name of the antimalarials used for the treatment of the disease or information on the nature of treatment sought was also collected from participants. Household assets were also collected during the interview.

The IMPACT survey also collected blood sample from the participants using filter paper blood spot samples for analysis on the type and content of antimalarials drugs as well as the prevalence of the genes that confers resistance against Sulfadoxine Pyreminthamine (SP). However, data analysis of this report did not include the subset data of blood sample testing.

2.5 Data Source

The data for this secondary data analysis study was extracted from the IMPACT household survey dataset. Variables limited to only those who reported malaria/fever were extracted and included in the analysis. Data from geo-referenced health facilities and household datasets of both the Ifakara and Rufiji demographic surveillance systems in Tanzania were also used in constructing variables that measured specified distance levels of a participating household to the nearest health facility.

2.6 Description and Extraction of Variables

Explanatory: Sex, Age, District location, Educational level of household head, Religion of household head, Tribe of household head, Bed net use, Socio-economic status, and Distance from a participating household to a health facility measured from 1km to 10 km.

Outcome: The outcome variable is treatment of malaria/fever with antimalarials measured categorically as ‘yes’ or ‘no’ response.

Extraction of the relevant variables from the household datasets was done in stata.

The distance variables, specified as follows: 1km, 5km and 10km were created by converting the geo-referenced household and health facilities data into the above specified

kilometres using a written computer language in visual FoxPro. Structured Query Language, (SQL) was used to write the program. The criteria for choosing distance as a categorical variable and the specified distance levels were as follows:

1. The programming language lacks the capacity to convert the geo-reference data into distance as a continuous variable, hence distance was categorised,
2. The written program did not work well for specified distances less than 1km,
3. The program could be varied to achieve distance levels between ≥ 1km and < 1 km,
4. Finally, the following distance levels were thought off as reasonable enough to ensure that a greater number of the study participants were within a health facility of at least 10km. A total of 1002, representing 65% of the total study participants were within, at least, 10km from a health facility. The remaining 431 study participants representing 35% of the total included for analysis were living in households that were more than 10km from a health facility.

The program works in the following steps:

1. Calculates distance from drug shops, dispensaries and other drug outlets in the Ifakara and Rufiji demographic surveillance coverage areas,
2. Generates spatial blocks for the study coverage Areas. The blocks are of various sizes from 1km to 10km,
3. The spatial blocks are assigned numbers and finally

4. The program generates list of those participants whose households fall within the specified distance (1km, 5km and 10km).

A health facility was defined as a hospital, health centre, clinic or any drug shop, licensed or unlicensed, selling either antimalarials or any type of drug. Thus the variable, 1km represents all those whose households were within 1km from the nearest health facility as defined above. The distance variables of 5km and 10 km also represent all those whose households were within 5km and10km from any health facility respectively .The inclusion of shops that sell any type of drugs was to make sure that all possible sources of antimalarials were captured as those who reported not selling antimalarials might clandestinely intended to do so.

Creation of wealth index for households using the Principal Component Analysis, (PCA) model.

The Principal Component Analysis, PCA, was used to construct socio-economic indices based on household characteristics and ownership of assets. The indices were then used to categorise study participants households into five socio-economic groups or quintiles from the most poor to the least poor.

The following household characteristics and assets were included in the PCA model: floor of the household, walls of the room whether they were locally made or with modern material such as cement, cocking materials such as local or gas cylinders, water source: from a pipe or well, toilet facilities: local or KVIP, source of light: candle, lantern or electricity bicycle, car, motorbike, and animal possessions.

The household characteristics and assets information was transferred from a data base format into stata via stata transfer. The model was based on the presence or absence of each asset or the nature of the housing materials .i.e. each asset was dummied with the response, 1 and 0. If participant had the asset the response was 1, otherwise it was assigned

0. For those with multiples of the same asset type, the "tab generate" command was invoked in stata to generate separate indices for each of the multiple assets as if each was a separate asset. For example, those who had more than one sheep, each sheep was reconstructed as a separate asset. The same procedure was applied to the household characteristics. The "pca" command was run to generate indices for all listed assets. The generated indices were used to categorise participants into five socio-economic groups or quintiles; most poor, very poor, poor, less poor, and least poor.

2.7 Data management

The three data collections instruments; modules A, B and C were transferred into stata using stata transfer, version 7.0 and linked together. Selection of variables and cleaning of the datasets were done in stata. Inconsistent observations were deleted. There were two individuals who had negative age values in the dataset and another participant had 1801 as age in the same dataset. Attempts to rectify these abnormal records were not successful. They were subsequently dropped from the dataset. Values entered for variables that were established to be unreasonably high or low were either deleted from the entire datasets or rectified with the support of thee data manager of the IMPACT household survey.

The geo-referenced health facilities and household datasets were structured differently. These datasets were in Microsoft excel format. Stata transfer, version 7.0, was used to transfer the data into Microsoft FoxPro. Structured Query Language (SQL) was used to convert the geo-referenced data, into kilometres as described above. After the conversion, the data was transferred into stata using stata transfer, version 7.0. This dataset was then merged with the household survey data (modules A, B and C) information using family id

as unique identifier. A copy of the dataset was backed-up in a rewriteable CD, and a flash-drive before proceeding with analysis.

Sample for analysis

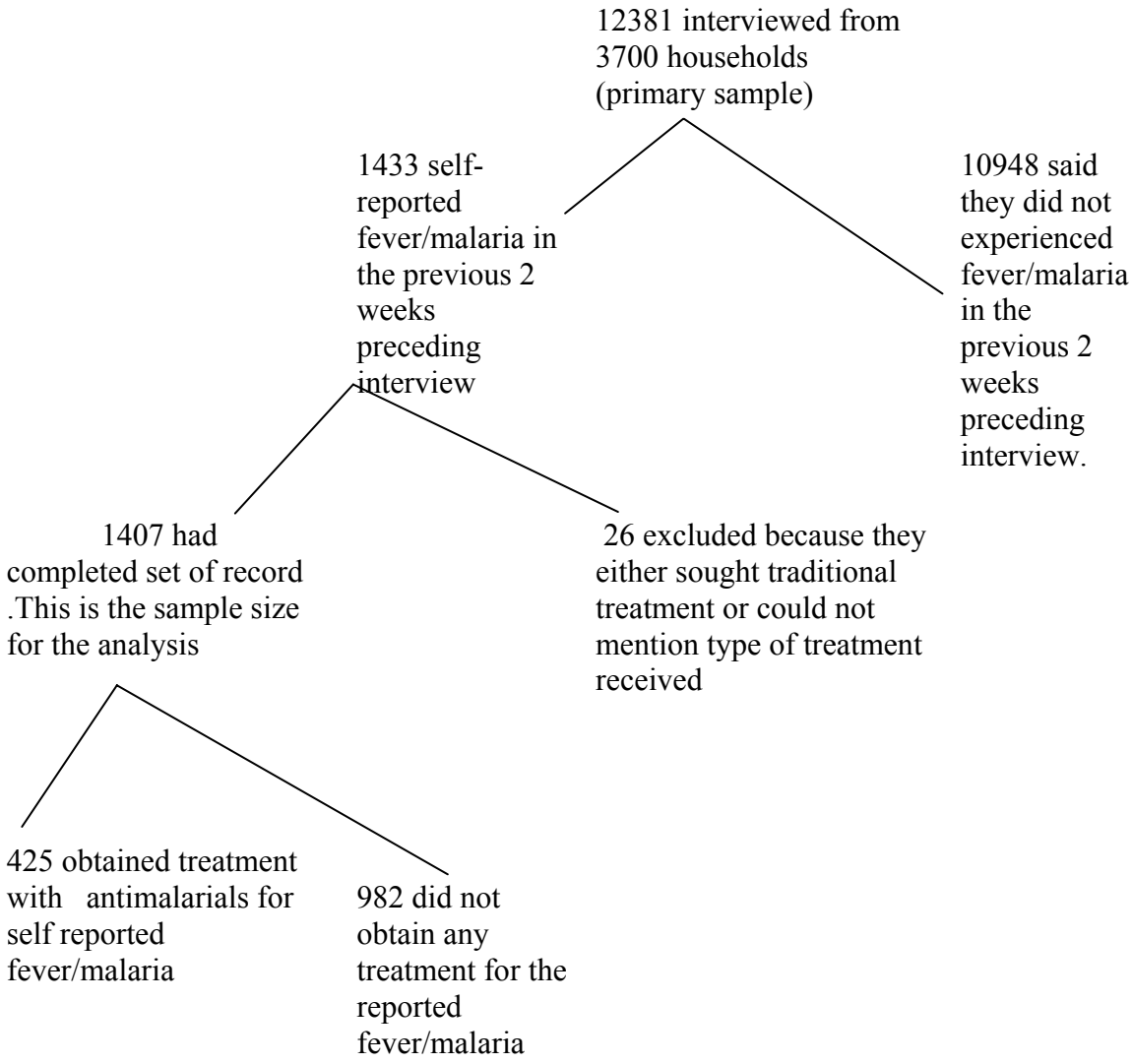


Figure2.1. A flowchart presenting a summary of how the sample for analysis was extracted from the primary study for analysis

2.8 ANALYSIS

Data analysis was done in stata (standard version 9.0, stata corp, Lakeway Drive-USA).The data was surveyset using family-id (same as household) as the primary sampling unit, psu and location, (Rufiji and Kil/Ulanga) as stratum. Sampling weights were fixed based on the final number of household that were included in the analysis to account for the effect of clustering at the household level. Out of the 3700 households sampled, only 820 had people who reported that they had experienced malaria in the last two weeks period preceding the interview. Out of this, 500 households came from Rufiji and 320 households from Kilombero and Ulanga. Therefore, sampling weights were fixed based on these proportions of households .Data on each participant was inversely weighted by their probability of selection.

The analytical strategy was to categorise participants into two groups; those who had reported malaria/fever and had access to any antimalarials for treatment and those who had reported malaria/fever but did not have access to antimalarials for treatment. The proportion of the sexes in each of the study groups was determined using a chi2 test to examine comparability of both sexes at baseline. A P-value of 0.05 or less was considered statistically significant result.

The prevalence of access to antimalarials for treatment of self reported malaria/fever together with the 95% confidence intervals for column percentages were calculated for the different age categories. Graphical representation of the distribution of the reported malaria/fever for the Rufiji and Kilombero/Ulanga valleys were drawn using Microsoft excel, 2003.

2.10 Test of Association

Before fitting survey regression modules**,** test of associations between the outcome variable and the explanatory variables were carried out on 2*2 tables at 5% confidence level to explore possible factors associated with use of antimalarials for treatment of malaria. Proportions of various age groups who used antimalarials for treatment were then tabulated.

2.11 Univariate Logistic Regression Analysis

Univariate svylogit models were first formulated to examine the association between treatment of the reported malaria/fever with antimalarials and the explanatory variables; Sex, age group , Educational level of the household head, Religion of the household head, Tribe of the household, District, insecticide mosquito net use, Socio-economic status, 1km, 5km and 10k from participants household to the nearest health facility.

The outcome variable, access to antimalarials for treatment of malaria is categorical and binary, i.e. whether respondents who reported malaria/fever treated the disease with any antimalarials or not. Before fitting the univariate models the outcome variable was regenerated as a dummy variable with 1 for a yes response and 0 for a no response. Odds Ratios, together with 95% confidence intervals were calculated for all the univariate logistic analysis. For the univariate distance models, the comparison was between participants who fell within the specified distances and those who were outside these distance categories. A P-value of 0.05 or less was considered statistically significant result.

2.12 Multivariate analysis

Multivariate survey logistic regression analysis was then carried to determine factors associated with access to antimalarials for treatment of the reported malaria /fever, while adjusting for all possible confounding factors/variables. Various multivariate svylogit models were explored before arriving at a parsimonious one. Tests of interactions between sex and age group, Socio-economic status and education level of household head, age and education level of household head were carried. The final model was also tested using the "lfit" and the "link" test. Again a P-vaue of 0.05 or less was considered statistically significant.

2.13 Ethical Approval

Ethical approval was given for the use of the IMPACT dataset by the Ifakara Health Research and Development Centre Ethics committee. The IMPACT household survey itself was approved by the same ethics committee. The University of Witwatersrand ethics committee also gave approval for this study. A copy of the findings of this report will be presented to Ifakara Health Research and Development Centre for dissemination to participants of the household surveys, in accordance with research involving human participants and in keeping with agreement of collaboration between the Ifakara Health Research and Development Centre on one hand and the School of Public Health, University of Witwatersrand and the INDEPTH- Network on the other.

CHAPTER 3

3.0 RESULTS

3.1 Descriptive summaries

About 11.6% (1433/12381) of the sample for the household survey reported that they had experienced malaria/fever in the last two weeks preceding the interview. About 1.8% (26/1433) out of these either obtained treatment from traditional sources or could not tell whether they used modern medicine (any antimalarial) for treatment. Therefore, 1,407 individuals were included in the analysis. 41% of these were males while the remaining 59% were females. However, a Chi2 test of association showed no statistical difference between the proportion of males and females in this sample, Pr |Chi2| = 0.907. The under fives year group formed 31% of the total sample size. The youngest participant was 23 days old and the oldest 93 years. Those aged above 50 years constitutes 13% of the total sample size. Table1 presents a summary of the demographic characteristics of the study participants.

There is low level of education among the household heads of study participants even though this may not reflect on the educational situation in the general population in the study area. Among the study sample, 31% lived in households where the head of that household had never been to school, while 20 % of the participants' heads of household had less than seven years of primary education. However, 40% of them came from households where the head of the household completed primary education. But the level of education among household heads declined sharply to about 7% in the Ordinary-level and above education category i.e 7% of the study participants' heads of household had formal education up to the ordinary level or beyond.

About 68% of the study participants came from households where the head practices Islam and 30% Christianity. This is quite a difference but it does not reflect on the true proportional representation of Islam and Christianity in the general population of Tanzania, as both religions are reported to be equally represented in many parts of the country though it may vary slightly from one area to another.(Dr.Rose Nathan, head of the Ifakara DSS: personal communication).

About 58% of the study participants were sleeping under treated insecticide bed nets in the two weeks preceding the interview and up to the time of the interview. The remaining 42% were not using mosquito nets to protect themselves from mosquitoes and other insects' bites.

Table3.1: Socio-demographic characteristics of study participants.

Variable	Category	No	% representation in the sample
Sex	**Total**	**1407**	
	Male	576	41
	Female	831	59
Age			
	Total	**1407**	
	0-4	441	31.34
	5-10	251	17.84
	11-16	78	5.54
	17-22	92	6.54
	23-28	83	5.9
	29-34	85	6.04
	35-40	86	6.11
	41-46	62	4.41
	47-52	40	2.84
	Over 52	189	13.43
Education level of household head			
	Total	**1407**	
	None	449	32
	incomplete primary	294	21
	complete primary	565	40
	O-level+	99	7
Socio economic status			
	Total	**1407**	
	Most poor	226	16
	Very poor	300	21
	Poor	265	18
	Less poor	315	23

	least poor	301	22
Religion of household head			
	Total	**1407**	
	Christianity	434	30.82
	Islam	965	68.54
	Local/none	8	0.64
Mosquito bed net use			
	Total	**1407**	
	Yes	816	58.03
	No	591	41.97
Location/District			
	Total	1407	100
	Rufiji	860	61.08
	Kilombero	304	21.59
	Ulanga	243	17.33
Tribe of household head			
	Total	**1407**	
	Ndama	59	4
	Ndengereko	597	42
	Pogoro	143	10
	Others	608	44
Distance to Health facility	Total	**1407**	
	1km	285*	
	5km	556*	Concurrent with 1km
	10km	**914**	65% are at least 10km from a health facility
	>10km	**493**	35% fall outside 10km from a health facility

*Participants who fall within 10km from a health facility are also within 1 km and 5km from the same health facility.ie they run concurrently.

Reported malaria/fever distribution across age groups

Out of 12381 individuals interviewed, 1433 said they had experienced malaria or fever in the last two weeks preceding the interview. This constitutes 11.6% (1433/12381) of the total number of people interviewed. Twenty six, (26) of those who reported malaria/fever either sought traditional treatment or could not tell whether they had used “modern medicine” (any antimalarial for treatment). These were not included in subsequent analysis

after calculating the prevalence of malaria/fever since it was not possible to tell the sort of treatment they received.

Prevalence of malaria/fever in the under- five years age group is 31.49%.This is the highest among all the age groups. Prevalence of the illness generally decreases across age groups, from about 18% among those between 5 and 10 years to about 3% in those aged between 42 and 52 years. Figure3.1 below illustrates the reported malaria/fever against age group.

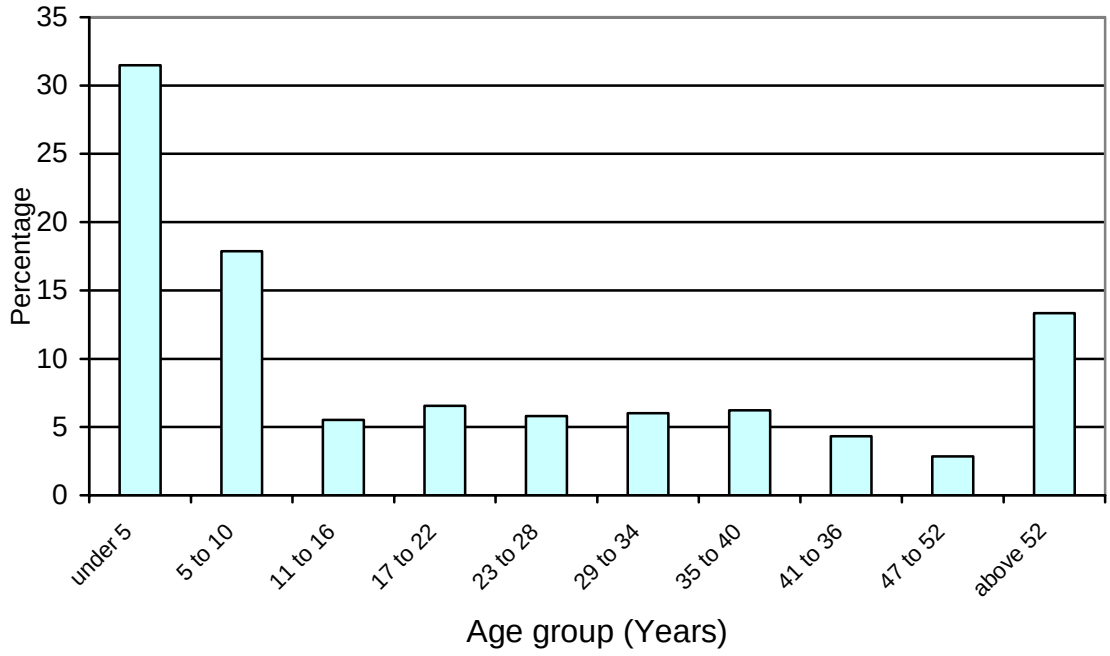


Fig 3.1: Distribution of reported malaria/fever across age groups in the Kilombero/Ulanga and Rufiji valleys in Tanzania, 2005

3.3 Prevalence and pattern of treatment across age groups.

Out of the 1407 participants who could tell whether they had modern medicine or did not take any medication even though they had malaria/fever, only 425 obtained treatment with an antimalarial. This represents 32 % (95% CI: 29.29%- 34.89%) of the total sample.

Treatment seems to fluctuate across the various age groups. However, a Pearson chi2 test (Pr =0.0239) , of association showed treatment is statistically associated with age.

Table 3.2 presents the proportion of each age group obtaining treatment. There are two age groups: 23 to 28 and 35 to 40 years that obtained more treatment than the other age groups. The general trend seems to suggest that treatment increases with age group.

About 36 % of those obtaining treatment had done so with Sulfadoxine Pyreminthamine, SP, as a monotherapy and 44% treated the reported malaria with SP+ Artesunate combination. 8% used quinine while 11 % used Amodiaquine only .The remaining 1% used chloroquine.

Table 3.2: Proportion of age group obtaining treatment for self reported malaria/fever

Age group/yrs	No	% obtaining treatment (%)	95% CI for column percentages
Total	**425/1407**	**32.03**	**29.29, 34.89**
Under fives	113/441	27.01	22.7, 31.8
5-10	65/251	29.58	23.69, 36.24
11-16	18/78	25.21	16.12, 37.15
17-22	29/92	33.02	23.94, 43.57
23-28	36/83	44.61	34.03, 55.71
29-34	29/85	36.54	26.17, 48.32
35-40	34/86	42.89	32.79, 53.62
41-46	20/62	32.18	21.55, 45.06
47-52	14/40	33.94	20.87, 50.02
Over 52	67/189	36.46	29.68, 43.83

Univariate logistic regression analysis.

Analysis with univariate survey logistic regression models revealed that, age group, bed net use, education level of household head, socio-economic status, tribe of participant's household head and the district of the participant are all statistically associated with treatment of malaria.

Those aged between 23 and 28 years were 2.17 times more likely to obtain treatment than those below fives years of age, [unadjusted OR=2.17, P-value=0.002.(95% CI: 1.326,3.575).The 35 to 40 years age group were 2 times more likely to obtain treatment than the under five year group.[unadjusted OR=2.01, P-value= 0.004, (95% CI:1.257,3.277),] while study participants who were aged above 52 years were 1.55 times more likely to obtain treatment than the under fives. [Unadjusted OR=1.55, P-value=0.026, (95% CI: 1.055, 2.2792)]. However, the difference between the other age groups and the under fives were not statistically significant on the univariate model.

With regards to education, study participants whose household heads had some education but did not complete primary education were 1.59 times more likely to obtain treatment with antimalarials than study participants whose household heads had never been to school, [unadjusted OR=1.59, P-value= 0.011, (95% CI: 1.110 ,2.2767)].Participants whose head of household had completed primary education were 1.8 times more likely to seek treatment compared to those whose household heads had never been to school, [unadjusted OR= 1.80, P-value= 0.0001, (95% CI: 1.321,2.464)]. For those whose household heads had either completed Ordinary level (O-level) or above the O-level were 2.5 times more likely to seek treatment for the reported malaria/fever than those whose household heads had never been to school, [unadjusted OR= 2.51, P-value=0.001, (95%

CI: 1.429, 4.400).However, There is no statistical evidence to support an association between sex and treatment of malaria.

The univariate analysis also revealed that there is an association between district location and treatment of malaria. Participants from Kilombero and Ulanga districts were less likely to seek treatment compared to participants from the Rufiji district. Participants from the Kilombero district were 0.33 (33%) less likely to obtain treatment, [unadjusted OR, =0.33, P-value=0.0001, (95% CI: 0.245, 0.450)] compared to participants from the Rufiji district who were assigned comparison odds of 1. Participants from the Ulanga district were 0.46 (46%) less likely to obtain treatment compared to those from the Rufiji district. [OR=0.46 P-value=0.0001, (95% CI: 0.309, 0.700)].

Tribe was also statistically significant in the univariate analysis. For participants who belong to the Ndengereko tribe, they were 0.411 (41%) less likely to treat their malaria/fever ailment with antimalarials compared to the Ndama ethic group. [Unadjusted OR=0.411, P-value=0.005, (95% CI: 0.221, 0.765)]. There was no statistical evidence to support the differences between the other tribes and the Ndama tribe, which was used as the comparison tribe. The odds ratios together with 95% confidence intervals of the univariate models are tabulated in table 3.3 below.

Socio economic status of the study participants was also found with statistical evidence, in the univariate analysis, to be associated with treatment of self reported malaria/fever with any antimalarial. The least poor were 1.7 times more likely to obtain treatment compared to the most poor group, [unadjusted OR= 1.7, P-value=0.021 (95% CI: 1.083, 2.636] while the less poor were 1.6 times more likely to treat compared to the most poor, [unadjusted

OR=1.60, P-value=0.034, (95% CI:1.0376, 2.490).The difference between the poor and the most poor as well as between the very poor and the most poor have no statistical significance on the univariate model .

Participants who were sleeping under insecticide treated mosquito's bed nets were 1.71 times more likely to obtain treatment than those who were not using insecticide treated mosquitoes' bed nets.[unadjusted OR=1.71, P-value=0.001, 95% CI: 1.312, 2.220)].

Table 3.3: Odd Ratios together with 95% confidence intervals for univariate analysis examining the association between treatment of the reported malaria and explanatory variables.

Variable	OR	P-value	95% CI
Age group			
under fives	1		
5-10	1.13	0.498	0.787 1.637
11-16	0.91	0.757	0.503 1.648
17-22	1.33	0.263	0.806 2.200
23-28	**2.18**	**0.002**	1.326 3.575
29-34	1.56	0.098	0.922 2.625
35-40	**2.03**	**0.004**	1.257 3.277
41-46	1.28	0.402	0.716 2.297
47-52	1.39	0.359	0.688 2.800
Over 52	**1.55**	**0.026**	1.055 2.279
Sex of study participant			
Male	1		
Female	1.01	0.919	0.798 1.284
Education level of household head			
None	1		
Incomplete primary	1.59	0.011	1.110 2.276
Primary	**1.80**	**0.0001**	**1.321 2.464**
O level+	**2.51**	**0.0001**	**1.429 4.400**
Socio-economic status			
most poor	1		
very poorer	1.28	0.279	0.821 1.985
poor	1.48	0.091	0.939 2.320
Less poor	**1.60**	**0.034**	**1.038 2.490**

Least Poor	**1.69**	**0.021**	**1.083 2.636**
Net use			
No	1		
Yes	1.71	0.001	1.312 2.220
Religion of household head			
Christianity	1		
Moslem	0.47	0.001	0.358 0 .613
Local	1.36	0.649	0.361 5.129
Tribe of household head			
Ndama	I		
Pogoro	0.48	0.058	0.224 1.026
Ngoni	1.62	0.258	0.703 3.713
Bena	1.91	0.146	0.798 4.544
Ngindo	0.60	0.181	0.286 1.266
Hehe	1.28	0.513	0.611 2.674
Ndengereko	**0.41**	**0.005**	**0.221 0.765**
Makonde	0.46	0.138	0.164 1.286
Matumbi	0.83	0.637	0.384 1.797
unknown	0.75	0.409	0.383 1.478
District			
Rufiji	1		
Kilombero	**0.33**	**0.0001**	**0.245 0.450**
Ulanga	**0.46**	**0.0001**	**0.309 0.700**
Distance of a household to the nearest health facility			
1km	1.26	0.072	0.979 1.631
5km	1.06	0.637	0.821 1.380
10km	1.04	0.602	0.901 1.196

3.4. **Multivariate analysis.**

The results of the multivariate analysis are summarized in table 3.4 below. After adjusting for age group, sex, socio-economic status, educational level of household head, religion of household head, the tribe of household head, and the district of the participant, only the age group, educational level of the household head, and the district location remained statistically significant in the final multivariate model. In the model, participants who were between 23 and 28 years old were 2.18 times more likely to obtain treatment than the under five years old, [adjusted OR = 2.18, P-value= 0.005, (95% CI: 1.260, 3.774)].

Participants aged between 35 and 40 years were also 2.24 times more likely to obtain treatment than the under five year age group, [adjusted OR=2.24, P-value=0.002, (95% CI: 1.347, 3.729)] while participants above 52 years were 2.36 times more likely to obtain treatment, [adjusted OR=2.36,P-value =0.001, (95% CI:1.529, 3.631)].The difference between the other age groups and the comparison age group; the under fives were not statistically significant.

Participants whose household heads had education up to Ordinary level or beyond the ordinary level were 1.94 times more likely to obtain treatment than participants whose household heads had never been to school. [Adjusted OR= 1.94, P-value=0.036, (95% CI: 1.044, 3.588)].

The multivariate analysis also showed that participants from the Kilombero/ Ulanga districts were less likely to obtain treatment compared to those from the Rufiji district. Those from the Kilombero district were 0.5 (50%) times less likely to seek treatment compared to those from Rufiji district, which had a comparison odds of 1, [adjusted OR=0.5, P-value=0.026, (95% CI: 0.268, 0.918)], while those from the Ulanga district were 0.67 (67%) times less likely to obtain treatment compared to those from Rufiji district, but this is not statistically significant after adjusting for all possible confounding factors.

Socio-economic status, tribe of the household head, religion of the house head and bed net use were not found, on the multivariate analysis, to be statistically associated with obtaining treatment for malaria/fever. Also the multivariate analysis showed that distance to a health facility is not a predictor of treatment. Participants who lived within a kilometre

away from the nearest health facility were 1.25 times more likely to obtain treatment than those whose households were far more than 1km away from the nearest health facility but this was not statistically significant after adjustments for possible confounders, [adjusted OR=1.25, P-value=0.169, (95% CI:0 .910, 1.710)],. Participants whose households were within 5 kilometres from the nearest health facility were less likely to seek treatment,[adjusted OR=0.94, P-value=0.708, (95% CI: 0.693, 1.283)] while those who lived within 10 kilometres from a health facility were 1.08 times more likely to obtain treatment compared to those living beyond 10 kilometres from a health facility, but these findings were not statistically significant. [OR=1.08, P-value=0.331 (95% CI: 0.930146, 1.256], after adjustments for possible confounders.

Table3.4: Odd Ratios together with 95% confidence intervals for multivariate analysis examining the association between treatments of reported malaria and explanatory variables.

Variable	OR	P-value	95% CI
Age group			
Under fives	1		
5-10	1.18	0.404	0.798, 1.750
11-16	1.13	0.700	0.597, 2.157
17-22	1.67	0.071	0.957, 2.909
23-28	2.18	**0.005**	1.260, 3.774
29-34	1.45	0.176	0.842, 2.55
35-40	2.24	**0.002**	1.347, 3.729
41-46	1.45	0.268	0.753, 2.776
47-52	1.61	0.224	0.748, 3.460
Over 52	2.36	**0.001**	1.529, 3.631
Sex of study participant			
Male	1		
Female	0.987938	0.927	0.761, 1.283
Education level of household head			
None	1		
Incomplete primary	1.18	0.427	0.786, 1.764
Primary	1.36	0.098	0.944, 1.970
O level+	1.94	0.036	1.044, 3.588

Socio-economic status			
Poorest	1		
Poorer	1.28	0.315	0.791, 2.071
Pro-poor	1.43	0.147	0.880, 2.342
poor	1.54	0.081	0.949, 2.506
Least Poor	1.42	0.194	0.835, 2.432
Net use			
No	1		
Yes	1.07	0.719	0.748, 1.523
Religion of household head			
Christianity	1		
Moslem	0.74	0.237	0.447, 1.220
Local	2.65	0.214	0.570, 12.339
Tribe of household head			
Ndama	1		
Pogoro	0.71	0.430	0.305, 1.660
Ngoni	2.25	0.081	0.905, 5.588
Bena	1.94	0.149	0.787, 4.795
Ngindo	1.13	0.790	0.466, 2.731
Hehe	1.22	0.610	0.571, 2.594
Ndengereko	1.01	0.981	0.431, 2.369
Makonde	0.96	0.942	0.296, 3.094
Matumbi	2.03	0.129	0.814, 5.065
55	0.79	0.510	0.388, 1.602
District			
Rufiji	1		
Kilombero	0.50	0.026	0.268, 0.918
Ulanga	0.67	0.129	0.400, 1.124
Distance of a house hold to the nearest health facility			
Not within	1		
Within 1km	1.25	0.169	0.910, 1.710
Not within	1		
within5km	0.94	0.708	0.693, 1.283
Not within	1		
within10km	1.08	0.331	0.926, 1.256

CHAPTER FOUR

4.0 DISCUSSION

This study intended to examine the association between access to antimalarials for treatment of reported malaria/fever and household level variables, distance to health facilities and demographic variables in the Kilombero/Ulanga and Rufiji valleys, areas that cut across three districts in Tanzania.

In the primary study of the household survey, an overall 11.6% (1433/12381) of the total number of respondents reported experiencing malaria/fever in the two weeks recall period preceding the interview. This figure, 11.6%, representing prevalence of malaria/fever in the study areas in 2005 may represent an underestimation or over estimation as the specificity of the case definition of malaria in this study could not be ascertained. A study by Patrick Kachur etal, in 2004 on prevalence of malaria among clients seeking treatment for fever or malaria at drugs store in rural Tanzania showed that 24% of the people who experienced fever and reported to drugs stores to purchase antimalarials were actually diagnosed with malaria even though 10.7% of them had reported before that they had malaria/fever[23].Some of the reported fever could be due to either upper respiratory infections, thereby inflating the prevalence of malaria/fever during this study. On the other hand, it is possible those who reported that they did not experience malaria/fever might actually had malaria for the simple reason that they could not recognise it or might have forgotten that they had experienced one some few days back.

Some people, especially in rural communities, have different perceptions and understanding of malaria or fever. While some may recognise fever as a sign of possible malaria infection, others may not recognise the symptoms of malaria and may attribute

fever to some causes. Malaria is perceived in the Dangbe community in Ghana as a disease caused by excessive contact with external heat which upsets the blood equilibrium[24] .

A cross- sectional survey in the Kibaha district in Tanzania on care-givers perceptions of clinical manifestations of childhood malaria in holo-endemic rural communities in Tanzania revealed that only 15.7% (68/432) of the care givers, presenting their children with severe malaria attacks mentioned convulsion as symptoms of severe malaria.[25] However, there is evidence of correlation between traditional symptoms and laboratory confirmation of malaria.[26] Thus, figures reported by different studies on self reporting of malaria vary from one setting to another depending on a variety of factors including local believes and altitudes towards the symptoms of the disease.

Analysis in this study has revealed that 32% of all those who had reported malaria/fever obtained treatment with any antimalarial. The analysis also revealed that treatment of self reported malaria/fever with antimalarials increased across age groups.

Studies on treatment of malaria/fever with antimalarials have found mixed results in many African countries. A community based cross- sectional survey in the Tulu District in southern –central Ethiopia in 2003, found treatment seeking for malaria to be similar across age groups[20]. The study further revealed that 14% of a total of 12, 225 interviewed had reported malaria within a two weeks recall period preceding the interview. Out of those who reported malaria, 13% reported seeking treatment within 24 hours of the onset of fever[20.] Another household survey in Togo revealed that 20% (95% CI: 20%-27%) of under five children obtained treatment with antimalarials obtained from a health centre

while 83% of the remaining children interviewed obtained treatment at home with an antimalarial[21.]

According to the Africa malaria report, 2003, surveys in nineteen African countries revealed that half of the febrile children living in malaria endemic countries seek treatment. The same Africa malaria report, 2003, also states that surveys in twenty eight African countries showed that treatment of fever in children less than five years of age is about 42%, though source of care seeking differs from place to place, and that more than 80% of the respondents used Chloroquine.

The findings of this study on prevalence of treatment, (32%), and pattern of treatment across age groups for the reported malaria/fever in the Rufiji and Kilombero/Ulanga valleys differ from the results of the surveys that were carried out in Ethiopia and Togo. There is also difference between the findings here and what is presented by the WHO Africa malaria report, 2003. Many reasons may account for this .At the time of the surveys compiled by the WHO Africa malaria report; many Africa countries were still using chloroquine as a first line drug for treatment of uncomplicated malaria. This is supported by the Ethiopian survey which reported that 88% of respondents had used chloroquine to treat self reported feve[20].

By 2001, Tanzania had replaced chloroquine with Sulfadoxine Pyreminthamine (SP) as a first line drug for treatment of uncomplicated malaria[11.] Chloroquine was much more affordable than SP and other antimalarials. It may therefore, be suggested that the wide availability and affordability of chloroquine at the time of the surveys reported by WHO Africa malaria report, 2003 might have accounted for the higher prevalence of treatment of

self diagnosed fever than what is reported in this study. The analysis here may however suggest that the replacement of chloroquine with SP by Tanzania might have gained low acceptance. However, this finding does not present conclusive evidence to support this assertion.

The higher coverage of treatment for reported malaria/fever in this study compared to the one conducted in Togo maybe due to the fact that this study was carried out in areas served by demographic surveillance systems where a lot of research activities are taking place including malaria programmes .For example, during this study in 2005, there was a piloting programme on combination therapy using Sulfadoxine Pyreminthamine, SP and Artesunate,(SP+Art) in a clinical facility in the Rufiji district. Intermittent Preventive Treatment of Pregnant women, ($IPT_{P)}$ using SP, is also encouraged in the two demographic surveillance areas. These programmes might have accounted for the slightly higher coverage of treatment for the disease. There was however, limited information on the dataset used for this report to allow for adjustment of the effect of those intervention studies on this study. It was not possible to know from the dataset the number of study participants who were also enrolled either in the SP+Art combination therapy piloting programme or the intermittent preventive treatment for pregnant women in the Rufiji area.

A significant finding in this report is the inverse relationship between age and treatment of malaria/fever. The under fives have the greatest burden of malaria, yet receive less treatment compared to those above five years of age. This revelation has significance for public health intervention programmes to achieve national malaria treatment targets. One would expect the age group with the greatest burden of malaria (under fives) to receive

more attention .However; this is not the case in the Kilombero/Ulanga and Rufiji areas as revealed by this study.

Twenty seven percent, (27%) of the under fives obtained treatment with antimalarials. This certainly does not present a good situation for treatment of malaria/fever in the Rufiji and Kilombero/Ulanga valleys in Tanzania. Coverage of treatment is low compared to what is reported by the WHO on treatment of febrile children less than five years of age in many Africa countries.

Some factors such as perceptions and altitudes have been identified to influence care seeking for under five children. A study by Peter O Ogunjuyigbe, 2004 title: "Under- five mortality in Nigeria: Perceptions and altitudes of the Yorubas towards the Existence of ''Abiku'' ", established that a lot of people in the study area did not have a clear perception of illness and treatment for children. The study further found out that some people attached under-five deaths to "Abiku" spirit.[27].Another study by Alister C. Munthali in Malawi, 2005, revealed that treatment of malaria for under fives were delayed due to poor perceptions about the aetiology, treatment and prevention of malaria[28].In the light of this it may be argued that issues of perception and altitudes towards care seeking for under five children may partly account for the low level of treatment for under five children in the Kilombero Ulanga and Rufiji valleys.

The mismatched between treatment and age group presents a worrisome picture as those who are mostly affected (under fives) are not the ones who seek treatment most for malaria/fever. Several reasons may account for this in the Rufiji and Kilombero/Ulanaga valleys. A possibility exists that the 23 to 28 years groups and the 35 to 40 years groups in

the Rufiji and Kilombero/Ulanga valleys were seeking treatment for fever due to other diseases such as upper respiratory infections rather than for malaria. The same reasoning could be extended to those aged above 52 years old category. The intermittent preventive treatment of malaria in pregnant women, IPT_P programme that was running at the time of this study could have also influenced the age pattern of care seeking for malaria in the study area. If more pregnant women were taking part in the IPT_P programme and were sampled for this study that would likely influence the pattern of obtaining treatment of malaria/fever with antimalarials across the various age groups as the pregnant women would more likely fall between 23 to 28 and 35 to 40 years. However, as stated above, limited information was available in the dataset used for this report to allow for stratified analysis to determine the effect of pregnant women taking part in the Intermittent Preventive Treatment of Malaria (IPT_P) with SP on the finding of this report.

The findings of this study that socio-economic status is not associated with treatment of malaria/fever is inconsistent with the findings of a study by Kachur et al, 2006 in Tanzania. They found treatment of self reported fever to be associated with socio-economic status in Ifakara, one of the areas where this study was carried out.

The relationship between socio-economic status and health seeking depends to a large extend on the household assets that go into the principal component analysis (PCA model) and the variation of those assets from one household to another. Many have sought to add household living standards to the PCA models to construct indices for wealth index classification. Thus, the different approaches to the PCA analysis could account for differences in the relationship between socio-economic status and health seeking for treatment of malaria/ever. For examples, if the variations of assets across the quintiles

gradients are not much, the differences between the better ranked and the poorly ranked socio-economic groups will not be much and therefore, will not reflect on the pattern of care seeking.

Education level has been found, in many studies, to be associated with care seeking. A study in Ethiopia showed that mother's health seeking behaviours for ill babies improve with increase in mother's educational level and improved socio-economic status of the mother/caregiver[29]. The findings of this study are therefore, consistent with what have been known in other areas about the relationship between educational level and care seeking.

It is quite reasonable to understand that participants from the Rufiji district were more likely to obtain treatment for malaria/fever than participants from the Kilombero/ Ulanga districts as the impact of the combination therapy piloting programme, that was going on in the Rufiji district at the time of this survey on the findings of this report cannot be ruled out. As stated above, adequate information did not exist to quantify this effect. However, one cannot rule out the role of the differences between Rufiji and Kilombero/Ulanga districts in terms of health facilities. Rufiji is relatively endowed than the Kilombero/ Ulanga districts in terms of health facilities. More health facilities in the Rufiji district might have accounted for more of the study participants obtaining treatment there than those from Kilombero/ Ulanga districts.

From the multivariate analysis, distance of a household to the nearest health facility could not predict treatment of the reported fever/malaria in the Kilombero/Ulanga and Rufiji valleys. Literature on the influence of distance of households to health facilities on treatment of malaria/fever is scanty. However, some studies have found household distance

to health facilities to be a determining factor in health care seeking**.** For example, a study in Malawi by Lawrence Kazembe, Immo Kleinsmchidt and Brian L Sharp, 2006 established malaria case fatalities to be related to distance of participants place of residence to health facilities. The study showed that areas far from health facilities were associated with increased risk of mortality while areas closer to health facilities were associated with reduced risk of mortality[30].

Another study in Kenya by Peter W.Gething etal, 2004 also found out that utilization of health facilities decreased slightly with increasing distance of participants' place of residence to health facilities up to 6 kilometres[31].

However, Mathew Jewett, 2001[32] on "malaria expenditure analysis: A Case Study of Tanzania," reported that 95% of Tanzanian population live within 5km of a health facility. This indicates that there is fair equitable distribution of health facilities in Tanzania. If a large segment of the study participants are living within the same or almost the same distance from health facilities, it is logical to suggest that this may produce a levelling effect and may not be a predictive factor in terms of who obtains treatment for malaria/fever.

4.1 Limitations of the study.

The study was based on both self reported and medically diagnosed episodes of malaria experienced in the previous two weeks prior to the interview. There was no way of verifying whether respondents correctly reported their malaria experiences in the reference period .i.e. the case specific definition of malaria could not be ascertained in this study. However, the routine DSS activities collect information on use of Sulfadoxine

Pyreminthamine/Fansidar for treatment of malaria during census rounds. The data for this study was also collected by the same fieldworkers who had been collecting the DSS data. Therefore, the data used for this report is much more accurate than similar studies carried out in areas without routine data collection activities.

This is secondary data analysis. Therefore, options were limited in the design and choice of variables examined. For example, variables on education level were collected from only the household head but not on individual level. This limits the capacity of this study to look at how education level influences treatment at individual level. Also factors such as who makes the decision and provides the resource for a child to be treated for fever/malaria could not be investigated because variables on these were not collected by the primary study. Nonetheless, this study provides valuable insights into factors that affect treatment of malaria in rural communities. It also provides information that could be used to better plan and design similar studies in different settings.

There is recall bias in this report. Participants were asked questions based on a two-week recall period. Participants would therefore, not vividly remember whether they actually had malaria/fever in the last two weeks preceding the interview. This will certainly affect the quality of this report. However, the two week recall period is the reference period used by WHO surveys and adopted by many researchers for similar surveys. Therefore, findings in this report are of comparable quality.

Variables that were not measured during the survey, for example, education level at the individual level would have certainly introduced residual confounding into this study. The association between treatment of malaria/fever with antimalarials and the socio-

demographic variables and distance to health facilities might have been influenced by unknown or unmeasured variables such as educational level of the participants. These possible confounders which were either unforeseen or could not be measured limits the findings of this study. However, the effect of residual confounding would not spuriously affect the result of this study. Also it was however, envisaged that a greater number of study participants likely to report malaria/fever would be the under five years children. Thus, measuring education level of under fives would not make much sense since one does not expect under fives to attain any meaningful level of education and more so these under fives would not be expected to take or influence decision making on treatment of malaria/fever. Measurement errors introduced during the surveys would have also introduced residual confounding and this would have affected the result of this study .In rural communities many people do not accurately report their age. Incorrect age reporting would have also introduced residual confounding.

The inability of the programming language that converted the geo-referenced data into distance variables to measure distance as a continuous variables limit the capacity of this study to examine or explore the effect of distance as a continuous variable on the use of antimalarials for treatment of malaria/fever. About 35% of the study participants households were estimated to be beyond 10km from a health facility. Due to limitations of the program, the treatment status of the 35% of the study participants could not be determined. This might have confounded the relationship between distance and treatment of malaria/fever with antimalarials.

CHAPTER 5

5. CONCLUSION AND RECOMMENDATION

5.1 Conclusion

This study has established that treatment of malaria/fever vary according to age and educational level of the household head in the Rufiji and Kilombero valleys. The district from where the participating individual comes could also predict treatment.

The mismatch between the pattern of malaria/fever across age groups and treatment represents a significant finding with far reaching implications for public health policy. It is expected that the age group with the greatest burden of malaria/fever would receive more attention. This, however, is not the case in this study. This revelation will be important in up-scaling of antimalarials including combination therapy policy formulation and implementatition in Tanzania and many malaria endemic Africa countries. The finding certainly has implications for achieving the millennium development goals of halving malaria mortality by 2015 at 1990 levels as more attention needs to be focused on the under five children to make any meaningful reduction on malaria mortality. But more studies need to be carried to establish if this is the trend in the Kilombero/Ulanga and Rufiji area or an isolated finding.

It must also be stated that the illiterate populations as well as the under fives age bracket especially in rural Africa communities will have to be targeted in malaria treatment and preventive programmes to reduce the continent's malaria burden, a move crucial to the achievement of two key millennium development goals: 1) reduce by two thirds the mortality rate of under five children by 2015 and 2) halt and begin to reverse the incidence of malaria by 2015.

5.2 Recommendations

It is recommended that consideration is given to the findings of this study for any plan for the up-scaling of combination therapy or any malaria treatment programme in the communities surrounded by Kilombero/Ulanga and Rufiji valleys. However, further research needs to be carried out to validate these findings as many factors are known to affect treatment of malaria/fever. For example, it may be more useful to consider community perceptions and altitudes towards malaria diagnosis and treatment. Integrating a qualitative approach into quantitative models will present a holistic and probably a clearer picture on how rural communities recognise and seek treatment for malaria with antimalarials. This will be crucial for malaria treatment policies.

The impact of direct cost of antimalarials on access to antimalarials for treatment of malaria/fever will have to be considered in multinomial models in future research so that a greater picture of factors that affect treatment of malaria/fever can be presented. Households may have certain assets which are not immediately accessible to meet pressing health needs. Therefore, household assets meant for creation of wealth index will have to be carefully chosen. Family income and other assets which are more likely to be used to meet pressing needs will have to be considered for PCA analysis rather than household characteristics which are likely not to reflect on how a household meets medical expenses.

References:

[1] World Malaria Report, 2005
http://www.rbm.who.int/wmr2005/html/1-2.htm
(Date accessed: 02/07/2007)

[2] The Abuja Declaration on roll back malaria in Africa.

African summit on the Roll back Malaria, 25th April, 2000, Abuja Nigeria.

http://www.ihn.info/popups/articleswindow.php?id=40

(Accessed date: 14/07/2007).

[3] Stephen M Magesa, Christian Lengeler, Don DeSavigny, Jan E Miller, Ritha JA Njua, Karen Kramer, Andrew Kitua and Alex Mwita: Creating "an enabling environment" for taking insecticide nets to national scale: the Tanzanian experience. Malaria journal, 2005.vol 4;page 34

http://www.malariajournal.com/content/4/1/34

(Date accessed: 24th March, 2008)

[4] .Jowet Mt and Miller NJ,The financial burden of malaria in Tanzania: Implication for future government policy. Int J of Health Planning and management. 2005 Jan/March; 20(1):67-84.

[5] Ministry of Health and Social welfare, District Health Services Profile, Tanzania; A chart Book of Selected Health and Demographic indicators, 2005.

[6] D N Durrheim and H A Williams: Assuring effective malaria treatment in Africa: drug efficacy is necessary but not sufficient. Journal of Epidemiology and Community

Health, 2005, Vol 59; pages 178-179.

[7] The use of antimalarialantimalarials. Report of WHO informal consultation.13-17 November, 2000.Page18

http://www.who.int/malaria/cmc_upload/0/000/014/923/use_of_antimalarials.pdf
(Date accessed:13/07/2007

[8] World Health Organization Facts on ACTS (Artemisinin Based Combination Therapy, January, 2006 update.

http://www.rbm.who.int/cmc_upload/0/000/015/364/RBMInfosheet_9.htm

(Date accessed: 02/07/2007).

[9] Tarimo, D.S Lwihula G K, Minjas, J N and Bygbjerg C I: "Mothers perception and Knowledge on childhood malaria in the Holendemic Kibaha District, Tanzania**:** Implications for malaria control and the IMCI strategy, March 2000, vol 5;pages 179-184.

http://www.blackwell-synergy.com/doi/abs/10.1046/j.1365-3156.2000.00537.x

(Date accessed: 10/07/2007).

[10] The Africa Malaria Report, 2003

http://www.rbm.who.int/amd2003/amr2003/ch1.htm

Date accessed: 02/07/2007

[11] Trape JF: The Public Health Impact of Chloroquine resistance in Africa. 2001 Am J.Trop.Med.Hyg; pages 12-17

[12] Mirjam Sconfield,Isabel Barreto Miranda,Mirjam Scunk Ibrahim Maduhu,Leonard Maboko,Micheal Hoelscher, Nicole Beres-Riha, Andrew Kitua and Thomas Loscher: Molecular surveillance of drug resistance associated mutations of Plasmodium falciparum, in South West Tanzania, Malaria journal, 15 January, 2007,vol 6;page 2.

[13] Kefas Muggitu, Salim Abdulla,Nicole Falk, Honorati Massanja, Ingrid Felger, Hassan Mshinda,Hans-Peter Beck, and Blaise Genton: Efficacy of Sulfadoxine Pyreminthamine, in Tanzania after two years as first line drug for uncomplicated malaria: assessment protocol and implications for treatment policy strategies. Malaria journal, November, 2005.vol 4; page 55.
http://www.malariajournal.com/content/4/1/55(Date accessed: 12/07/2007).

[14] World Health Organization, Guidelines for the Treatment of Malaria;2006
http://www.who.int/malaria/docs/TreatmentGuidelines2006.pdf
(Date accessed: 12/07/2007).

[15] S P Kachur, C. Black, S. Abdulla AND C Goodman: Putting the genie back into the bottle? Availability and presentation of Oral artemisinin compounds at retail pharmacies in Urban Dar Es- Salam" Malaria journal.2006, vol 5; page 25

[16] World Health Organisation, 2003; Access to Antimalaria medicines, improving the affordability and financing of artemisinin- based combination Therapies.
http://www.who.int/malaria/cmc_upload/0/000/016/745/37268_ACT_final2.pdf
(Date accessed:12/07/2007)

[17] Asenso Okyere, Dzator: household cost of seeking malaria care in Ghana. A retrospective study of two districts in Ghana.,Scocial science & medicine, September, 1997: vol 45 (5) ; pages 659-667 .

[18] Njau JD, Goodman C, Kachur SP, Palmer N, Khatib R A, Abdull S, Mills, A and Bloland P. Fever treatment and Household Wealth: The challenge posed for rolling out combination therapy for malaria *Trop Med Int Health*, 2006. *Vol* 11; pages 229-313.

[19] Lawrence N Kazembe, Christopher C Appleton, and Immo Kleinstschmidt: Choice of treatment for fever at household level in Malawi: Examining spatial patterns; Malaria journal, 2007, vol6; page 40.

[20] Wakgari Daressa, Treatment seeking behaviour for febrile illness in an area of seasonal malaria transmission in rural Ethiopia, Malaria journal, 2007.vol6; page 49.

[21] Deming MS, Gayibor A, Murphy K, Jones TS, Karsa T:Home treatment of febrile children with antimalarialantimalarials in Togo. Bulletin of the World Health Organization, 1989, vol67;pages 695-700.

[22] Nshakira N,Kristesen M, Ssali F, White NSR: Appropriate treatment of malaria? Use of antimalarialantimalarials for children fevers in districts medical units, drugs shops and homes in eastern Ugunda, Trop Med Int Health, April 2002, Vol 7(4);pages 309-16.

http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=ShowDetailView&TermToSearch=11952946&ordinalpos=1&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstractPlus (Date accessed: 13/07/2007).

[23] Patrict Kachur S, Sculden J,Goodman CA, Kassala H, Elling BF, Khatib RA Causer, LM,Mkikima S, and Abdulla: Prevalence malaria parasetimia among clients seeking treatment for fever or malaria at drug stores in rural Tanzania , Tropical Health & Internal Health , April 2006, vol;11(4) pages 441-451.

[24] Irene Ackua Agyepong, Malaria: Ethnomedical Perceptions and practices in an Adangbe farming community and implications for control, Social Science and Medicine July 1992.Vol 35(2); pages 131-137.

[25] Tarimo DS, Urassa DP, and Msamanga GI: Care takers' Perceptions of clinical manifestations of childhood malaria in holo-endemic communities in rural Tanzania, East Africa Medical Journal, Feb 1998, Vol75(2); pages 93-6. http://www.ncbi.nlm.nih.gov/sites/entrez?cmd=Retrieve&db=PubMed&list_uids=9640831&dopt=Abstract(Date accessed: 12/07/2007).

[26] Janet Dzator and John Aful-Adjaye:A Study of Malaria Provider Choice in Ghana. Health Policy, vol69 (3), September 2004,Pages 389-401.

[27] Peter O Ogunjuyigbe:Under-five mortality in Nigeria: Perception and Altitudes of the Yorubas towards the existence of "Abiku" Demographic Research,2004, vol 11;pages 43-56.

[28] Alister C Munthali: Managing malaria in Under Fives Children in a Rural Malawian Village, Nordic Journal of African studies, 2005, vol 14(4); pages 127-146. http://www.njas.helsinki.fi/pdf-files/vol14num2/munthali.pdf (Date accessed;11/07/2007)

[29] Fassil Tessema, Makonnen Asefa, Fekadu Ayele, Mothers Health Services utilization and health care seeking behaviour during infant rearing: A longitudinal community based study, south west Ethiopia, The Ethiopian Journal of Health Development,2002, vol16,(special issue);pages 51-58.

[30] Lawrence Kazembe, Immo Kleinsmchidt and Brian L Sharp: Patterns of Malaria related Hospital admissions and mortality among Malawian children: an example of spatial modeling of hospital register data, Malaria Journal, 2006, vol5; page 93. http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1635723 (Date accessed:11/07/2007).

[31] Peter W.Gething, Abdisalan M. Noor, Dejav Zurovac , Peter M Atkinson, Simon I Hay,, Mark S Nixon, and Robert W Snow: Empirical Modelling of Government health services use by children with fevers in Kenya, Acta Tropica,2004 vol 91(3);page 22

[32] Mathew Jowett, Nigel Miller and Nainkwa Mnazava: Malaria Expenditure Analysis: A Case Study of Tanzania, March, 2000. A report commissioned by DFID-EA Tanzania. http://www.rbm.who.int/cmc_upload/0/000/012/805/tanzania_exp.pdf (Date accessed:16/07/2007)

33 The use of antimalarial drugs. A report of informal consultation, Geneva 2000.

http://www.rbm.who.int/cmc_upload/0/000/014/923/am_toc.htm#intro

34 François Nosten: FAQs on Artemisinin- based Combination Therapy

http://www.shoklo-unit.com/faq.shoklo-unit.com/index2.html

Appendix 1: Map of Tanzania showing the study area (in red), the Rufiji and Kilombero valleys



Appendix 2: Human Research Ethics clearance Certificate from Wits

Fourth Cross Section HH survey Kilombero, Ulanga and Rufiji Districts
CDC/IHRDC Malaria Programme in Tanzania

Module B

Member Section

Fill one form for every member within household

District Initials |____|

Village Initials |___|___|___|

Household Number |___|___|___|___|___|

Date of Interview |___|___|/|___||___|/|___|___|

Name of the Person _____

Sex 1=Male 2= Female |____|

Date of Birth |___|___|/|___|___|/|___|___|

Ask the following questions for every adult member. If the member is under 12 the respondent should be the parent/Guardian living with the child

23:- What is your relationship with the above mentioned person
1= Myself (this person must be more than 11 years of age) |____|
2=Mother
3=Father
4=Grand mother
5=Grand father
6=Uncle/Aunt
7=Brother/Sisters
8=Other/Explain _____

24:- Did you/(child) sleep under net last night?

1= Yes 2= No 9= Don't now |____|
If know skip to question 25

24_1 when was the net purchased |___|___| / |___|___|___|___|
"99/9999" Month / Year

24_2 Have you ever treated your net ?

1= Yes 2= No 9= Don't know |____|
If know skip to question 25

24_3 When was the last time your net was treated?

|__|__| / |___|___|___|___|
If don't know write "99/9999" Month / Year

25:- Within the last 4 months did you (child) get blisters all over your (his/her) body.

1= Yes 2= No 9= Don't know |___|

If no or don't know skip to question 26

25: a: Did you /(child) visit any dispensary /health centre/hospital for treatment of this disease?
1= Yes 2= No 9= Don't know |___|

25: b: Describe name place where you visited first
Name |__|___|___|___|___|___|___|___|___|___|___|___|___|___|
Village |___|___|___| other place|___|___|___|___|___|___|___|___|
If it's within Dss area fill Initials: Out Dss area Fill in the name of the village or town

26 Have you ever failed to walk properly or not be able to speak perfectly within the last 4 moths?
1= Yes 2= No 9= Don't know |___|
If no or doesn't know skip to question 27

26: a: Did you /(child) visit any dispensary /health centre/hospital for treatment of this disease?
1= Yes 2= No 9= Don't know |___|
If no or don't know skip to question 27

26: b: Describe name place when you visited first
Name |__|___|___|___|___|___|___|___|___|___|___|___|___|___|
Village |___|___|___| other place|___|___|___|___|___|___|___|___|
If it's within Dss area fills Initials: Out Dss area Fill village or town

27:- Did you /(child) had fever or malaria within the last 14 Days
1= Yes 2= No 9= Don't know |___|
If no or doesn't know skip to the end of the questionnaire

28:- When did this disease start (how many days have passed)?
00=Today 01 to 86 = Number of days 87= More than 86 99= Don't know |___|___|

29:- Do you/(child) feel sick today?
1= Yes 2= No 9= Don't know |___|
If no or doesn't know skip to question 31

30 If yes, for how long /(child) have you been suffering from this disease?
00=Today 01 to 86 = Number of days 87= More than 86 99= Don't know |___|

31:- What were the symptoms? (Don't read from the list)
1=mentioned 2= not mentioned

|__| Fever, Body temperature
|__| Headache
|__| Dizziness
|__| Vomiting
|__| Fast breathing
|__|Convulsion
|__|Other/Describe _____
|__| don't know
|__| Cold/shivering
|__| Body pain
|__| Diarrhea
|__|Coughing
|__|Loss of consciousness

32: Have you/(child) received any treatment for this disease?
1= Yes 2= No 9= Don't know |___|

32-a If the answer is yes, where did you receive this treatment in the first place?
|__|__|__|__|__|__|__|__|__|__|__|__|__|__|

After that, did you receive any treatment from any other place/person?

33. Keep on asking questions till all the places of medical care are answered. Fill 1 in the box for the first place 2 for the second place if it's used etc. If the place of medical care the patient did not attend fill 0

Explain to her/him all places of medical care that he/she did not describe. If the place of medical care was used more than once fill into another box

1- Hospital	|__| |__| |__| =>Module C
2- Health centre	|__| |__| |__| =>Module C
3- Normal Shop	|__| |__| |__|=> Module C
4- Pharmacy	|__| |__| |__|=>Module C
5- Village health workers	|__| |__| |__|=> Module C
6- Traditional healers	|__| |__| |__|=> Module C
7- Private lab	|__| |__| |__|=> Module C
8- Other medical care giver	|__| |__| |__|=> Module C
9- Natural herbs	|__| |__| |__|=> Module C
10- Home first aid kit	|__| |__| |__|
11- Home first aid kit from the neighbor *(Not a member of the family)*	|__| |__| |__|

If she/he mentioned 10 / 11 within question no 32a (Home, relative, Neighbour) ask question no 33 otherwise skip to question 34

33a Drugs If he/she mentioned generic name try to ask name used in business	33b Amount which you received 1=Tablets 2=Bottle 3=Injection 4=Tube 5=Packet (ORS) 9=Don't know	33c When did you get this medicine? (past several days) 00=Today 1-86 Number of days 87=More than 86 days 99= Don't know	33d Where did you get this medicine? 1=Home 2=Relative/next door neighbor 3=Other 9=Don't know	33e How much did you pay for this medicine? 77777=Free or from home stock 99999= Don't know
|__|____|__|__|_|	Mark |___| |__|__|.|___|	|___|___| days past	|____|	|__|__|__|__|__|
|__|__|__|__|__|	Mark |___| |__|__|.|___|	|___|___| days past	|____|	|__|__|__|__|__|
|__|__|__|__|__|	Mark |___| |__|__|.|___|	|___|___| days past	|____|	|__|__|__|__|__|
|__|__|__|__|__|	Mark |___| |__|__|.|___|	|___|___| days past	|____|	|__|__|__|__|__|
|__|__|__|__|__|	Mark |___| |__|__|.|___|	|___|___| days past	|____|	|__|__|__|__|__|

33f. if he/she doesn't know the price of each medicine write exact total Tsh |__|__|__|__|__|

34:- Is it necessary to fill module C? |__|
1= Yes 2= No
If no or don't know skip to question 36

35:- If yes, how many module C do you have to fill? |__|
If the member is a female aged 15 and above finish question 36 -44 if the answer is no skip to the end of the questionnaire

36:-Have you been pregnant for the past 2 year's? |__|
1= Yes 2= No 9= Don't know
If the answer is no or does not know skip to the end of questionnaire

The following questions concern your last pregnancy for the past 2 years.

37:- During your pregnancy did you attend ANC clinic for check up?
1= Yes 2= No 9= Don't know |____|
If no or doesn't know skip to the end of questionnaire

38:- What was the age of the pregnancy when you started attending ANC clinic for the first time?
99= Don't know Weeks|____|____|

39:- How many times did you attend clinic for check up before giving birth?
99= Don't know |____|____|

40:- Did you use Fansidar/Sp to prevent malaria during your pregnancy?
1= Yes 2= No 9= Don't know |___|
If the answer is no skip to question 41

40:a How many times did you use those drugs?
1= Yes 2= No 9= Don't know |___|

40: b How many pills did you take for a dose?

1= Yes 2= No 9= Don't know |___|

40: c Where did you receive these treatments?

Name |__|___|___|___|___|___|___|___|___|___|___|___|___|___|
Village |__|___|___| other place|___|___|___|___|___|___|___|___|
If it's within Dss area fill Initials: Out of the Dss area Fill village or town

41 Can I see your ANC Clinic Card for your latest pregnancy?

1= Yes 2= No |____|

If the answer to the question its no or doesn't know skip to end of the questionnaire

In case you get the ANC Card complete the questions according to card

42 How many weeks was the mother pregnant when she visited ANC clinic for the first time?

01 to 40 = Write exact number of weeks Week |____|____|

43 How many times did the mother pay visit to the clinic before she gave birth?

|____|____|

44 How many times did she use Sp during her pregnancy?
99= Don't know |____|____|

44: a How many pills she swallowed at once
01 to 09 = Write Exactly number 9= Don't know |____|

Thank you for your cooperation do you have any questions or comment

|___|___| Interviewer Checked by |____|____|

Module C:

District _____

Village Initials |____|____|____|

Household Number |____|____|____|____|

Date of Interview |____|____|/|____|____|/|____|____|

Name of Person _____

Person Number |____|____|

Sex 1=Male 2= Female |____|

Date of birth |____|____|/|____|____|/|____|____|

45. Name of the Place of Medical Care _____

Village _____

46. Place type

1= Government Hospital/Health Centre/ Dispensary |____|
2= Non Government Hospital/Health Centre/ Dispensary
3=Pharmacy
4=Village health worker
5=Normal shops
6= Village Nurse
7=Traditional Healer
8=Other place, describe _____

Now I will ask questions about your visit to this place

47. When did you visit that place?

00 = Today Days passed |____|____|
01-86 = Specific days
87 = More than 86 Days
99 = Don't know

If the place is a shop skip to question 48

47-a. Patient was admitted?
1= Yes |____|
2=No
9= Don't know

If the answer is No, skip to question 48

47-b if yes how many days was the patient admitted |____|

00=Less than one day 01-86= Total number of days 87=More than 86 days
99= Don't know

48- Who visited the place of Care?

Sick person (Patient) - 1= Yes 2 = No |_____|
Other Adults – (More than 12 Yrs of Age) (Total) |_____|
Children under 13 (Total) |_____|

49-What kind /Type of Transport was used to reach the place of care?

1=By Foot 2= Bicycle 3= Motorbike 4= Public Transport |____|
5 = Other (specify) _____

50-How long did it take to reach the place of care?

1= More than 15 minutes |____|
2= Between 15 to 1 hour
3= Between 1 hour to 2 hours
4= More than 2 hours
9= Don't know

51. What is the transport cost to the place of care?

77777= Free
99999 = Don't know Tshs |___|____|____|____|____|

52-Time Spent receiving medical service at the place of care
Please include time spent to see the doctor, time spent waiting for medical service, lab testing, receiving drugs, and if the patient admitted to the center include time spent up to getting the bed.
1= Less than 15 minutes |____|
2= Between 15m to 1 hour
3= Between 1 hour to 2 hours
4= More than 2 hours
9= Don't know

If the place is a shop skip to question 54

53- Did you spend any night outside your home in order to attend the place of care?
1=Yes 2=No |____|

53-a. How much did you spend on the place you slept on that night?
77777=Free
99999=Don't know Tshs |____|____|____|____|____|

54- Did you spend money on food or soft drinks during your visitation at the place of care?
1= Yes |____|
2=No

If the answer is "No or Don't know" skip to question 55

54_a How much did you spend?

77777= Free
99999= Don't know Tshs |____|____|____|____|___|

55. Type of Transportation used from the place of Care

1=By Foot |____|
2= Bicycle
3= Motorbike
4= Public Transport
5= Other Name / Describe

56. Time spent getting back from the place of Care

1 = Less than 15 minutes |____|
2 = Fifteen minutes to 1 hour
3= 1 hour or 2 hours
4= More than 2 hours
5=Don't know

58. How much did you spend on transport on your return from the place of care?
77777= Free Tshs |____|____|____|____|___|
99999= Don't know

59. Did you receive any medical service (Child received any Medical service) from the place of care?

1=Yes |____|
2=No
9= Don't know

59.a Name of the Drug	**59. B What amount of drugs did you receive?** 1=Tablets 2=Bottle 3=Injection 4=Tube 5=Packet=(ORS) 9=Don't know	**59.c Did Nurse/Medical officer decide to provide you with this medicines or it was your own decision?** 1=Nurse/Medical officer 2=Myself	**59. d How much did you Pay?** Tshs |____|____|____|____|___| 77777=Free 99999=Don't know
	Mark |_|. |__|____|.|__|	|___|	|_|_|_|_|_|_|
	Mark |_| |__|____|.|__|	|___|	|_|_|_|_|_|_|
	Mark |_| |__|____|.|__|	|___|	|_|_|_|_|_|_|
	Mark |_| |__|____|.|__|	|___|	|_|_|_|_|_|_|
	Mark |_| |__|____|.|__|	|___|	|_|_|_|_|_|_|
	Mark |_| |__|____|.|__|	|___|	|_|_|_|_|_|_|

{59.If he/she does not know the price of each drug fill-in the total price Tsh |__|__|__|__|____|____|

Now I will ask questions concerning costs of other medical charges

60. How much did you pay for each of the stated services?
77777= Free
99999= Don't know

A: - Registration Fees/Card TSH |__|__|__|__|__|
B: - Consultations Fees TSH |__|__|__|__|__|
C: - Syringe TSH |__|__|__|__|__|
D: - Lab test Fees TSH |__|__|__|__|__|
E: - Incentive/appreciation TSH |__|__|__|__|__|
F: - Other TSH |__|__|__|__|__|
G: - Other TSH |__|__|__|__|__|

(If she/she does not know to the price of each service, write the exact total)
Tshs |___|___|___|___|___|

62:-Did you pay anything instead of cash at this place?

1= Yes |_____|
2=No

9=Don’t know
If yes, describe _____

63:- Did you receive any kind of treatment through a loan?

1= Yes |_____|
2=No
9=Don’t know
If yes, describe _____

Interview |_____|_____|

Checked |_____|_____|